Economic Effects of Management Changes for Kenai River Late-Run Sockeye

Prepared For

Alaska Department of Fish and Game

January 1996

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Acknowledgements

The authors thank the members of the Alaska Department of Fish and Game study team who worked with ISER to establish the scope of the study and the methods of analysis. They are Robert Bosworth, Robert Wolfe, Jeff Hartman, and Mike Mills of ADF&G and Kurt Schelle and Ben Muse of the Commercial Fisheries Entry Commission. Many other staff members of ADF&G also provided information and review comments. Those include Ken Tarbox, Dave Nelson, Steve Hammarstrom, Doug McBride, Paul Ruesch, and others. Elaine Dinneford of the Commercial Fisheries Entry Commission provided valuable fisheries data.

Doug Larson and James Wilen of the Department of Agricultural Economics at the University of California at Davis reviewed the study design and final report.

Finally, the authors thank other ISER staff members who helped with the analysis and the preparation of the final report, including Monette Dalsfoist, Teresa Hull, and Jim Kerr. Renee Lindow, a University of Alaska student, conducted the processor interviews included in Appendix J.

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Executive Summary

Economic Effects of Management Changes for Kenai River Late-Run Sockeye

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If fishery managers allowed more late-run sockeye salmon into the Kenai River in July, what would be the economic gains for the sport fishery and the losses for the Upper Cook Inlet commercial fishery?

The Institute of Social and Economic Research at the University of Alaska Anchorage examined that question, under a contract with the Alaska Department of Fish and Game (ADF&G). We looked mainly at the effects of increasing the management target for late-run sockeye by 200,000.

Managers could make that change in a number of ways—but for this study, ADF&G provided us with specific assumptions about what they would do. Different assumptions could change our results. To assess the effects of the management changes we studied, it helps to think about three questions:

(1) What creates the economic effects?

(2) How do we measure those effects?

(3) How do different conditions affect the results?

If 200,000 more sockeye were in the Kenai River, resident sport anglers would take more trips to the Kenai, spend more for those trips, and catch more fish. But while fishing more on the Kenai, they would take fewer fishing trips elsewhere (as Figure 1 shows). Better fishing would also encourage visiting anglers to take more trips to the Kenai and spend more in the economy.

Commercial fishermen would lose some of their harvest and their incomes. Fishermen and processors would work fewer hours, and the fishing and processing industries would buy less from other businesses.

We measured the effects of those changes in two ways: changes in *net economic value* and *economic impacts*.

Net economic value is a measure of benefits minus costs: we add up all the benefits and costs of a change, then subtract the costs. What's left is the net gain or loss in value.

Economic impacts are changes in payroll, jobs, or sales. Impacts are aggregate rather than net measures of change.

Figure 1 shows our estimates of economic effects, when Kenai River sockeye runs and prices paid fishermen are at medium levels.

• *Estimated commercial losses appear somewhat larger than sport gains*— a gain of $1.3 million for the sport side and a loss of $1.7 million for the commercial side. But given the range of uncertainty in our estimates, we can't definitely conclude that actual commercial losses would be larger than sport gains.

• *The Alaska economy would probably lose slightly more jobs than would be created.* A rough estimate is that increased spending for sport fishing would create about 46 jobs, but lost commercial harvests would cost the economy 64 jobs. But given the uncertainty about the future level of visitor spending, the actual number of jobs created on the sport side could range from 13 to 70.

Our results would vary in years of different run sizes and prices. During high runs, managers wouldn't need to make any changes to put 200,000 more sockeye in the river—so there would be no gains or losses.

During low runs, managers would eliminate more commercial fishing time, to make sure extra sockeye reached the Kenai River. Then commercial losses would be larger than sport gains—and the higher the price of sockeye, the larger the losses. When prices were low and runs were medium, sport gains would probably exceed commercial losses.

Figure 1. Effects of Increasing Sockeye Sonar Count by 200,000

What Drives Economic Effects?

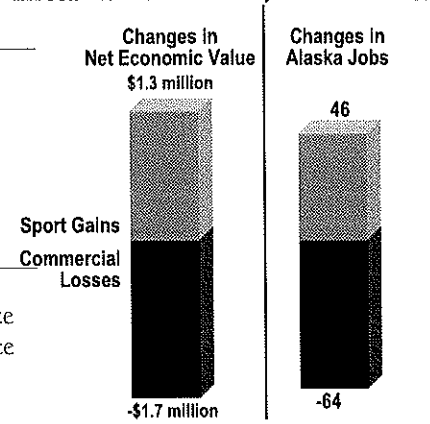
Sport Fishery

- Roughly 45,000 harvest increase
- 4,000 more resident trips to Kenai
- $550,000 more resident spending for Kenai trips
- 3,400 fewer resident trips to other sites
- $450,000 less resident spending for other trips
- More visitor spending creates jobs (13-70)

Commercial Fishery

- 0-3 fewer openings, depending on run size
- Reduced harvest (0-500,000 salmon), depending on run size
- Lost fishing income of $6-$10 per fish, depending on price
- Fewer hours worked in fishing and processing
- Less spending by fishing and processing industries

Effects at Medium Run, Medium Price



Background

The study originated when the Alaska Legislature appropriated money to ADF&G in 1994 for an economic analysis of "management alternatives for Cook Inlet salmon."

ADF&G decided, based on public interest and other factors, to focus the study on the economic effects of increasing the management target for late-run Kenai River sockeye. The current management target for late-run sockeye is 450,000 to 700,000 sockeye (as measured at the sonar counter below the Soldotna bridge). Increasing the target by 200,000 would raise the range to 650,000 to 900,000. Making such a change would require reducing the Upper Cook Inlet commercial salmon harvest, except in years of high runs. The Alaska Board of Fisheries, which regulates the fisheries, establishes the management target and decides if it will be changed.

Both the sport fishery and the commercial fishery in the Central District of Upper Cook Inlet highly value late-run Kenai River sockeye, which generally begin moving into the river in late June and peak toward the end of July. This run alone makes up about half the total commercial salmon harvest in Upper Cook Inlet. And about three-quarters of the statewide harvest of sockeye is taken from the Kenai River and its tributary, the Russian River.

Sport anglers want more sockeye; commercial fishermen want to keep what they have.

What ISER Studied

We mainly studied the effects of increasing the Kenai River management target by 200,000 late-run sockeye. To help define a range of variation, we also looked at the effects of increasing the sonar count by just 100,000, and of decreasing the sonar count by 100,000.

Specifically, we estimated economic effects on the Kenai River sport fishery, including the Russian River (Map 1, page 5); and on the commercial fishery in the Central District of the Upper Cook Inlet management area (Map 2, page 6).

There are other potential effects of such a change—effects we were asked to recognize but not to quantify. Those include:

• Potential increased damage to riverbanks and fish habitat. Any change that attracts more anglers to the Kenai River—which already sees 100,000 sport anglers in a season—has the potential to increase bank trampling and damage to vegetation and fish habitat.

• Potential overescapement of sockeye. Fishery managers believe that having too many spawning salmon return to a river has the potential to damage future runs, by taxing spawning and rearing areas and food supplies. Biologists haven't established an overescapement estimate for Kenai River late-run sockeye.

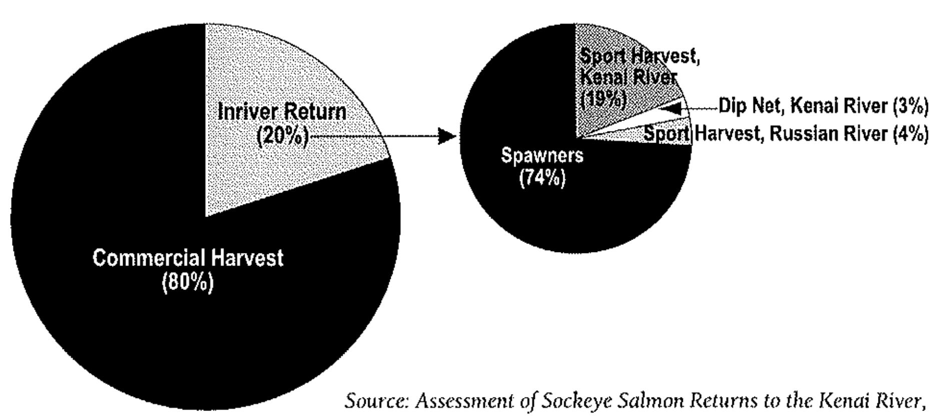
• Potential benefits for commercial setnetters in the Northern District of Upper Cook Inlet and Susitna River sport anglers and personal use dipnetters. Managers assume that during low Kenai River runs they would have to eliminate a regular districtwide opening in the Central District to make sure 200,000 additional sockeye reached the Kenai River. In those circumstances, more salmon would move past the Central District drift fleet and into the Northern District, where some would be harvested. We don't have estimates of how many.

Current Allocation

Figure 2 shows how the late run of Kenai River sockeye has been divided in the 1990s. Commercial drift and setnetters in the Central District of Upper Cook Inlet harvested about 80 percent. Of the sockeye that returned to the river, about 74 percent spawned. Sport anglers on the Kenai River mainstem took about 19 percent and anglers on the Russian River took 4 percent. Dipnetters (who harvested fish under both personal use and subsistence regulations during that period) took about 3 percent.

Since 1990, annual commercial harvests of Kenai River sockeye have varied from just over 1 million to nearly 7 million. Annual sockeye sport harvests on the Kenai and Russian rivers varied between about 120,000 and 270,000.

Figure 2. Allocation of Kenai River Late-Run Sockeye, 1990-1994



Source: Assessment of Sockeye Salmon Returns to the Kenai River, Doug McBride and Steve Hammarstrom, ADF&G, 1995

Measuring Economic Effects

On the front page we defined net economic value as benefits minus costs: the gain or loss after all benefits are added and all costs are subtracted. Changes in net economic value are difficult to calculate, because this measure takes into account not only monetary costs and benefits (like the market price of fish or costs of fishing tackle) but also assigns a dollar value to intangibles (like the pleasure of fishing). On page 8 we describe how we assigned a dollar value to improved Kenai River fishing. Here we just want to point out that net economic value takes into account the substantial non-monetary value in the sport fishery.

General Findings

To assess how changes in run sizes, prices, sport bag limits, and other conditions would affect our results, we developed 10 study scenarios . Assumptions that went into those scenarios, and our findings by scenario, are described on pages 8-12. Here we present general findings not tied to specific scenarios. We found if the Kenai River management target for late-run sockeye were increased by 200,000:

• *The net increase in resident trips to all Alaska sites would be about 650, and the net increase in resident spending for fishing trips would be about $108,000.* Southcentral resident households with sport anglers would make 4,000 additional trips to Kenai River sites and spend $550,000 more in late July. But our analysis showed that in order to make more trips to the Kenai, resident anglers would make fewer trips and spend less elsewhere in Alaska—about 3,400 fewer trips and $450,000 less spending.

• *Most of the increase in the net economic value of the sport fishery for residents is non-monetary:* the value of improved sport fishing. Some is savings—because residents substitute less expensive trips to the Kenai River for more expensive fishing trips to other Alaska sites.

• *Most of the loss in net economic value for the commercial fishery is monetary*: reduced harvest revenue. Some is reduced job satisfaction.

• *As measured by economic impacts, reducing the commercial harvest would probably cost the economy more jobs and payroll than would be created by the improved sport fishery.* One reason is that the commercial fishery creates jobs and payroll in two ways—from the market value of the harvest itself, and from fishery-related spending in other industries. The sport fishery creates jobs only through fishery-related spending. Unlike commercial fishermen, sport anglers don't earn money while they're fishing—although they enjoy a great deal of non-monetary value.

• *How many jobs and how much payroll an improved sport fishery would create statewide would depend mostly on how much more non-resident anglers spent.* As we said earlier, Alaskans would certainly take more trips and spend more for Kenai River fishing, if the fishing were improved—but they would also take fewer trips to other Alaska sites. So most of the additional resident spending would simply be shifted from one place to another within the state. But if better fishing induced non-residents to stay longer and spend more than they otherwise would have, that spending would represent additional money in the economy.

• *Non-residents visiting Alaska might extend their visits to fish more on the Kenai—and spend more in the economy.* That additional spending could be anywhere from $630,000 to $3.3 million more in a season, generating between 13 and 70 jobs. These are rough, order-of-magnitude estimates based on survey responses of the small percentage of non-resident anglers who said they would have stayed longer in Alaska if the fishing were better. We do think this change would probably be much larger than the change in resident spending for sport fishing.

• *A reduction in Cook Inlet sockeye harvests is unlikely to affect Alaska consumers much*—because most Cook Inlet sockeye is sold outside the state.

• *By reducing the supply of sockeye, the proposed reduction in Cook Inlet commercial sockeye harvests could increase prices paid fishermen for Cook Inlet sockeye by as much as 1 cent per pound.* But we think that even such a small price increase is unlikely—because Cook Inlet sockeye make up a relatively small share of all Alaska sockeye, and because the growing supply of farmed salmon worldwide would offset the effects of a smaller Cook Inlet harvest.

Assumptions

Size of Kenai River late sockeye run

Low run: Fewer than 2 million
Medium run: 2-5 million
High run: More than 5 million

Ex-Vessel Price (price paid fishermen) for Cook Inlet sockeye

Low price: $1.00/lb.
Medium price: $1.43/lb.
High price: $1.75/lb.

Definitions

Southcentral Alaska: the Municipality of Anchorage, the Kenai Peninsula Borough, and the Matanuska-Susitna Borough

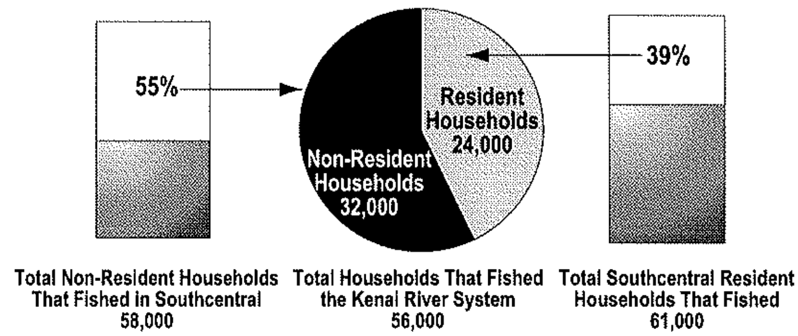
Kenai River system (study sites): all fishing on Kenai River mainstem from the mouth at Cook Inlet to Kenai Lake and including the Russian River

Organization of the Summary

Profile of the Sport Fishery

The Kenai River system sport fishery (including the Russian River) is easily accessible and immensely popular with Alaskans and tourists. In 1993, 39 percent of all the Southcentral households with anglers fished on the Kenai or Russian rivers, and 55 percent of the visiting households that fished in Southcentral Alaska traveled to the Kenai or Russian rivers (Figure 3). Southcentral Alaska includes the Kenai Peninsula Borough, the Municipality of Anchorage, and the Matanuska-Susitna Borough.

Figure 3. Importance of Kenai River to Sport Fishing, 1993



The Kenai River has long been known for its king salmon fishing, but in recent times growing numbers of anglers have been going after sockeye. Significant numbers of coho salmon are also harvested in the river.

About three-quarters of the statewide sport harvest of sockeye is taken in the Kenai mainstem and the Russian River. This study look at the economic effects of a change in management of the late-run of sockeye, which generally begins moving into the river in late June and peaks toward the end of July. (The early run is much smaller and is mostly harvested in the Russian River.)

Figures 4 and 5 show the importance of the Kenai and Russian rivers to Southcentral anglers. Half of all households in Southcentral Alaska—61,000 of an estimated 122,000 households—had sport anglers in 1993. Those sport fishing households made nearly 626,000 fishing trips. An estimated 25 percent of those trips were to the Kenai and Russian rivers, by far the most popular sport fishing sites in the region. The average fishing trip by residents to all Southcentral sites lasted 1.8 days and cost $155. Trips to the Kenai River cost residents less—averaging 1.6 days and $105 per trip (Table 1).

Visiting anglers also fish the Kenai heavily. About 58,000 non-resident households made 98,000 sport fishing trips while visiting Southcentral Alaska in 1993. Around 54,000 of those trips were to the Kenai River system. Visitors spent more per trip than residents—an average of $400 for all Southcentral trips and $460 for trips to the Kenai. Their trips were also longer, averaging close to 3 days (Table 1).

Altogether, residents and visitors spent $136 million for 1993 sport fishing trips in Southcentral Alaska, with $34 million of that for trips to the Kenai and Russian rivers (Figure 6). The biggest expense for residents on fishing trips to the Kenai was transportation (including the costs of fuel and other vehicle expenses). Resident anglers on average spent little for guide and charter services; by contrast, non-resident households spent an average of $160 per trip for guides and charters (Figure 7).

How many late-run sockeye do anglers take from the Kenai and Russian rivers? Figure 8 shows that the sport harvest of late-run sockeye in the past decade has varied from less than 40,000 to more than 330,000.

Figure 4. Southcentral Resident Trips by Region, 1993

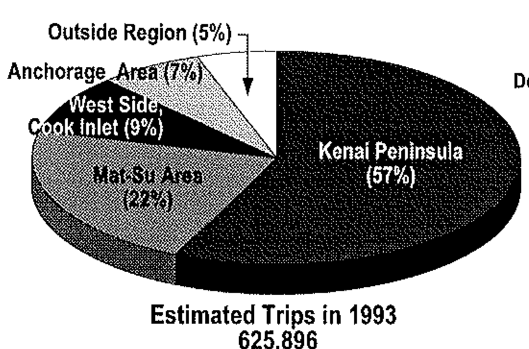
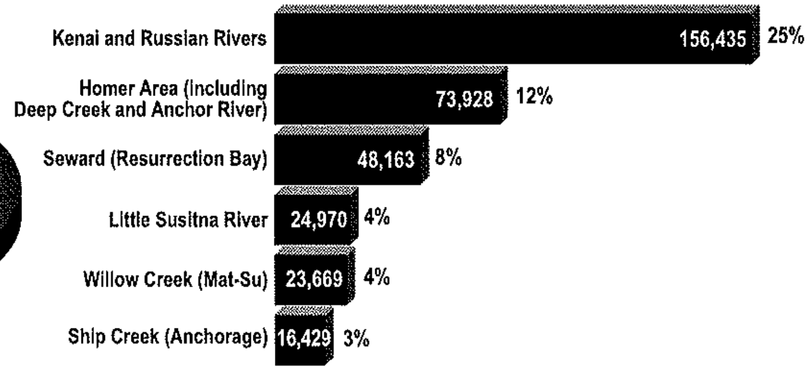


Figure 5. Most Popular Fishing Sites for Southcentral Residents, 1993



**Sources of Table 1, Figures 2-4 and 6 and 7: ISER Surveys*

Map I. Kenai River System Sport and Personal Use Fisheries

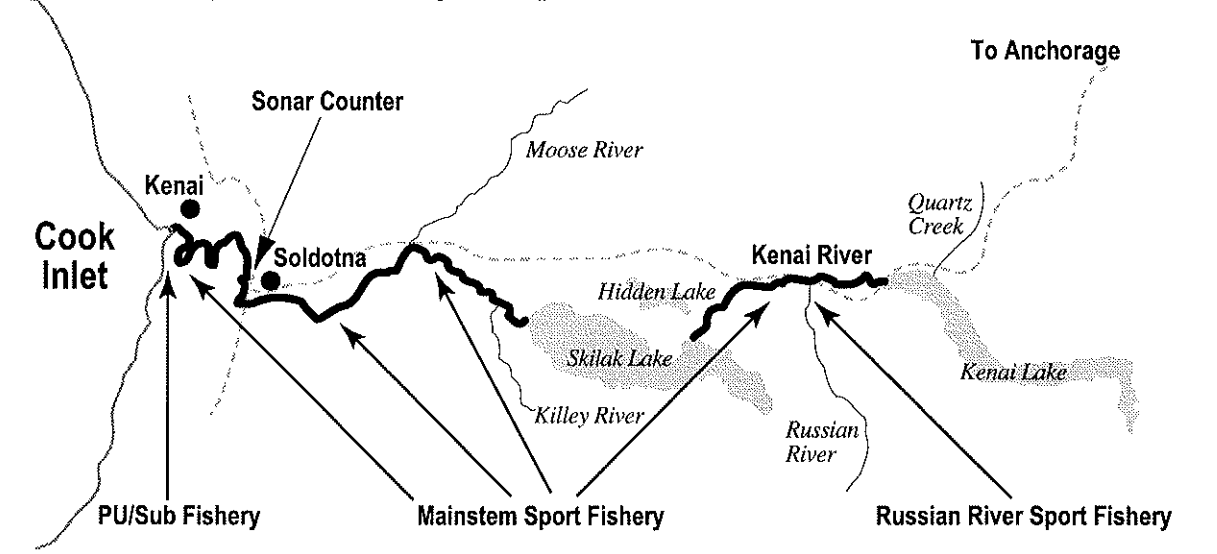


Figure 6. Resident and Non-Resident Spending for Fishing Trips, 1993

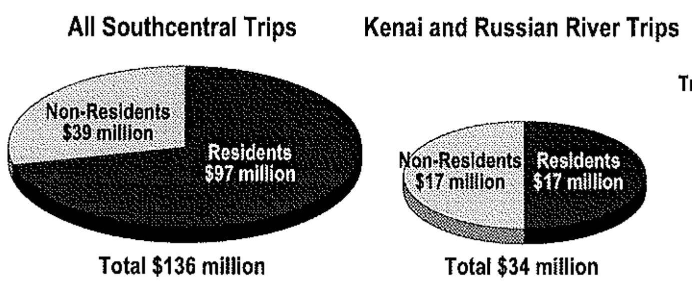


Figure 7. Per Trip Spending for Kenai River Trips

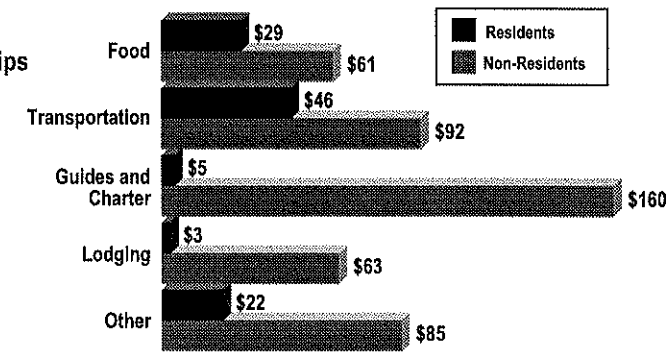
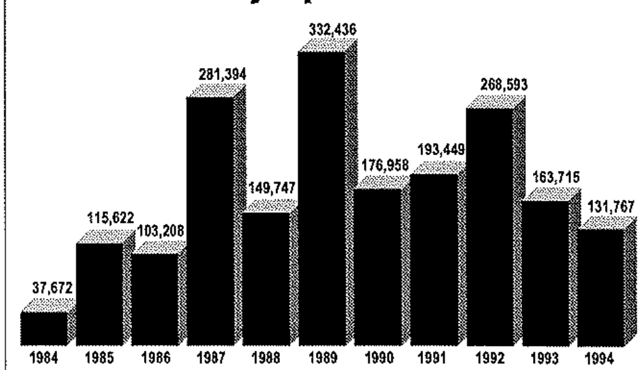


Table 1. Cost and Length of Sport Fishing Trips, 1993

	Resident Households	Non-Resident Households
All Southcentral Trips		
Average Per Trip Spending	$155	$400
Average Number of Trips per Household	10	1.7
Average Length of Trip	1.8 days	2.9 days
Trips to Kenai and Russian Rivers		
Average Per Trip Spending	$105	$460
Average Number of Trips per Household	6.7	0.7
Average Length of Trips	1.6 days	2.7 days

Figure 8. Kenai and Russian River Sockeye Sport Harvests



Source: Assessment of Sockeye Salmon Returns to the Kenai River, Doug McBride and Steve Hammarstrom, ADF&G, 1995

Profile of the Commercial Fishery

Cook Inlet is divided into two commercial fisheries management areas—Upper and Lower Cook Inlet. Anchor Point is the boundary between the two regions. Upper Cook Inlet is in turn divided into two districts—the Central District (from Anchor Point north to Boulder Point) and the Northern District (from Boulder Point north).

The Upper Cook Inlet salmon harvest is taken with drift and set gillnets. The drift fleet is restricted to the Central District. Setnetters fish in both the Central and the Northern Districts, but about 70 percent of setnetters are concentrated on the east side of the Central District.

Both the size of the Upper Cook Inlet harvest and its value can change sharply from year to year, depending on the size of salmon runs and the price paid fishermen. The harvest was as small as 3 million and as large as 10 million in the past five years, and the ex-vessel value ranged from less than $20 million to more than $100 million (Figures 9 and 10).

Sockeye make up about 80 percent of the harvest. Kenai River sockeye alone make up about 50 percent of the Upper Cook Inlet commercial harvest (Figure 11). Other sockeye in the harvest include stocks of the Kasilof, the Susitna, and other rivers along Upper Cook Inlet. Those stocks of sockeye—as well as runs of king, coho, and chum salmon—mingle in Upper Cook Inlet, complicating management.

Driftnetters and eastside setnetters in the Central District took about 95 percent of the Upper Cook Inlet sockeye harvest in the 1990s (Figure 12). It is those fishermen who would lose salmon (mostly sockeye but also including other species) if a management change allowed more sockeye into the Kenai River.

Table 2 shows 1994 employment and earnings of drifters and eastside setnetters in the Central District. About 29,000 people worked either as heads of operations (permit holders) or crew members. Harvest revenues totaled $33 million; crew members were paid about 20 percent of that total, mostly through shares.

Table 3 estimates 1994 harvesting costs for Central District permit holders. Variable costs (like food and fuel) totaled $4.2 million for the drifters and $2 million for the setnetters. Fixed costs (like insurance and taxes) totaled $5 million for the drifters and $2 million for the setnetters. Crew payments for drift crews amounted to $2.7 million and setnet crews $3.9 million.

Boats and equipment for the drift fleet were valued at $76 million and at $56 million for eastside setnetters in 1994. Drift permits had an estimated value of about $38 million and setnet permits close to $15 million (Table 4).

Map 2. Upper Cook Inlet Management Districts

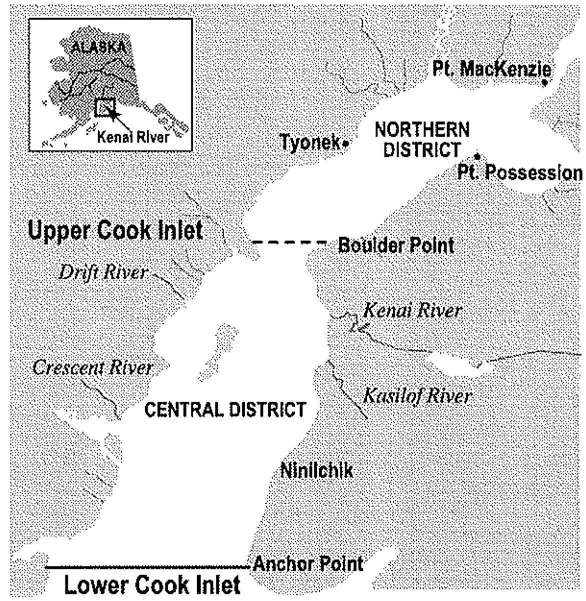


Figure 9. Upper Cook Inlet Commercial Salmon Harvests
(In Millions of Fish)

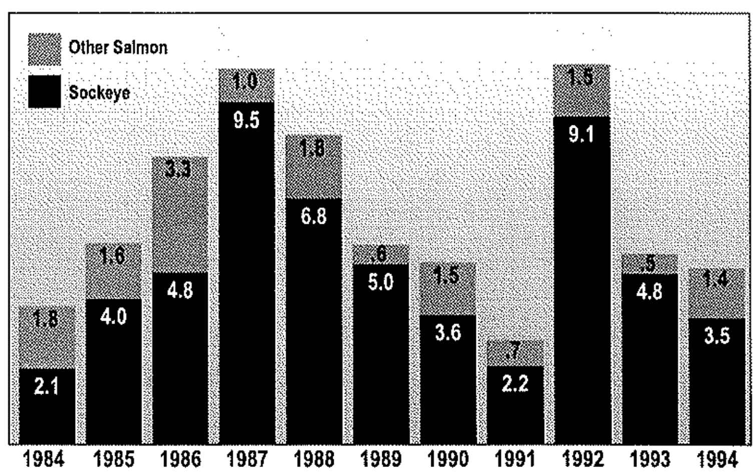
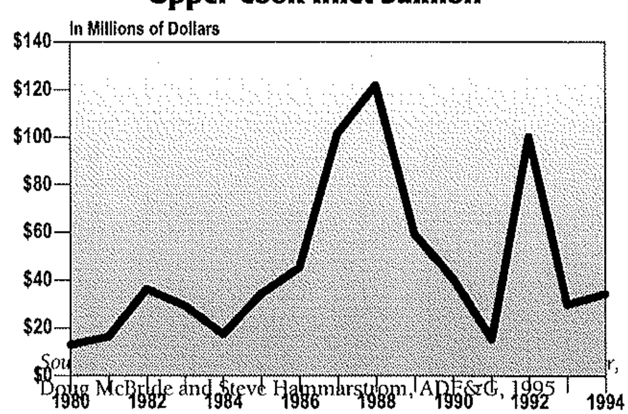


Figure 10. Ex-Vessel Value, Upper Cook Inlet Salmon



Sou... r, Doug McBride and Steve Hammarstrom, ADF&G, 1995

Table 2. Employment and Earnings in Central District, Upper Cook Inlet, 1994

	Driftnet	Eastside Setnet	Total
ESTIMATED NUMBER OF PERMITS FISHED IN 1994	580	514	1,094
ESTIMATED TOTAL OPERATIONS	567	258	825
AVERAGE NUMBER OF FISHERMEN PER OPERATION			
Heads of operations	1.0	1.0	1.0
Crew*	1.6	4.6	2.6
TOTAL	2.6	5.6	3.5
ESTIMATED TOTAL FISHERMEN			
Heads of operations	567	258	825
Crew	884	1,183	2,068
TOTAL	1,451	1,442	2,893
METHOD OF PAYMENT (FOR PERSONS OTHER THAN HEADS OF OPERATIONS)			
Owner	6.1%	13.1%	10.1%
Share	73.3%	62.5%	67.1%
Fixed rate	5.4%	12.7%	9.6%
Family member	6.6%	3.5%	4.8%
Other	5.3%	4.0%	4.5%
Not available	3.3%	4.2%	3.8%
TOTAL	100%	100%	100%
ESTIMATED TOTAL CREW EARNINGS	$2,709,000	$3,941,000	$6,649,000
ESTIMATED TOTAL REVENUES	$19,548,000	$13,508,000	$33,057,000
TOTAL CREW EARNINGS AS % OF TOTAL REVENUES	13.9%	29.2%	20.1%

Source: Estimates based on ISER permit holder and crew surveys.
**Includes a few permit holders other than heads of operations paid as owners.*

Figure 11. Composition of Upper Cook Inlet Salmon Harvest, 1990-1994

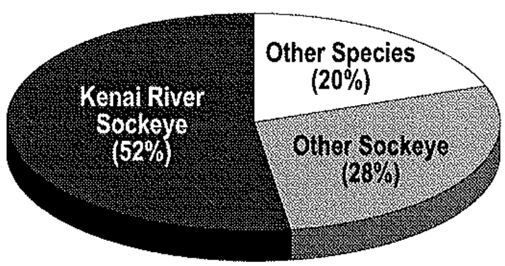


Figure 12. Division of Upper Cook Inlet Sockeye Harvest, 1990-1994

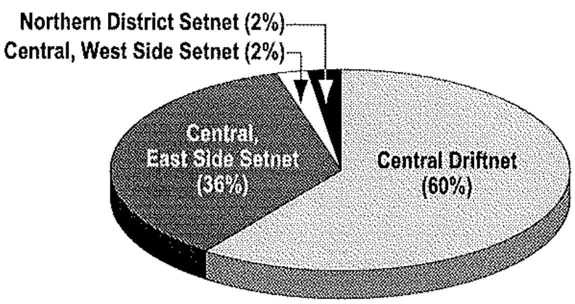


Table 3. Salmon Harvesting Costs for Limited Entry Permit Holders, Central District , 1994

	Drifters	East Side Setnetters
Payments to Crew	$2.7 million	$3.9 million
Variable Costs	$4.2 million	$2.0 million
Fixed Costs	$5.2 million	$2.1 million

Table 4. Value of Limited Entry Permits and Property in Central District, 1994

	Drifters	East Side Setnetters
Boats, Equipment and Property	$76.2 million	$56.3 million
Value of Permits	$37.7 million	$14.6 million

Sources for Tables 2-4: ISER Surveys; CFEC permit price data

Sources for Figures 8-11: Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993 and 1994, Paul Ruesch, and Jeff Fox, ADF&G Commercial Fisheries Management and Development Division

Methods of Estimating Effects

Changes in Net Economic Value

For both the sport and the commercial fisheries, we used several standard methods to assess changes in net economic value. Our most reliable results use statistical analysis to assess the net benefits people derive from fishing, based on their actual past choices among different options with different costs. Although sport fishermen don't pay for the fish they harvest, they do spend money on food, fuel, bait, and other expenses. The behavior analysis estimates whether people would still go fishing, if it cost them more. Then, the net value of the fishery is what they would be willing to pay, minus their actual costs.

For the sport fishery, we relied heavily on the results of large surveys of sport anglers (Table 5 on page 9). We asked Southcentral anglers where they fished, how often they went, how far they traveled, how much they spent, and other information about fishing trips in 1993. From that information, and from ADF&G data and other sources of information about fishing conditions at different Alaska sites, we built a computer model that estimates how much Southcentral anglers would value improved fishing at the Kenai River. The model works through equations that (1) use information about what people actually spent for fishing trips to different sites under different conditions; (2) relate anglers' choices of where and when to fish to the cost and the quality of fishing (as measured by variables like the sonar fish count, the catch rate, and the weather); and (3) estimate how much anglers would value improved fishing conditions at the Kenai River.

To assess changes in net value for permit holders, we used observations about past landings and participation to develop a model that assesses potential changes in the profitability of fishing, if commercial fishing opportunities were reduced. We relied mainly on ADF&G management information and landings data for 1990 through 1993. To assess changes in net value for crew members, we used responses from a crew survey that asked how they would rank different jobs that paid different amounts to assess how they would value reduced fishing opportunities.

Changes in Economic Impacts

Economic impacts are jobs, income, sales, or other measures associated with some economic activity. Economic impact analysis provides familiar, concrete measures of change—but it doesn't include any intangible value.

To assess changes in economic impacts, we estimated how spending by sport and commercial fishermen would change, and how these changes in spending translate into changes in jobs and income in Alaska. We also estimated direct changes in jobs and income of commercial fishing and processing workers as a result of harvesting and processing fewer fish.

Data Sources

We used three main sources of information for our analysis:

- 1993-95 surveys of commercial fishermen (both permit holders and crew members) and sport anglers, including residents and non-residents. Table 5 shows numbers of respondents, dates, response rates, and estimated margins of error for our surveys.
- ADF&G fisheries data
- ADF&G assumptions about how management changes would be put into effect and the resulting changes in sport and commercial harvests.

Assumptions and Scenarios

For Kenai River sockeye, no two years are alike: the size and timing of the run; the management regulations; sport and commercial fishing activities; prices paid commercial fishermen; and many other factors can vary. So how can we

What About Late-Run Kenai River Kings?

Our contract with ADF&G asked us to look specifically at the economic effects of changing the management target for Kenai River late-run sockeye. Reducing commercial openings to allow more sockeye into the river would also have the effect of increasing the number of late-run king salmon returning to the river. There is no targeted commercial fishery in the Central District for late-run kings, but commercial fishermen catch kings while fishing for sockeye, because the runs overlap.

Our analysis includes the economic effects of extra kings returning to the river, but we did not measure those effects separately. ADF&G biologists estimate that under the management alternatives we studied, increasing the number of sockeye by 200,000 would increase the king return by about 1,600. Part of the reason why the increase in the number of kings wouldn't be larger is the timing of the commercial closures. ADF&G told us to assume that managers would let extra sockeye into the river by eliminating one or more commercial openings during the peak of the sockeye run in late July. Because the king run is more spread out than the sockeye run, eliminating one or two openings wouldn't sharply reduce the incidental commercial catch of kings.

assess the potential economic effects of a management change, when conditions in the fishery change so much and so frequently?

To try to capture the range of likely effects, we chose—in consultation with ADF&G—a set of 10 hypothetical scenarios with different assumptions about run sizes, ex-vessel prices, sport bag limits, and other factors.

Most of the scenarios assume an increase of 200,000 sockeye at the Kenai River sonar counter.

To help define a range of variation, we also included one scenario that would increase the sonar count by just 100,000, and one scenario that would decrease the sonar count by 100,000. The economic effects of adding 100,000 sockeye were about half those of adding 200,000. Subtracting 100,000 sockeye from the sonar count had roughly equal results in the opposite direction.

Table 6 shows the study scenarios and major assumptions about changes in prices, run sizes, and sport bag limits.

Table 5. ISER Sport and Commercial Fishing Surveys, 1993-1995

Survey Respondents	When	Method	Number of Responses	Response Rate	Margin of Error
Sport Anglers Alaska Statewide	June 1993	phone	1,355	83%	±4%
Sport Anglers Alaska Statewide*	Fall 1993	phone/panel	918	68%	±5%
Southcentral Alaska Sport	Winter 1994/1995	phone (panel sample of 1993 respondents)	160	57%	±11%
Southcentral Alaska Sport (new sample)	Winter 1994/1995	phone	491	76%	±6%
Non-resident sport anglers	Winter 1993/1994	mail	4,278	61%	±2%
Non-resident sport anglers (follow-up of 1994 survey)	Winter 1994/1995	mail/panel	972	45%	±4%
Cook Inlet permit holders (pre-season)	May 1994	phone	487	85%	±4%
Cook Inlet permit holders (post season)	Fall 1994	phone	320	90%	±6%
Cook Inlet crew	Fall 1994	phone	213	84%	±10%

**ADF&G conducted follow-up interviews with the same respondents interviewed in June.*

Table 6. Study Scenarios and Assumptions

	Scenario Name and Code									
	+200K at sonar A	Higher sport bag limit B	Higher sport and dip net bag limits C	+100K at sonar D	-100K at sonar E	Low run, Low price A1	High price A2	Low run A3	High run A4	low price A5
Assumptions about management										
Change in sonar target	+200,000	**+197,189***	**+152,576***	**+100,000**	**-100,000**	+200,000	+200,000	+200,000	+200,000	+200,000
Change in sport bag limit	no change	**higher**	**higher**	no change	no change	no change	no change	no change	no change	no change
Change in personal use bag limit	no change	no change	**higher**	no change	no change	no change	no change	no change	no change	no change
Assumptions about conditions										
Run size	medium	medium	medium	medium	medium	medium	medium	**low**	**high**	**low**
Ex-vessel price	medium	medium	medium	medium	medium	**low**	**high**	medium	medium	**low**
Number of anglers	medium	medium	medium	medium	medium	medium	medium	medium	medium	medium

**Scenario is based on the same reduction in commercial harvests and increase in return to the river mouth as Scenario A. The increase in the sonar count target is less than 200,000 because sport harvests (Scenarios B and C, and dip net harvests (Scenario C) below the sonar are higher.*

Note: Bold type indicates change from Scenario A.

Low Run: Less than 2 million — *Medium Run: 2-5 million* — *High Run: More than 5 million*

Low Ex-Vessel Price: $1.00/lb. — *Medium Ex-Vessel Price: $1.43/lb.* — *High Ex-Vessel Price: $1.75/lb.*

Table 7. Comparison of Scenario Assumptions and Historical Run Sizes and Ex-Vessel Prices

Run Size and Price	Scenario Assumptions	Historical 1984-1994
Medium run, medium price	5	3
Medium run, low price	1	1
Medium run, high price	1	0
Low run, medium price	1	0
High run, medium price	1	3
Low run, low price	1	2
High run, low price	0	1
High run, high price	0	1

Note: See Table 6 for definitions.

None of those scenarios is intended as a prediction of what will actually happen in future years; they're intended to help us look at the range of possibilities. But it helps put the scenarios in context to look at how the assumptions about run size and price compare with actual run and price conditions over the past decade. As Table 7 shows, 5 scenarios assume medium run, medium price; those conditions occurred 3 times in the past 11 years. High runs and medium prices also occurred 3 times; one scenario assumes those conditions. The scenarios don't reflect historical conditions in two instances—when runs were high and prices were either high or low.

ADF&G Estimates of Harvest Changes and Commercial Closures

Critical to assessing economic effects are estimates of how sport and commercial harvests might change under different conditions, and how managers would alter commercial fishing time to allow more sockeye into the Kenai River. ADF&G provided assumptions about harvest and management changes. These assumptions are at the foundation of the analysis: how many fish commercial fishermen lose, and how many the sport anglers gain, are very important for determining economic gains and losses. On the sport side, changes in the quality of fishing (as measured not only by harvests but by the time it takes to catch a fish) are also important.

Table 8 shows assumed changes in sport harvests, if 200,000 more sockeye came past the sonar counter. Table 9 shows how managers would adjust regular and emergency commercial fishing openings to make that change, and how many fish Central District fishermen would give up, assuming different run sizes.

No management change would be required in years of high runs, and so there would be no change in sport harvests. In years of medium or low runs, ADF&G estimates that under current bag limits (3 sockeye per day, 3 in possession) sport anglers would catch about 1 in 5 of the additional sockeye.

In high run years, commercial fishermen in the Central District wouldn't lose any salmon. In medium run years, they would lose an estimated 245,000, mostly sockeye but including other species. In a low run year, they would lose 500,000—because managers would eliminate a regular, districtwide opening. During regular openings, the drift fleet is typically allowed to operate throughout the Central District, harvesting fish bound for all the rivers and streams along Upper Cook Inlet. During emergency openings (which managers use to augment regular openings during the peak of the run), the drifters are typically confined to an area close to shore, known as the corridor, where they harvest mainly sockeye bound for the Kenai River.

The eastside setnetters would give up more harvest in medium runs (when just emergency openings would be eliminated), and the drifters give up more catch during low runs (when a regular opening would be eliminated). ADF&G estimates that in a medium run, the setnetters would face 75 percent of the loss and in a low run the drifters would face about 75 percent of the loss.

Table 8. ADF&G Assumptions About Changes in Sockeye Sport Harvest (Scenario A)

	Low Run	Medium Run Current Bag Limit	Medium Run Double Bag Limit	High Run
Sockeye	+45,000	+45,000	+50,800	No change
King	+500	+500	+500	No change

Table 9. ADF&G Assumptions About Changes in Commercial Harvests (Scenario A)

	Low Run (fewer than 2 million)	Medium Run (2-5 million)	High Run (More than 5 million)
Changes in Commercial Openings			
Regular	1 fewer	No change	No change
Emergency	1-2 fewer	2-3 fewer	No change
Change in Drift or Setnet Harvest, Central District			
Sockeye	-417,000	-245,000	No change
King	-1,800	-1,600	
Other	97,500	0	
Change in Return to Mouth of Kenai			
Sockeye	+221,000	+221,000	No change
King	+1,800	+1,600	
Other	0	0	

Summary of Findings

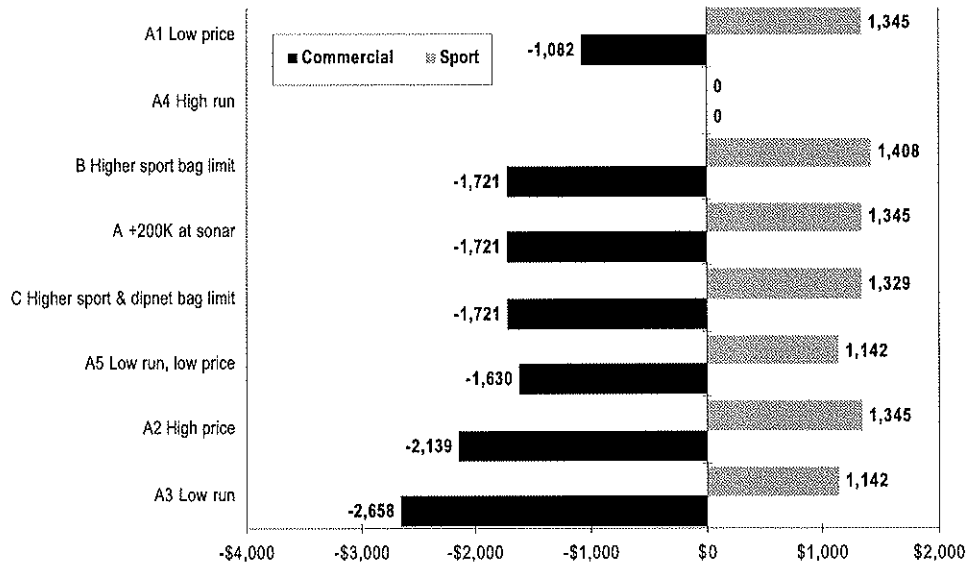
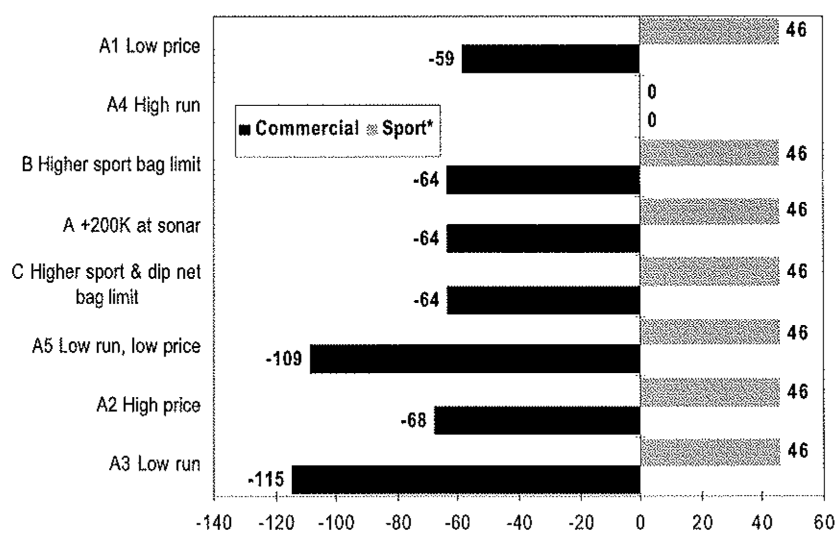


Figure 12. Changes in Net Economic Value With 200,000 Increase in Sonar Count (In Thousands of Dollars)

Figure 12 shows changes in net economic value under the scenarios, and Figure 13 shows changes in jobs under the scenarios. We found:

- *In more than half the scenarios, we can't say with certainty whether there would be gains or losses in net value,* given the range of uncertainty in our results. Those include Scenario A (medium runs and prices); Scenario B (higher sport bag limits); Scenario C (higher sport and personal use dip net bag limits); Scenario A1 (medium run, low ex-vessel price); and A4 (high run).
- *The biggest gain in net economic value for the sport fishery—roughly $1.4 million—would be from the combination of adding 200,000 sockeye and doubling the bag limit.* Most of the gain for sport anglers would be non-monetary: enhanced enjoyment of fishing. Some would be savings, from substituting less expensive fishing trips to the Kenai for more expensive trips elsewhere in Alaska.
- *Commercial losses would probably exceed sport gains when sockeye runs were low* (Scenarios A3 and A5). That's because ADF&G managers assume that in a low-run year, fishermen would have to give up a lot more fish to allow 200,000 more sockeye into the Kenai River. The higher the ex-vessel price, the more valuable each fish would be. At high prices, commercial losses would likely exceed sport gains, in years of medium as well as low runs.
- *The Alaska economy would probably experience a net loss of jobs and payroll in years when the run size and ex-vessel price were both medium. The reduction in the commercial harvest would cost the economy the equivalent—in work hours—of about 64 jobs and $1.9 million in payroll.* Of those jobs, 24 would be among fishermen, 10 among processing workers, and 30 in other Alaska industries. Our rough "medium estimate" is that improved sport fishing would create about 45 new jobs and $990,00 in payroll in industries that supply goods and services to sport anglers. However, this estimate is based on limited data from our survey of non-residents, and the actual effects might be significantly smaller or larger.

Figure 13. Changes in Alaska Jobs With 200,000 Increase in Sonar Count



**Medium estimate, based on medium estimate of changes in non-resident expenditures.*

Chapter I. Purpose and Scope of Study

How late-run Kenai River sockeye salmon should be divided between commercial and sport fishing groups has become an increasingly contentious issue in Southcentral Alaska. This study examines the potential economic effects of increasing the number of late-run sockeye salmon in the Kenai River. The Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage carried out the study, under contract with the Alaska Department of Fish and Game (ADF&G). The Alaska Legislature appropriated funds for the study.

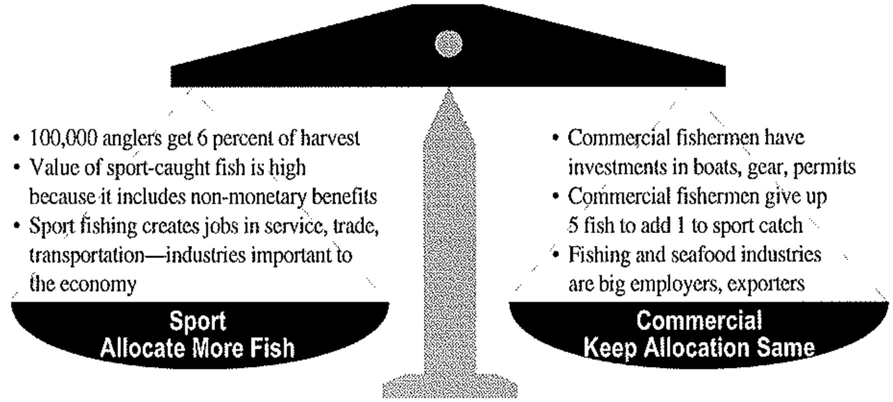
Commercial drift and setnetters in the Central District of Upper Cook Inlet harvest the bulk of the run, which generally begins moving into the river in late June and peaks toward the end of July. Managers regulate commercial openings to make sure enough sockeye reach the river for spawning and for sport fishing. The current management target set by the Alaska Board of Fisheries is 450,000 to 700,000 sockeye, measured at the Kenai River sockeye sonar counter (19 miles up from the river mouth and about 1.5 miles below the Soldotna bridge).

The study looks mainly at the potential economic effects of increasing the number of late-run sockeye at the sonar counter by 200,000—under various assumptions about run sizes, prices, bag limits, and other important factors. But to get a more complete picture of the potential effects of re-allocation, it also looks at effects of reducing the number of sockeye in the river.

Sport and commercial groups have also clashed over the interception of Kenai River late-run king salmon. ADF&G did not ask us to look at the economic effects of any management alternatives aimed specifically at increasing the number of late-run kings in the Kenai River. We did—as discussed on page I-5—take into account how numbers of king salmon in the river are likely to change if numbers of sockeye are increased.

This analysis isn't intended to try to settle the complicated question of who should get how many Kenai River salmon—a question that has not only economic but political, biological, and other dimensions. Figure I-1 below illustrates some of the arguments cited by those who want to keep the allocation of sockeye the way it is and those who want more fish for sport anglers. Both sides have defensible arguments. We don't assess the relative merits of those arguments. We present one kind of information that may be useful in this very difficult public debate: what are the potential economic effects on the commercial and sport fisheries if more sockeye go past commercial nets and into the Kenai River?

Figure I-1. Weighing A Change in Sockeye Allocation
Common Arguments For and Against



Sources of Uncertainty In Results

Given how important Kenai River sockeye are to Alaskans, it's reasonable to ask how confident we are in our results. Our general answer is that we believe our results give us a good but not a precise picture of the likely effects of reallocating a share of Kenai River sockeye. There are many sources of uncertainty that we have tried to minimize but can't eliminate.

- **Uncertainty about Future Conditions**—Neither we nor anyone else can predict future run sizes and prices (which will make a very substantial difference in effects on the commercial fishery) or the future level of non-resident sport fishing on the Kenai River (which makes a great deal of difference in our conclusions about changes in economic impacts of the sport fishery). We attempted to take potential run and price differences into account by looking at three levels of run size and price, based on historical data. We attempted to deal with uncertainty about growth in non-resident spending by making low, medium, and high estimates of how much non-resident anglers might increase their spending because of improved fishing on the Kenai. These are the best estimates we could make with available data, but they are still just rough, order-of-magnitude estimates.
- **Data Collection**—Our analyses are largely based on surveys of resident and non-resident sport anglers, commercial permit holders, and commercial fishing crews. Our survey designs were reviewed by independent experts. Overall we believe our survey results are sound, with good response rates and reasonable margins of error. The biggest shortcomings are in the mail-out survey of non-resident anglers who had previously fished in Alaska. We asked non-residents how much they would be likely to extend visits to Alaska, if there were better sockeye fishing on the Kenai River. Their answers about how much longer they would stay didn't vary with differences in the amount of improvement in fishing. We think many respondents may have given quick answers based on partial understanding of the questions—so their answers may not provide a reliable indication of how non-resident anglers' trips might be affected by better Kenai sockeye fishing. We attempted to deal with that problem, as described above, by making low, medium, and high estimates of changes in non-resident spending.
- **Choice and Design of Models**—We used several methods to estimate changes in net economic value. We think our best results for both the sport and the commercial fisheries are from computer simulation models that project change by doing statistical analysis of what people did in the past under various conditions. Our results are only as good as the computer models. Our model designs and results were reviewed by independent experts in fisheries economics. The reviewers called our analysis "well-conceived" and "carefully and thoroughly executed."

Projected and Actual Changes

In this study we have assumed managers could make precise changes in numbers of sockeye coming into the Kenai River. But in the complex real world of Cook Inlet salmon fisheries, precise management is impossible. Salmon runs are brief but intense, with hundreds of thousands or even millions of fish moving within very short periods. Also, several stocks of sockeye and other salmon mingle in Upper Cook Inlet, complicating the management of any given run. Weather, timing of runs, and other factors affect harvests.

That's why the Kenai River management target for sockeye is a range rather than a single number. As the adjacent table shows, in the past 15 years, managers have been within (or very close to) the target range seven times, exceeded it seven times, and were below once. Raising the management target by any given amount would not make fisheries management any more precise. As in the past, in some years the return would be near the low end of the range and sometimes near the high end.

We also know that if fisheries management isn't precise, neither are our results: in any given year the actual economic effects would be greater or smaller than we project, depending on how close managers come to their targets. Still, the economic effects we project under different run sizes, prices, and other factors provide a reasonable picture of how increasing the management target for late-run Kenai River sockeye could affect the sport and commercial fisheries.

Management Targets and Sonar Counts of Kenai River Sockeye

	Management Target	Sonar Count	Level
1981	350,000-500,000	408,000	within
1982		620,000	above
1983		630,000	above
1984		345,000	below
1985		501,000	within
1986		501,000	within
1987	400,000-700,000	1,597,000	above
1988		1,021,000	above
1989		1,599,000	above
1990		659,000	within
1991		645,000	within
1992		995,000	above
1993		814,000	above
1994		1,004,000	above
1995	450,000-700,000	630,447	within

Why Do An Economic Study?

Both the commercial and sport fisheries are undoubtedly important to the economies of the Kenai Peninsula and the state. Sockeye make up most of the value of the commercial salmon harvest in Upper Cook Inlet. The commercial fishing industry—including the processing sector and businesses that supply the fleet—is one of the major employers in the Kenai Peninsula Borough. On the sport side, the Kenai River system (including the Russian River) is the state's top sport fishing site. The tourism industry—trade, services, and transportation—is also a major employer in the borough, and many tourists (including both those from other areas of Alaska and from outside the state) are drawn by sport fishing. Fishing also provides pleasure and food for sport anglers and personal use fishermen.

Sport and commercial fishing groups both believe their economic contributions are underrated; they argue that those contributions should be better understood and better documented. The tens of thousands of anglers who fish in the Kenai River want more salmon. On the commercial side, there are fewer fishermen—but permit holders have big investments in boats and gear, and some paid $100,000 or more for the limited entry permits that allow them into the fishery. Boat owners and crews worry about how much they could lose if they can't catch as many sockeye.

Responding to the long-standing debate between sport and commercial fishing groups, the Alaska Legislature in 1994 appropriated money to the Alaska Department of Fish and Game for a study that would provide "information and models that will enable comparisons of economic values of management alternatives for salmon in Cook Inlet. . . that are comparable for the commercial and sport salmon fisheries."

The legislature intended this study to generate useful information for those using the fishery and for the Alaska Board of Fisheries, which regulates the fishery. Such information will be increasingly important as time goes on—and as the population of the state continues to grow, the tourism industry expands, access to fisheries continues to increase, and the decline in oil production makes the health of our other natural resource industries all the more critical to Alaska's economy.

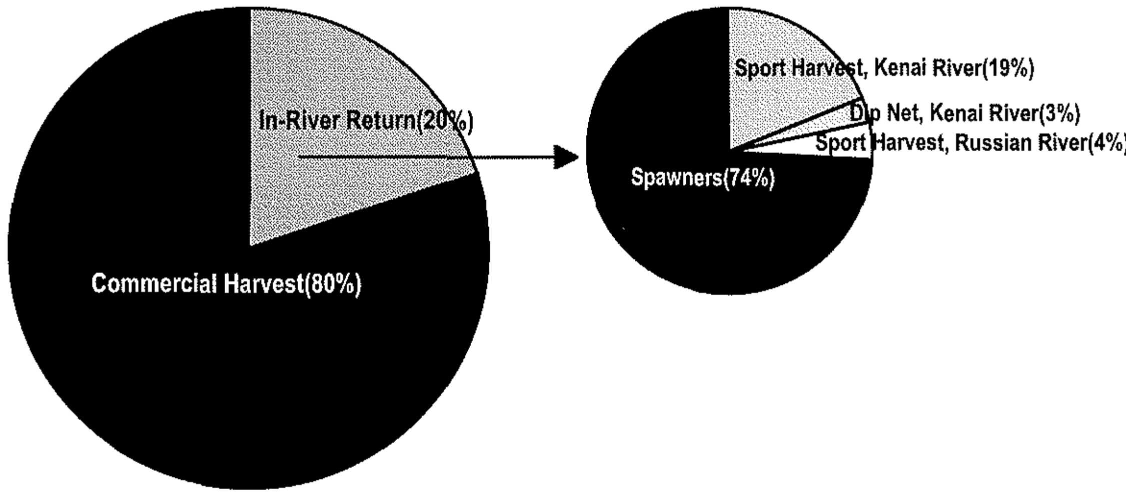
Current Allocation

The late run of sockeye begins moving into the Kenai River toward the end of June and generally peaks toward the end of July. (There is an early, much smaller run of Kenai River sockeye; this report deals exclusively with the late run.) Since 1990, the run has ranged from less than 2 million to more than 8 million fish. A share of those fish have to reach their upriver spawning grounds every summer, to insure future runs. The Alaska Board of Fisheries decides how the rest will be divided among commercial, sport, and personal use fisheries (which include both dip net and set gillnet fisheries). The Alaska Department of Fish and Game (ADF&G) puts the board's policies into effect.

ADF&G tries to keep the number of sockeye passing the Kenai River sonar counter in the range established by the Board of Fisheries—currently 450,000 to 700,000. The inriver return (the return to the river mouth) is larger than the sonar count, because sport anglers and dipnetters harvest sockeye between the river mouth and the sonar. Biologists can't count fish at the mouth, but they estimate the total return by adding the harvests below the bridge to the sonar count.

Figure I-2 shows that in the 1990s, about 80 percent of the total late-run of Kenai River sockeye has been commercially harvested in Upper Cook Inlet and 20 percent returned to the river. Of the fish that returned to the river, close to 75 percent spawned, about 19 percent were harvested by sport anglers in the Kenai River mainstem, 4 percent by sport anglers on the Russian River (which is a tributary of the Kenai River), and 3 percent by personal use and subsistence fishermen.

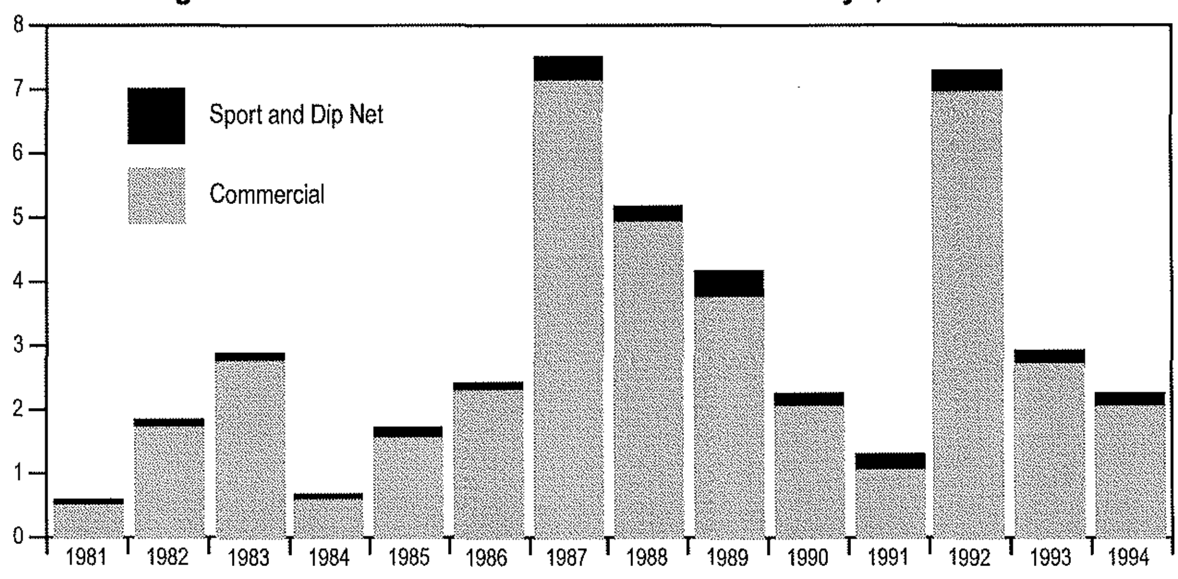
Figure I-2. Allocation of Kenai River Sockeye in the 1990s



Source: Assessment of Sockeye Salmon Returns to the Kenai River, Doug McBride and Steve Hammarstrom, Alaska Department of Fish and Game, Division of Sport Fish, 1995.

Figure I-3 shows how the *harvest*—which excludes the spawning escapement—of Kenai River late-run sockeye varied between 1981 and 1994 and how it was divided among commercial, sport, and personal use and subsistence harvests. The total harvest in recent years has ranged from less than 1.5 million fish to more than 7 million fish. Commercial drift and setnetters took on average 93 percent of the harvest, sport anglers 6 percent, and dipnetters 1 percent.

Figure I-3. Harvest of Late-Run Kenai River Sockeye, 1981-1994



Source: Assessment of Sockeye Salmon Returns to the Kenai River, Doug McBride and Steve Hammarstrom, Alaska Department of Fish and Game, Division of Sport Fish, 1995.

Scope of Study

Why Focus on Kenai River Sockeye?

What ISER studied—and how we studied it—were largely determined by ADF&G, which manages the state's fisheries under the direction of the Alaska Board of Fisheries. Figure I-4 shows how the study evolved.

After the legislature appropriated money for the study in early 1994, ADF&G set up an internal study team to decide what could be analyzed, given the available money and the existing biological information. Five species of salmon come up Cook Inlet to spawn in a number of rivers and streams. Commercial, sport, subsistence, and personal use fishing groups harvest those salmon in many locations and with various types of gear from May into September. Assessing the economic effects of "management alternatives" for all Cook Inlet salmon fisheries would be an enormous job.

So the study team held public meetings to find out what issues Alaskans were most interested in. Sport and commercial groups were particularly interested in the allocation of Kenai River sockeye and king salmon. There were also other areas of interest—such as allocation of Susitna River salmon stocks. Studying all the Cook Inlet salmon issues that were raised was beyond the resources of this study.

At about the same time the study team was considering the scope of the study, the Alaska Board of Fisheries appointed a task force to make recommendations about the allocation of late-run sockeye in the Kenai River. The creation of that task force was another sign of the strong public interest in Kenai River sockeye.

After meetings and discussions, the department issued a Request for Proposals—a document asking research groups to submit proposals for a study of "the economic effects of Kenai River late-run sockeye and king salmon fisheries . . . . under an assumed change in the Kenai River Sockeye Salmon Management Plan to increase the inriver run size for Kenai River late-run sockeye by 200,000 fish."

ISER and several other groups submitted proposals; the department chose ISER's proposal in May 1994. Then ISER and ADF&G's study team met a number of times—first to reach an agreement on the broad study questions and analytic methods and then to determine specific management alternatives and assumptions.

In the summer of 1994 ISER began work on the project. We first held focus meetings with commercial and sport fishing groups, to help determine how to structure the surveys that would provide information for our analysis. Between October 1994 and March 1995 we surveyed commercial fishermen and sport anglers—resident and non-resident—to collect information about spending, places fished, reactions to possible management changes, and more.

From early 1995 through October we did much of the economic analysis, and from October through December we produced final estimates and wrote the report.

Figure I-4. How the Study Developed

February 1994	Alaska Legislature funds "Cook Inlet Economic Study"
March 1994	ADF&G establishes internal study team to plan study • Team holds public meetings • Team talks to fisheries managers
March 1994-May 1994	ADF&G decides to focus on Kenai River sockeye ISER awarded contract to study economic effects of increasing numbers of sockeye in Kenai River by 200,000
May 1994-June 1994	ISER holds public focus groups to help develop survey questionnaires ADF&G study team and ISER meet to: • Define study questions and analytical methods • Develop regulatory and management alternatives • Determine assumptions about run sizes and other variables
June 1994-October 1995	Project Underway • ISER surveys fishing groups, residents and non-residents • ISER does analysis
December 1995	ISER submits draft report ADF&G reviews draft
January 1996	ISER submits final report

What About King Salmon?

Anyone who reads newspapers or listens to the news in Alaska knows that late-run Kenai River king salmon are also a big source of contention between sport and commercial fishing groups. There is no targeted commercial fishery for late-run kings in the Central District of Upper Cook Inlet, but because the late runs of sockeye and king overlap, commercial fishermen harvest kings while they're fishing for sockeye. In the past decade the reported commercial catch has varied from 5,000 to 20,000 kings per season. ADF&G's study team did not ask us to study any management alternatives that had the primary goal of increasing the number of king salmon available for sport fishing. All the management strategies we were asked to examine had the primary goal of changing the number of late-run sockeye moving into the Kenai River.

However, any increase in the management target for Kenai River sockeye would also affect the number of kings reaching the river. ADF&G estimates that about 1,600 more king salmon would reach the river in an average year, if the sonar count of sockeye were increased by 200,000. Biologists estimate sport anglers would catch about 500 of those additional kings.

Part of the reason the number of kings in the river wouldn't increase substantially under the management alternatives we studied is the timing of the commercial closures. ADF&G told us to assume that managers would allow more sockeye into the river by eliminating anywhere from one to three commercial openings during the peak of the sockeye run, which is typically July 15 to July 30. That limited reduction in commercial fishing time at the peak of the sockeye run would not significantly increase the return of kings to the river—because the king run is much more protracted.

Although we didn't study any management changes in the king salmon fishery, or any variations in the king run size or price, ISER's analysis *does* take into account the economic effects of the estimated increase in the number of kings in the river and the estimated increase in the sport catch of kings in an average year. We also count the value of estimated changes in numbers of other species of Kenai River salmon (as shown in Table IV-2 in Chapter IV) that would result if numbers of sockeye were increased.

Methods of Analysis

There are a number of ways to measure the economic effects of a change in public policy. We did two kinds of economic analyses: (1) economic impacts and (2) net economic value. The economic impact analysis looks at how a proposed change in sockeye allocation would affect economic activity, through changes in value added, jobs, and income. The net economic value analysis looks at the broader picture of all the costs and benefits—including both monetary and non-monetary—the proposed change could create, and how those costs and benefits together would increase or reduce the value of the sockeye fishery to society as a whole. Both methods are valuable, even though they assess economic effects in different ways. The two methods are explained more in Chapter III.

We assessed potential economic change under ten scenarios. Eight of those scenarios examine the effects of increasing the number of sockeye at the Kenai River sonar counter by 200,000, with a number of variations:

- One scenario examines just the potential effects of the increased sonar count.
- Two scenarios examine the possible effects of liberalizing the regulations governing the sport and personal use fisheries.
- Four scenarios consider the possible effects of variations in sockeye run size and price.
- One scenario explores combinations of assumptions.

The remaining two scenarios compare the potential effects of increasing or decreasing the number of sockeye at the sonar counter by 100,000. We included those scenarios for two reasons: (1) to help define the possible range of variation in economic effects; and (2) to discover whether commercial and sport groups place the same value on gaining fish as on losing the same number of fish; knowing the relative values people place on gaining or losing fish is important to our analysis.

Chapter III describes the ten scenarios in detail. ISER economists relied on ADF&G biologists for all the management and harvest assumptions in this study—including, for instance, assumptions about how increasing the number of sockeye in the Kenai River would change numbers of other kinds of salmon, and how sport harvests in the Kenai River and commercial harvests in Upper Cook Inlet salmon would change under various scenarios. Chapter IV describes how biologists developed their assumptions and presents their estimates of change in commercial and sport harvests and spawning escapement under various conditions. Those estimates are critical to our analysis—because what you assume about how many fish sport and commercial groups gain and lose strongly influences findings about economic gains and losses.

Organization of the Report

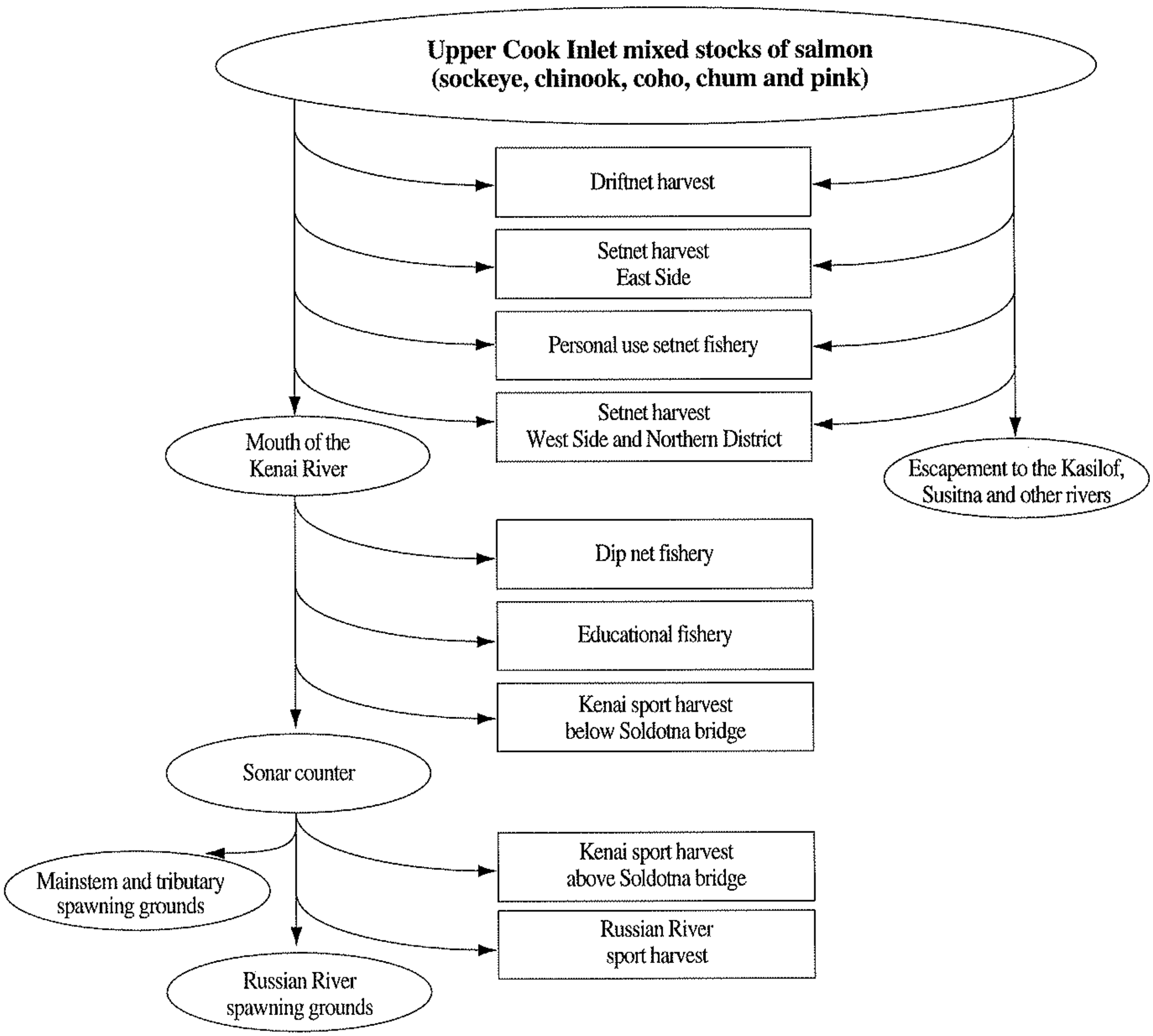
This report is divided into five parts. Part I (Introduction) consists of four chapters that set the stage for the analysis by discussing the origins of the study, introducing the fisheries, and explaining the study methods, analytical assumptions, scenarios, and limits of the analysis. Part II (Sport Fishery) has three chapters—first a profile of the Kenai river sport fishery, followed by chapters describing our methods and findings about changes in net economic value and economic impacts in the sport fishery. Part III (Commercial Fishery) begins with a profile of the Upper Cook Inlet commercial fishery, then describes our methods and findings about changes in net economic value and economic impacts for the commercial fishery. Part IV (Other Considerations and Conclusions) has two chapters. The first talks briefly about other potential effects of increasing the number of late-run sockeye in the Kenai River—effects we did not analyze. The final chapter summarizes and compares our findings about potential changes in both the sport and commercial fisheries. Part V (Appendixes) is a series of technical appendixes that document our analytical methods and augment information presented in the report.

Chapter II. Introduction to the Fisheries

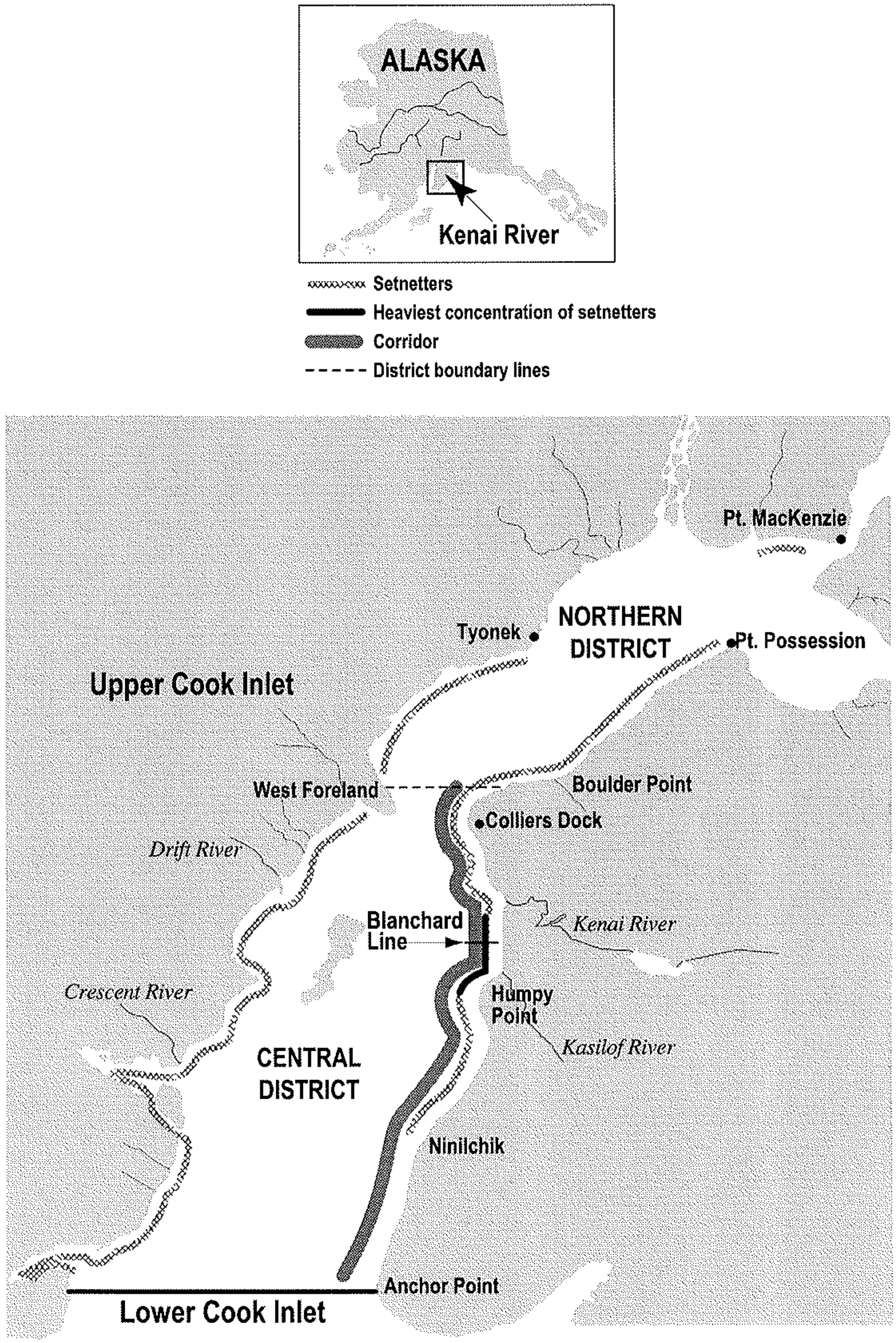
This chapter describes the Upper Cook Inlet commercial salmon fishery and the Kenai River sockeye sport fishery, including brief discussions of how they are currently managed.

Five species of salmon come up Cook Inlet and into the Kenai River and other rivers and streams to spawn between May and September. Figure II-1 diagrams the flow of salmon past the commercial, subsistence, personal use, and sport harvesters to their spawning grounds. Maps II-1 and II-2 show Upper Cook Inlet commercial fishing districts and Kenai River sport fishing areas.

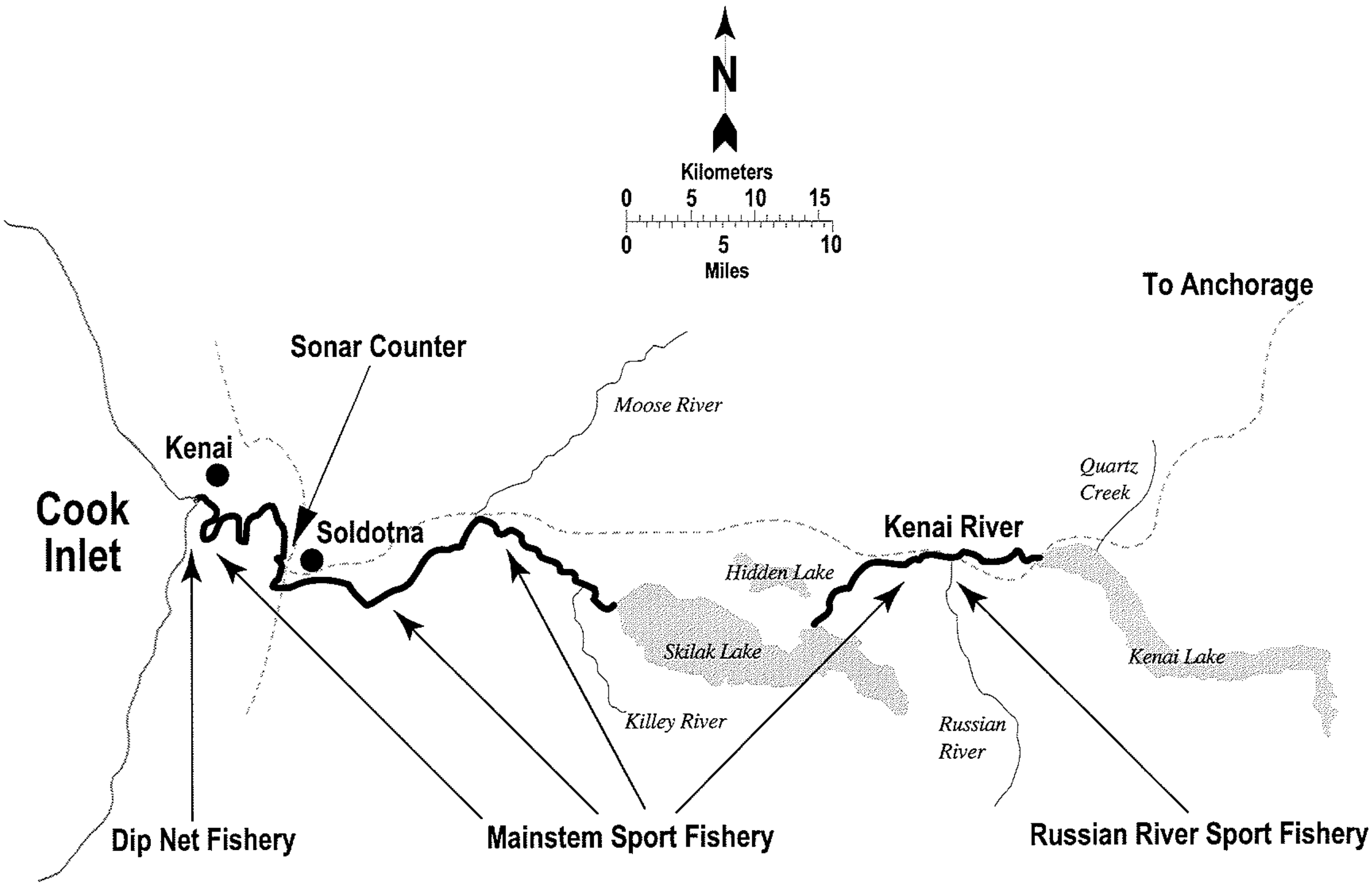
Figure II-1. The Flow of Salmon in Upper Cook Inlet



Map II-1. Upper Cook Inlet Commercial Fishery



Map II-2. Kenai River Sport Fishery



The Upper Cook Inlet salmon fisheries are mixed stock—runs of several stocks of sockeye and runs of different species overlap, which means that the fishery can't be managed with only the allocation of Kenai River sockeye as the goal. Sockeye return not only to the Kenai River but to the Kasilof and Susitna and other rivers and streams in Upper Cook Inlet. Runs of king, coho (silver), chum, and pink salmon are in Upper Cook Inlet at the same time as the late Kenai sockeye run. Managers have to balance a variety of management goals.

The Alaska Board of Fisheries, which regulates the state's fisheries, has a management plan for Upper Cook Inlet salmon stocks. Some fisheries are managed—after enough fish have escaped for spawning— primarily for commercial purposes, others for sport uses. Whether a given run is managed mainly for commercial or sport uses depends on a number of factors, including the size of the run and established uses of fish from that run. (Subsistence users of fish and game have priority over other users, under federal and state law; in circumstances where there are not enough resources for all users, subsistence users are to be first in line.)

The Board of Fisheries' Upper Cook Inlet Salmon Management Plan says that:

- Northern district king salmon, early Kenai River king salmon, and early Russian River sockeye will be managed mainly for recreation uses.
- Salmon stocks normally in Upper Cook Inlet from July 1 through August 15 will be managed mainly for commercial purposes.
- After August 15, salmon that spawn in Kenai Peninsula drainages will be managed primarily for recreation uses and salmon that spawn elsewhere will be managed primarily for commercial uses.
- The incidental catch of Susitna River coho, late Kenai River king, and early Kenai River coho by commercial fishermen should be kept to a minimum.

Upper Cook Inlet Commercial Salmon Fishery

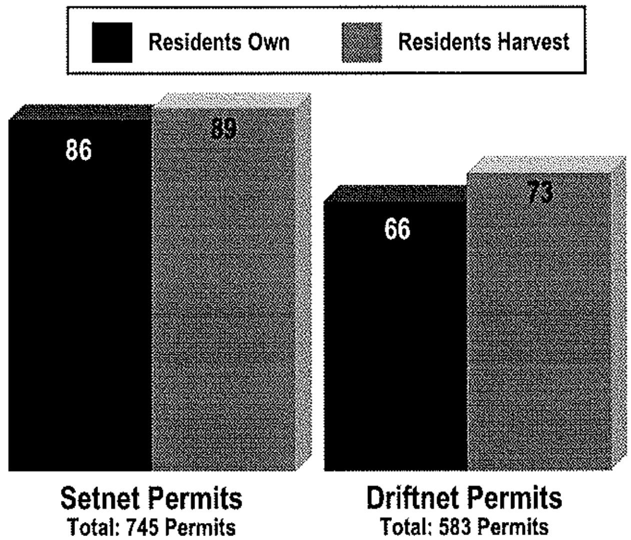
Cook Inlet is divided into two large commercial fisheries management areas—Lower Cook Inlet and Upper Cook Inlet, which is the area this study is concerned with. Anchor Point is the boundary between the two. Upper Cook Inlet is in turn divided into the Central and Northern Districts. The Central District is from Anchor Point north to Boulder Point; the Northern District is from Boulder Point north (Map II-1).

Commercial fishing in Upper Cook Inlet is done with drift and set gillnets. The drift fleet is confined to the Central District. Setnetters fish in both districts, but about 70 percent of setnetters are concentrated on the east side of the Central District. It is the drift fleet and the east side setnetters in the Central District that harvest the bulk of the Upper Cook Inlet salmon harvest—and it is they who would give up a share of salmon, if managers allowed more sockeye into the Kenai River.

Entry to the Cook Inlet commercial salmon fisheries has been restricted through a permit system since the 1970s. There are currently 745 setnet permits and 583 driftnet permits for the Cook Inlet salmon fisheries (including the Lower and Upper management areas). All the driftnetters and the majority of the setnetters fish in the Upper Cook Inlet management area.

Alaskans own 86 percent of the setnet permits and 66 percent of the driftnet permits in Cook Inlet. In the 1990s Alaska residents' share of the harvest has averaged slightly more than their share of the permits, as Figure II-2 shows. Residents (based on permit address) took about 89 percent of the Cook Inlet setnet harvest and 73 percent of the driftnet harvest in recent years.

Figure II-2. Resident Ownership of Cook Inlet Set and Driftnet Permits and Average Share of Harvest, 1990-1993



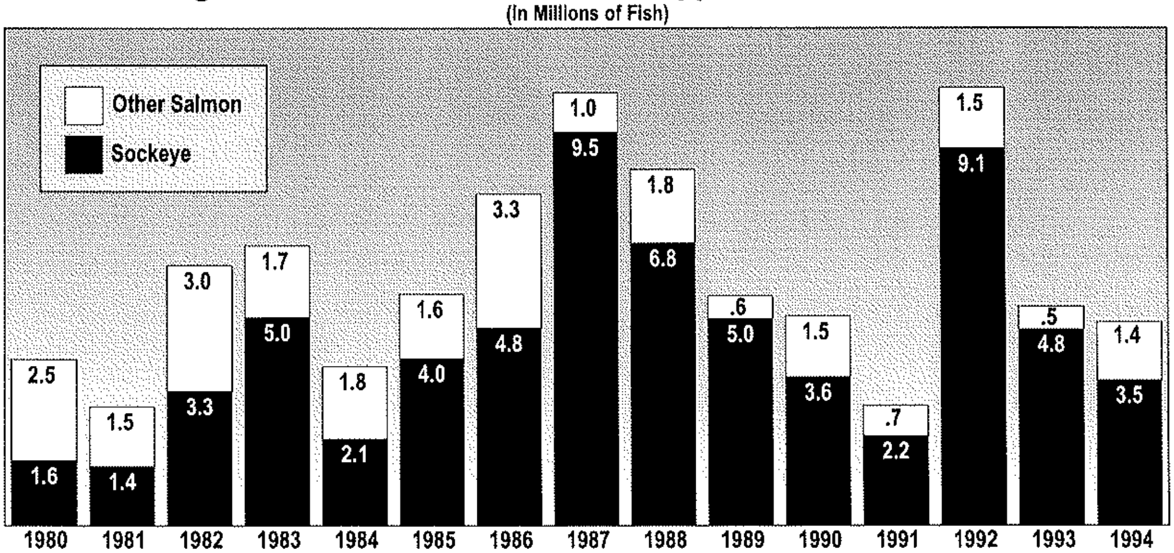
Sources: Alaska Commercial Fisheries Entry Commission; ISER calculations from CFEC harvest data, average 1990-93.

The annual commercial salmon harvest in Upper Cook Inlet varied from less than 3 million to more than 10 million over the past 15 years (Figure II-3). Five species of salmon are harvested commercially, but sockeye dominates the harvest and the ex-vessel value (the total paid fishermen).

Over the past 15 years sockeye have made up anywhere from 50 percent to 90 percent of the commercial harvest. The late-run of Kenai River sockeye is the largest sockeye run in Upper Cook Inlet. Largely as a result of higher Kenai River sockeye runs, harvests increased dramatically during the 1980s, jumping from an annual average of 1.1 million fish in the 1970s to 4.4 million in the 1980s. Except for 1992, sockeye runs in the 1990s have been smaller than they were in the late 1980s.

Figure II-3. Commercial Harvest of Upper Cook Inlet Salmon

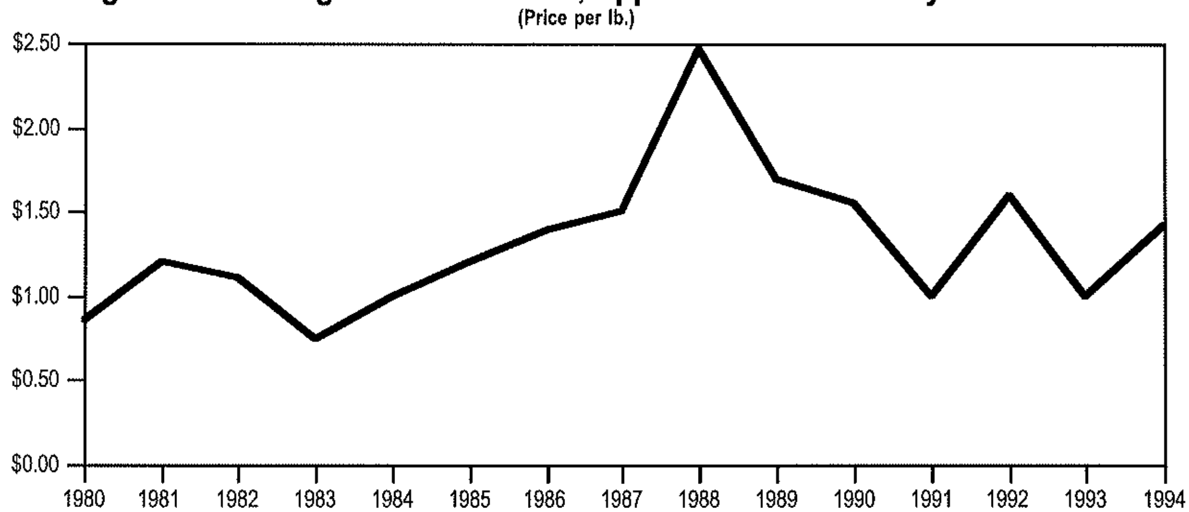
(In Millions of Fish)



Source: Paul Ruesch and Jeff Fox, *Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993,* Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division

Prices of sockeye can change sharply from one year to the next, but in the mid and late 1980s prices were mostly up. The price paid fishermen (the ex-vessel price) peaked at $2.47 per pound in 1988 (Figure II-4). By 1991, ex-vessel prices had fallen to less than half that level, and they've varied between $1.00 and $1.60 per pound in the past five years.

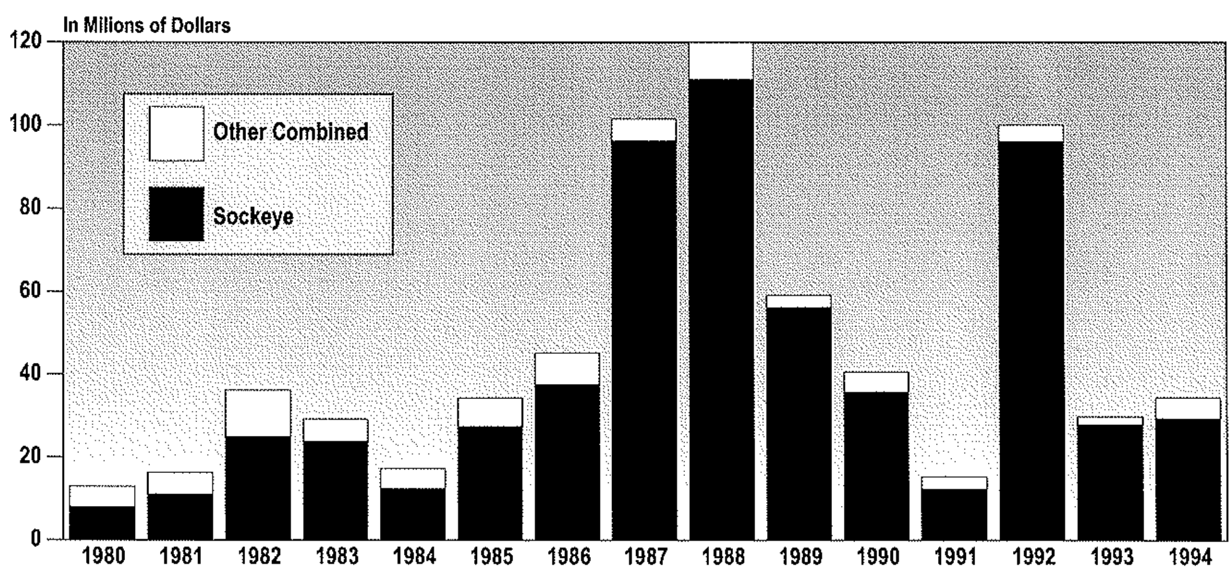
Figure II-4. Average Ex-Vessel Price, Upper Cook Inlet Sockeye Salmon



Source: Paul Ruesch and Jeff Fox, *Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993,* Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division

In the 1990s, sockeye have accounted for more than 90 percent of the ex-vessel value of the Upper Cook Inlet salmon harvest. A combination of high prices and a large run led to a peak ex-vessel value of more than $121 million for Upper Cook Inlet salmon in 1988—with sockeye contributing $111 million of the total. King salmon have contributed about 1 percent of the ex-vessel value of the harvest in the 1990s. There is no targeted fishery for kings in the Central District of Upper Cook Inlet, but commercial fishermen can sell kings they catch incidentally while targeting other species.

Figure II-5. Ex-Vessel Value of Upper Cook Inlet Salmon

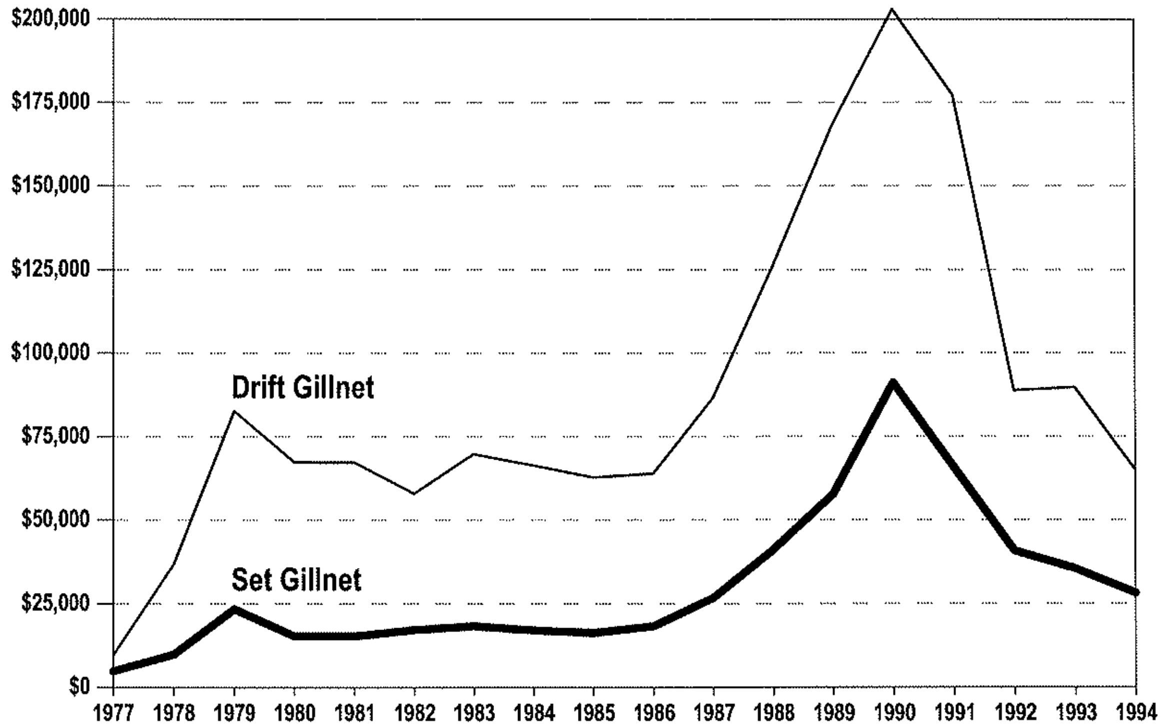


Source: Paul Ruesch and Jeff Fox, *Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993,* Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division

The dramatic increase in the value of the Upper Cook Inlet commercial salmon fishery in the late 1980s is reflected in the soaring value of limited entry permits (Figure II-6). A Cook Inlet setnet permit that sold for $15,000 in 1980 sold for $91,000 by 1990. A driftnet permit that sold for $67,000 in 1980 cost $203,000 by 1990.

Depressed salmon prices—and generally smaller runs—in the 1990s have sharply cut values of Cook Inlet permits. Average prices of both drift and setnet permits dropped more than 50 percent just between 1990 and 1992. In 1994, the average price of a Cook Inlet driftnet permit was less than $65,000 and the average price of a setnet permit was around $28,000.

Figure II-6. Average Price of Salmon Permits, Upper Cook Inlet Drift and Set Gillnet



Source: *Changes in the Distribution of Commercial Fisheries Entry Permits, 1975-1994,* Alaska Commercial Fisheries Entry Commission, June 1995

Salmon runs can fluctuate sharply from one year to the next, and changes in fisheries are never completely predictable. Biologists don't entirely understand why Upper Cook Inlet sockeye runs—with the largest being the late Kenai River run—increased so much in the 1980s and have dropped so much in the 1990s (with the large 1992 run an exception). Many analysts expect lower prices and smaller harvests in the near future.

Kenai River Sport Fishery

The Kenai River system (including the Russian River) is the state's most popular salmon sport fishing area. The river has long been famous for its king salmon fishing, but the popularity of sockeye fishing has been growing. Large numbers of anglers also fish for Kenai River coho salmon in the late summer. Most king fishing is done from boats; kings typically don't run near the shore. Sockeye do run close to the shore, and most sockeye fishing is done from the riverbank.

There are early and late runs of both sockeye and king salmon in the Kenai River. For most of both the early and late runs, sockeye and kings are in the river at the same time. The early run of sockeye generally begins trickling into the Kenai River at the end of May and continues through much of June. This early run, which is much smaller than the later run, is mainly bound for the Russian River—a tributary of the Kenai—and is known as the early Russian River run (Map II-2). That run is not concentrated enough to afford good sport fishing until the fish move to the confluence of the Kenai and Russian rivers. The late run of sockeye (which includes a late run of sockeye bound for the Russian River) begins moving into the Kenai River in late June and peaks in late July.

Roughly three-quarters of the statewide sport harvest of sockeye is from Kenai Peninsula rivers—about two-thirds from the mainstem Kenai River and most of the rest from the Russian River. The late run offers good sport fishing along much of the mainstem and at the confluence of the Kenai and Russian rivers. But the best sport fishing doesn't last long—typically about three weeks, from mid-July through the first week of August.

Sport fishing on the Kenai River increased dramatically in the 1980s. Table II-1 shows days fished on the river since 1981. "Days fished" is a measure not only of how many anglers fished on the Kenai River in a season, but also of how many times they fished. Those numbers can vary substantially from year to year, depending on the strength of the salmon runs. But the overall trend in the early 1980s was up sharply; in 1989 there were twice as many days fished as there had been in 1981. In the 1990s numbers have been down from the 1989 peak.

Table II-1. Days Fished* on the Kenai River

1981	178,720
1982	231,950
1983	229,230
1984	248,790
1985	294,610
1986	300,320
1987	261,510
1988	338,540
1989	376,900
1990	342,662
1991	323,368
1992	332,573
1993	324,120
1994	340,904

**Number of anglers multiplied by days fished.*

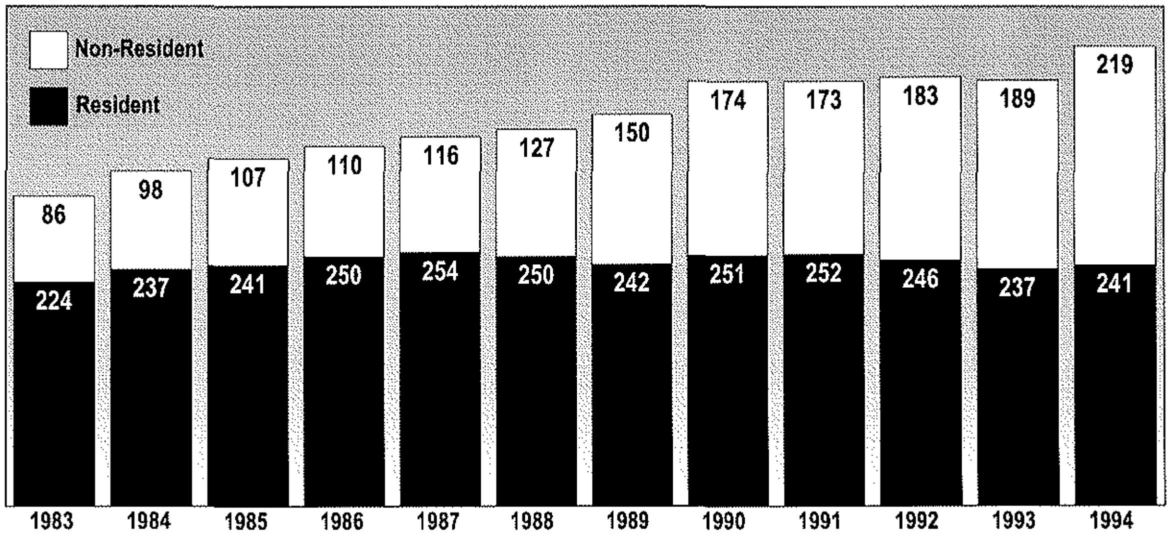
Source: Alaska Department of Fish and Game, annual statewide harvest survey

One change during the 1980s was the discovery that sockeye could be caught with flies in the Kenai River. For a long time most Alaskans believed that sockeye couldn't be caught with flies in the turbid, glacial water of the Kenai mainstem, and most of the sockeye harvest from the Kenai system was from the Russian River. Before snagging was outlawed, most sockeye caught in the Kenai were snagged. But more anglers were drawn to the Kenai as they learned how to catch sockeye with flies—and sockeye, unlike king salmon, are accessible to anglers without boats.

Also in the 1980s there were a lot more people living in Southcentral Alaska—the region that includes the Kenai Peninsula as well as Anchorage and the Mat-Su Borough to the north. The Kenai River is within easy driving distance of Anchorage, where nearly half of Alaskans live. Southcentral Alaska's population increased very quickly during the economic boom of the early 1980s, and the region's population was up 40 percent between 1980 and 1990 (despite a brief decline during the recession of 1986-88).

Alaska in general and the Southcentral region in particular have also become increasingly popular with anglers from outside Alaska. That trend is reflected in Figure II-7, which shows growth in the number of resident and non-resident anglers statewide between 1983 and 1994. In 1983, 224,000 Alaskans and 86,00 non-residents fished in the state. By 1994, the number of resident anglers had changed little (241,000) while the number of non-resident anglers had more than doubled, reaching 219,000.

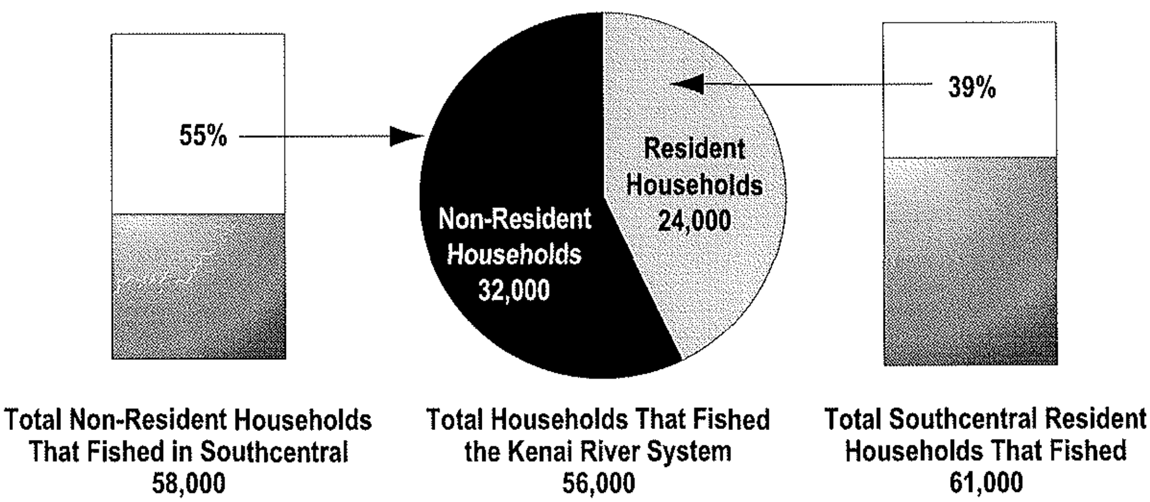
Figure II-7. Resident and Non-Resident Sport Anglers in Alaska
(In Thousands)



Source: Michael Mills, *Harvest, Catch, and Participation in Alaska Sport Fisheries During 1993,* Alaska Department of Fish and Game, Division of Sport Fish, September 1994.

Figure II-8 shows the importance of the Kenai River system to sport anglers. Nearly 40 percent of Southcentral households that fished in 1993, and 55 percent of non-resident households that fished in the region, made trips to the Kenai River. Looked at another way, nearly half the households—both resident and non-resident—who fished anywhere in Southcentral Alaska in 1993 fished the Kenai River system.

Figure II-8. The Importance of the Kenai River Sport Fishery, 1993



Sources: Estimated from ISER surveys and ADF&G data, based on fishing trips in May, June, and July. Includes fishing on the mainstem and in the Russian River.

Table II-2 and Figure II-9 show the sport harvest of Kenai River sockeye compared with the inriver return (the return to the mouth of the river) over the past decade. The sport harvest varied from less than 40,000 to more than 330,000 sockeye—anywhere from 11 to 26 percent of the inriver return. Generally, the higher the inriver return, the higher the sport harvest, but it's not an exact correlation. Other factors—like the timing of the run—also influence the catch. If, for instance, a large number of fish move into the river later than expected, and many anglers have given up and gone home, then the sport catch wouldn't reflect the fact that more fish were in the river.

Table II-2. Sport Harvests of Late-Run Kenai River Sockeye, 1984-1994

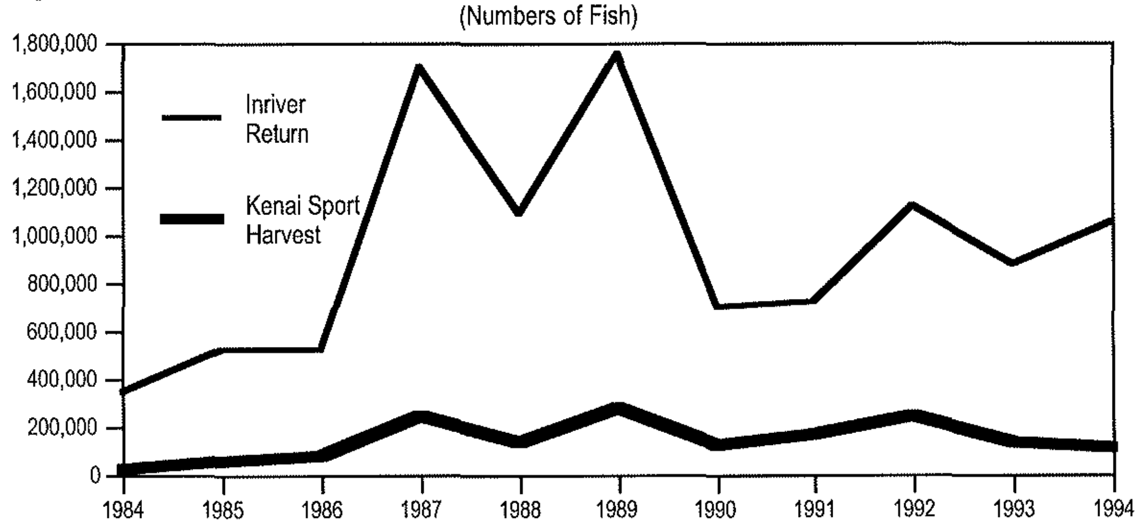
	Kenai Mainstem	Russian River	Total Harvest	As Percentage of Inriver Return*
1984	15,702	21,970	37,672	11%
1985	57,212	58,410	115,622	22%
1986	72,398	30,810	103,208	20%
1987	240,819	40,575	281,394	16%
1988	129,811	19,936	149,747	14%
1989	277,226	55,210	332,436	18%
1990	120,783	56,175	176,958	25%
1991	162,000	31,449	193,449	26%
1992	242,492	26,101	268,593	24%
1993	137,179	26,536	163,715	19%
1994	93.616	26,375	119,991	11%

* *Inriver return calculated by adding sport and personal use harvests below the sonar counter to the sonar count.*

Source: *Assessment of Sockeye Salmon Returns to the Kenai River,* by Doug McBride and Steve Hammarstrom, Alaska Department of Fish and Game, Sport Fish Division, 1995.

Figure II-9. Inriver Return and Sport Harvest of Late-Run Kenai River Sockeye

(Numbers of Fish)



Source: Assessment of Sockeye Salmon Returns to the Kenai River, by Doug McBride and Steve Hammarstrom, Alaska Department of Fish and Game, Sport Fish Division, 1995. Includes harvests from Kenai mainstem and Russian River.

Table II-3 shows the 1993 Kenai River sport salmon harvest of guided and unguided anglers. Many guided anglers are non-residents; they hire guides with boats so they can go after kings. Unguided anglers target mainly sockeye, which they can catch from the riverbank. Unguided anglers took 88 percent of the sockeye catch, while guided anglers took 54 percent of the king catch.

Table II-3. Kenai River Salmon Sport Harvest, 1993

Number of Fish	Guided	Unguided
Sockeye	16,457	120,722
King	16,463	13,849
Silver	23,743	26,795
Total	**56,663**	**161,366**
Composition of Catch by Angler Group		
Sockeye	29%	75%
King	29%	9%
Silver	42%	17%
All species	**100%**	**100%**
Share of Catch by Species		
Sockeye	12%	88%
King	54%	46%
Silver	47%	53%

Source: *Harvest, Catch, and Participation in Alaska Sport Fisheries During 1993,* by Michael Mills, Alaska Department of Fish and Game, Division of Sport Fish, September 1994.

Fisheries Management

Hitting the Management Target

Probably the most important thing to keep in mind about management of late-run sockeye—or any other salmon—is that precise management is impossible. Salmon runs in Upper Cook Inlet are brief but intense, with hundreds of thousands or even millions of fish moving within very short periods. Stocks from a number of rivers and streams mingle in the inlet, complicating management. Run sizes can change dramatically and unpredictably from year to year. Managers have to make decisions quickly but are hampered by the limits of their information and management tools.

The primary goal for managers of Kenai River sockeye (and the other Upper Cook Inlet salmon stocks) is making sure enough spawn each season to produce healthy future runs. At the same time, they try to make sure not too many sockeye go upriver to the spawning grounds; many biologists believe that too many spawners also have the potential to hurt future runs, by damaging spawning habitat and overstressing rearing areas and food supplies.

Based on research and historical data, biologists estimate how many salmon need to return to the river to spawn. The management target for Kenai River sockeye (as measured at the sonar counter near the Soldotna bridge) established by the Alaska Board of Fisheries is principally spawning escapement, but it also includes a share for sport anglers. It is only since the late 1960s, when sonar counters were introduced, that biologists have been able to count salmon returning to Alaska's rivers. The management target for Kenai River sockeye has been increased several times over the past 25 years, as biologists learned more about the fishery and as sport fishing increased.

The current management target for Kenai River late-run sockeye is 450,000 to 700,000 fish at the sonar counter. (The total inriver return—the return to the mouth of the river—is larger than the sonar count, because sport anglers harvest some sockeye before they reach the sonar counter). The management target is a range rather than a single figure because it's not possible to control returns to the river that accurately. In fact, keeping returns within the broad target range is difficult. Managers try to regulate returns to the river by regulating commercial openings.

Regulating returns to the river requires continuous monitoring, maximum flexibility of regulatory tools (timing, duration, and location of commercial openings), and more than a little bit of luck. Shifting weather and tides and changes in fishing effort make it difficult to predict what the commercial catch will be for any given opening. Another complication is that Kenai River sockeye mix with other stocks in the inlet.

No one can predict exactly when the sockeye will move into the Kenai River—and when they do move, almost all of them will often move within a two-week period. Hundreds of thousands of sockeye can pass the sonar counter within a few days. So it's not surprising that managers often miss their target for late-run sockeye. Table II-4 shows the management targets and estimated sonar counts from 1981 though 1995.

Table II-4. Management Targets and Sonar Counts of Kenai River Sockeye

	Management Target	Sonar Count	How Did We Do?
1981	350,000-500,000	408,000	within
1982	↓	620,000	above
1983		630,000	above
1984		345,000	below
1985		501,000	within
1986		501,000	within
1987	400,000-700,000	1,597,000	above
1988	↓	1,021,000	above
1989		1,599,000	above
1990		659,000	within
1991		645,000	within
1992		995,000	above
1993		814,000	above
1994		1,004,000	above
1995	450,000-700,000	630,447	within

Source: Paul Ruesch and Jeff Fox, Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993, Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 1994.

From 1981 through 1986, the management target was 350,000 to 500,000 sockeye. Managers hit (or came very close to) that target 4 out of 6 years. The remaining 2 years returns exceeded the top end of the range by about 25 percent.

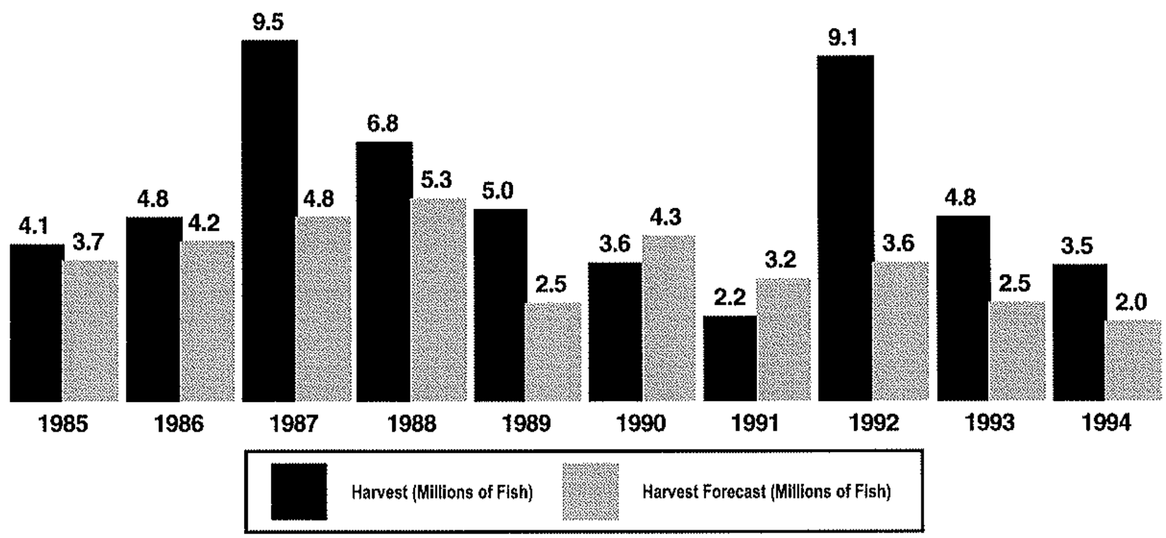
In 1987, the target was raised to 400,000 to 700,000 sockeye, and it remained at that level through 1994. During those 8 years, returns were within the target range twice. In the other years, returns exceeded the top end of the target by anywhere from 15 percent to more than 100 percent. In 1995 the Board of Fisheries increased the bottom end of the target to 450,000. The 1995 returns were within the target range.

So altogether in the past 15 years, managers were within or near the target range 7 times and exceeded it 8 times.

Commercial Management

The first step in management of the Upper Cook Inlet sockeye fishery is ADF&G's forecast of the commercial sockeye harvest for the coming season. Those forecasts are intended to help fishermen and managers plan for the coming season. But forecasting complex, volatile salmon runs is difficult, as Figure II-10 shows. Almost all forecast harvests since 1985 have been smaller than actual harvests—and the difference in some years was more than 100 percent. So managers begin the season with a lot of uncertainty about the actual size of the Upper Cook Inlet salmon runs.

Figure II-10. Actual and Forecast Harvests of Upper Cook Inlet Sockeye Salmon
(In Millions of Fish)



Source: Paul Ruesch and Jeff Fox, *Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993,* Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 1994.

Three primary managed sockeye runs move into Upper Cook Inlet, bound for the Kasilof, Susitna, and Kenai rivers. The Kenai River run is the largest; it builds to a peak quickly and then tapers off. The surge of fish can be quite dramatic—numbers coming into the river can go from one to 60,000 in a single day. ADF&G monitors run strength in the inlet through test fisheries and commercial landings. Returns to rivers are monitored by sonar counters and weirs.

There are regularly scheduled, 12-hour commercial openings on Mondays and Fridays throughout the late sockeye run in both the Central and Northern districts of Upper Cook Inlet. As information about the run size accumulates from the commercial catch and escapement into rivers, managers can augment those regular openings with emergency openings. Those emergency openings are typically in the Central District, where most of the harvest is taken, and are often restricted to just a portion of the district. Managers attempt to hit the management targets for the various rivers in Upper Cook Inlet by controlling commercial openings.

As mentioned earlier in the chapter, the Upper Cook Inlet salmon harvest is taken with set and drift gillnets. The drift fleet is confined to the Central District; setnetters fish in both the Central and the Northern districts but about 70 percent are concentrated on the east side of the Central District between Humpy Point and the Kenai River (Map II-1). The east side setnet fishery mainly targets the Kasilof and Kenai river runs. The west side setnetters in the Central District target the smaller

During regular Central District openings—which are districtwide, unless restricted by emergency order—the drift fleet can fish in the middle of the inlet, where they catch sockeye bound for all the Upper Cook Inlet river systems, including those in the Northern District. During emergency openings (which managers add as they learn more about the strength of the runs) the drift fleet is typically restricted to an area known as "the corridor," roughly 1.5 to 3 miles offshore on the east side of the Central District (Map II-1). Confining the driftnetters to this corridor is intended to reduce their catch of sockeye bound for the Susitna River system.

Figure II-11 shows the importance of sockeye (and in particular Kenai River sockeye) to the Upper Cook Inlet salmon harvest in the 1990s, and Figure II-12 shows the division of the sockeye harvest among drift and setnetters. Sockeye have made up 80 percent of the Upper Cook Inlet harvest in recent years; Kenai River sockeye alone accounted for more than half the harvest.

Figure II-11. Composition of Upper Cook Inlet Salmon Catch, 1990-1994

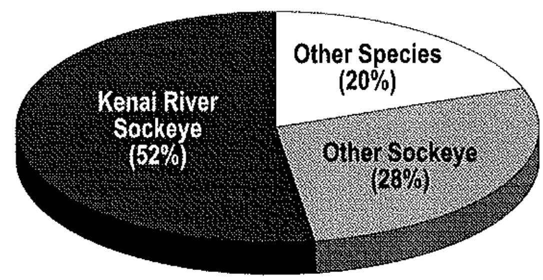
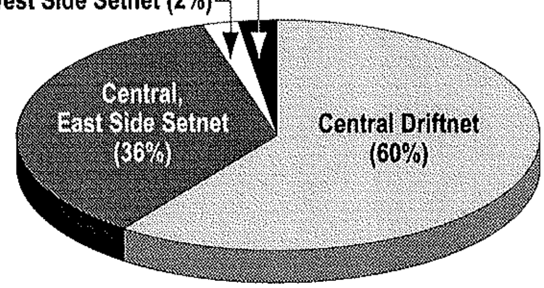


Figure II-12. Division of Upper Cook Inlet Sockeye Harvest, 1990-1994



Source: Upper Cook Inlet Commercial Fisheries, Annual Management Report, 1993 and 1994, Paul Ruesch, and Jeff Fox, ADF&G Commercial Fisheries Management and Development Division

The Central District drift fleet took about 60 percent of the sockeye harvest between 1990 and 1994. The setnetters on the east side of the Central district took about 35 percent. Setnetters in the Northern District and on the west side of the Central District each took around 2 percent of the sockeye harvest.

Sport Fishery Management

The sport fishery for late-run sockeye on the Kenai River is from the mouth of the river up to Kenai Lake (Map II-2). The Department of Fish and Game manages the sockeye sport fishery by licensing anglers and establishing bag and possession limits. The typical limits in recent times have been three sockeye harvested per day and three in possession. There are also gear and area restrictions.

The fishery is normally open 24 hours a day. Managers can cut limits or add restrictions if the run is weak. For instance, the 1993 season began with a bag limit of two sockeye, with anglers restricted to fishing between 6 a.m. and 11 p.m. In years when more than 700,000 sockeye pass the sonar counter, managers increase the bag limit to six fish.

Personal Use and Subsistence Dip Net Fisheries

During recent years, Alaskans have been able to take late-run sockeye with dip nets in the area from the mouth of the Kenai River up to the Warren Ames Bridge (about 5 miles from the mouth), under either subsistence or personal use regulations. (There have also been personal use and subsistence set gillnet fisheries on Cook Inlet beaches.)

Regulations governing the subsistence and personal use fisheries have changed often over the past decade, largely in response to court decisions in the ongoing battle over who qualifies as a subsistence user and what areas of Alaska are open to subsistence hunting and fishing. In some years there have been personal use fisheries, in others subsistence fisheries; in a few years there were both. Both subsistence and personal use fisheries are restricted to Alaska residents.

The chief difference between a subsistence and a personal use fishery is that subsistence uses have priority over other uses. That means if managers decide a run may fall short of necessary spawning escapement, then any commercial or sport fisheries must be restricted before a subsistence fishery is restricted. Personal use fisheries do not have such a priority.

For Kenai River late-run sockeye, in 1994 there was a subsistence dip net fishery that started early in the season and was open two days a week, with households allowed to take 25 fish during the season. In 1995, however, a court upheld a determination by the Joint Board of Fisheries and Game that Upper Cook Inlet was a non-subsistence area.

In most recent years, the Alaska Board of Fisheries authorized a personal use dip net fishery in the Kenai River when the sockeye count at the sonar reached some specified level (from 450,000 to 700,000 in different years); dipnetters were typically allowed 6 fish per day. But in 1995, after the courts declared that Upper Cook Inlet was not a subsistence area, there was an additional personal use fishery that essentially operated under the same regulations that had governed the subsistence dip net fishery in 1994.

In the past 10 years the combined annual personal use and subsistence dip net harvest in the Kenai River has varied from fewer than 1,000 to about 50,000 sockeye; in 1994 the dip net harvest was about 33,000.

Chapter III. Methods, Assumptions, and Limits

This chapter describes how we measured potential changes in the sport and commercial fisheries, and talks about the limits of the analysis. The personal use dip net fishery for late-run Kenai River sockeye would also be affected by management changes. But the limited historical information on that fishery made it impossible for us to analyze change in the same way we did for the sport and commercial fisheries. We did, as we discuss in the section on study scenarios (beginning on page III-10) examine one scenario that includes an increased dip net harvest.

Measuring Economic Effects

We used two measures of potential effects of re-allocating some Kenai River sockeye: *net economic value* and *economic impacts*. Some of the same information goes into both analyses, but the two concepts measure economic effects in quite different ways.

Net economic value measures how much an economic activity (like fishing) is worth to residents of some geographic area—like Alaska. Net economic value measures worth by subtracting costs from benefits; in this study, those are the benefits the Kenai River sockeye fishery provides, minus the costs of getting those benefits. It includes both market and non-market benefits and costs.

Economic impacts are spending and the jobs, income, or other measures associated with an economic activity (like fishing). Spending for fishing directly creates jobs and income (for commercial fishermen, processors, sport fishing guides, and others) and indirectly creates additional jobs and income (for store owners and others) as fishery income circulates through the economy.

What are some of the limitations inherent in the way we measure economic effects? The net value method attempts to put a dollar value on what something is worth. It values the marginal (or additional) unit of a good or service at market price, if there is a market price. That means it assumes everyone would pay the market price for an additional unit of something. In reality, what people would pay for one more unit would depend on market conditions. And some goods have no market price. For non-market goods (like sport fishing trips), net value can only estimate worth indirectly, by observing what people pay for goods with a market price (fishing tackle) to get goods without a market price. Finally, net value totals up dollar value without paying attention to distribution—although a change in value might affect some people much more than others.

A shortcoming of impact analysis is that it typically fails to take into account that other economic changes would partially offset changes from a specific activity. For instance, if a factory closed and 200 employees lost their jobs and $100,000 in income, it is not correct to say that the economic impact of the closing would be the loss of 200 jobs and $100,000 in income. A complete analysis would have to consider how many of the workers found other jobs, offsetting some of the loss.

In this study, we did in fact look at some offsetting changes elsewhere in Alaska that would accompany changes in the Kenai River sport and commercial fisheries. For instance, we took account of how increased spending by Southcentral residents for sport fishing on the Kenai would decrease spending for sport fishing trips elsewhere in the region. And in a small economy like Alaska's, which depends on sales of natural resources to consumers outside the state, it is more reasonable to assume that most jobs and income lost because of reduced spending by commercial fishermen or non-resident sport anglers would not be replaced by other jobs and income.

Despite the limits of the two analytical methods, both are standard, very widely used techniques. There is no perfect way of assessing economic effects. Both net value and economic impact analysis provide useful results that allow us to compare effects of a change under various alternatives.

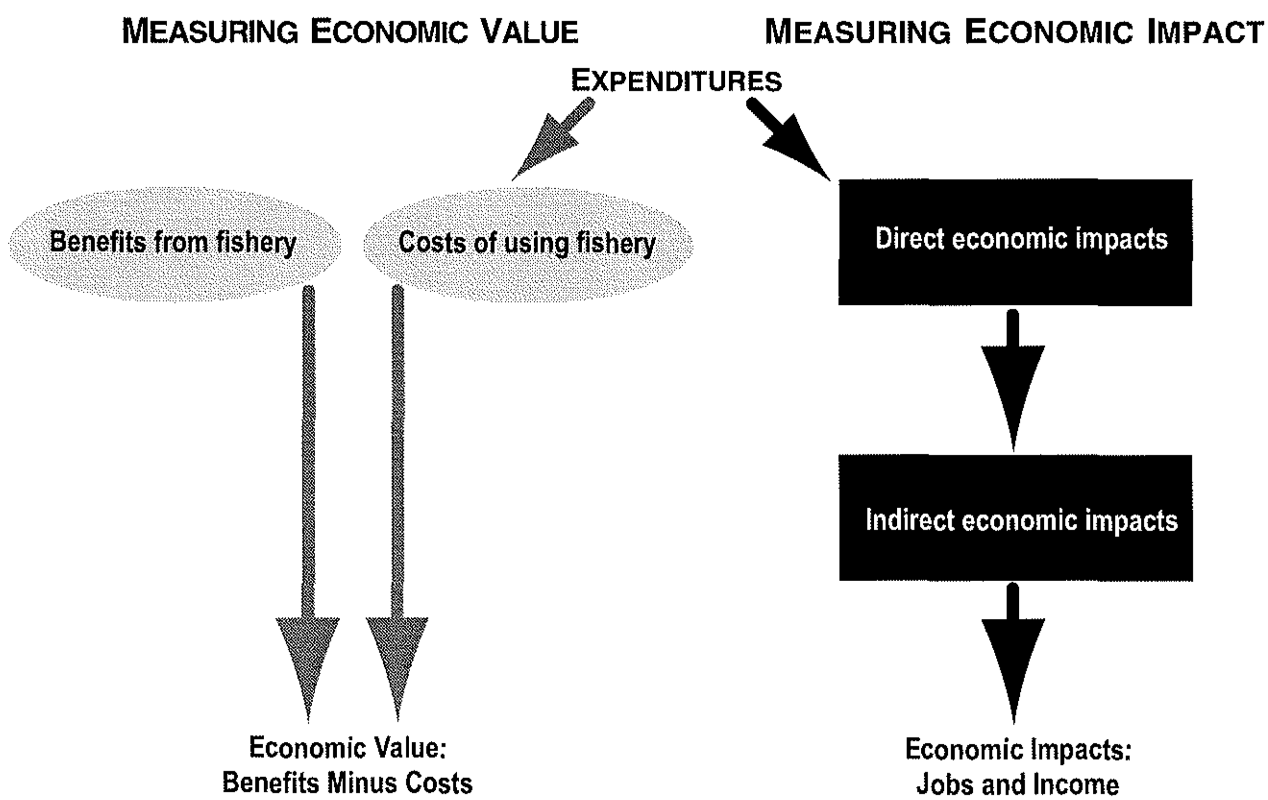
Calculating Value and Impacts

A critical difference between the two analytical methods is in the way they deal with expenditures. Expenditures include payments to commercial fishermen, fish processing workers, sport fishing guides, owners of tackle shops, and others. Figure III-1 shows how expenditures are used to determine economic impacts and net economic value.

To calculate economic impacts, we consider expenditures as a means of generating jobs and income both directly (for fishermen and others in the fishing industry) and indirectly (for people who benefit when those in the fishing industry spend money). If expenditures drop, jobs, income, and economic activity drop; if expenditures increase, more jobs and income are created and economic activity increases.

To calculate value, we consider expenditures as the costs of using the fishery. For instance, if a sport angler hires a fishing guide, or a commercial boat captain pays crew members, those are costs of using the fishery. People pay those costs in the hope of getting the benefits of the fishery—for commercial fishermen, those benefits are the market value of their catch and the enjoyment of their work. For sport anglers, the benefits are the pleasures of fishing—catching fish but also less tangible benefits like spending time on a scenic river. After estimating costs and benefits, we subtract costs from benefits. That difference between costs and benefits is the net value. If the benefits from a change are bigger than the costs, economic value increases; if the costs exceed the benefits, economic value decreases.

Figure III-1. Measuring Impacts and Value



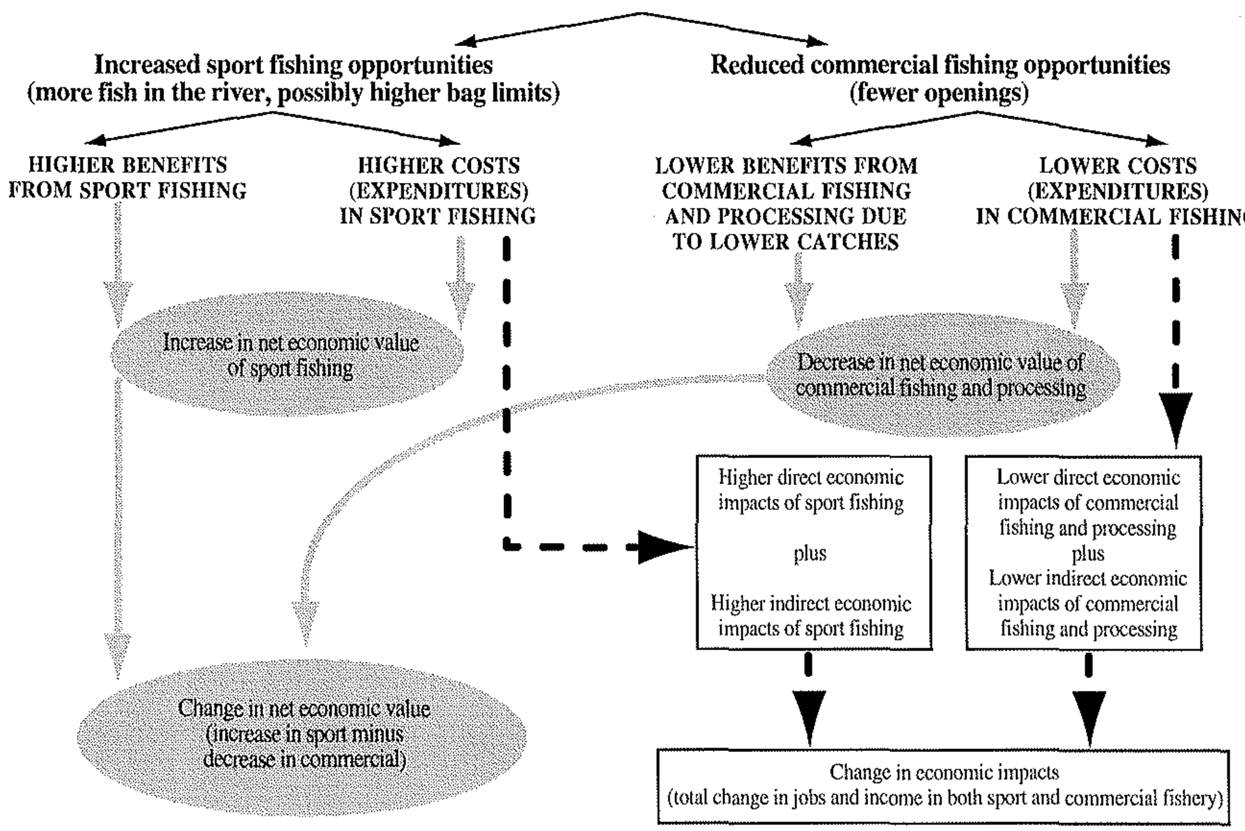
Measuring Effects of More Sockeye in the Kenai River

Figure III-2 shows how we use the economic impact and net value methods to estimate the effects of allowing more sockeye into the Kenai River. If fishery managers let more sockeye return to the river, the change would increase opportunities for sport anglers and decreases opportunities for commercial fishermen. Sport anglers could expect more benefits—like catching more fish, or catching fish more easily. More fish could also draw more anglers to the Kenai, so sport anglers as a group would also likely spend more. Commercial fishermen and processors, on the other hand, could expect smaller benefits because their catches would be reduced—but costs would also be reduced, because fishermen would spend less for wages, fuel, and some other kinds of expenses.

So how do those changes in benefits and costs figure into economic impacts and net value? The dotted lines and squares in Figure III-2 trace the change in economic impacts. Sport anglers' expenditures are higher, creating more jobs and higher incomes. Expenditures on the commercial side are lower, meaning fewer jobs and less income. If the gains on the sport side exceed the losses on the commercial side, the economy as a whole gains jobs and income; if the commercial losses exceed the sport gains, the economy loses jobs and income.

The solid arrows and circles in Figure III-2 trace the changes in economic value. On the sport fishing side, higher benefits relative to expenditures mean an increase in economic value of the sport fishery. But reduced benefits relative to expenditures on the commercial side mean a drop in economic value of the commercial fishery. To estimate the change in the overall value of the fishery, we compare the losses on the commercial side to the gains on the sport fishing side: if the sport gains are bigger, the overall value of the fishery increases; if the commercial losses are bigger, the overall economic value of the fishery decreases.

Figure III-2. Effects of Higher Inriver Return



Data Sources

Our analysis is based on surveys of sport and commercial fishermen, interviews with processors, information from prior fisheries studies, and data from public agencies

Our survey procedures included a number of steps to help insure that we collected accurate, meaningful data. We pre-tested survey questions, to find and clarify unclear or ambiguous questions. A data editor reviewed the completed survey forms for completeness and consistency; whenever possible, our interviewers called back respondents to resolve any problems we found. We configured our data entry programs to reject some types of incorrect data. We entered a sample of surveys twice and compared the two entries to measure the accuracy of data entry. Once all the survey data was on the computer, we reviewed it and corrected for missing or unreasonable values.

Our site data came from many sources, which we can group into three categories: (1) conversations with fisheries experts from ADF&G and other organizations; (2) reports and other fisheries-related material from ADF&G; (3) guide books, gazeteers, newspapers, maps, and other sources

One researcher initially entered site dataon spreadsheets, and then another researcher checked the data for accuracy. A third check on accuracy of data came when researchers reviewed their model results. While complete accuracy is impossible in a project that brings together extremely large amounts of data from many sources, we believe the steps we took kept inaccuracies in the data to a minimum.

ISER Surveys

In 1993 and 1994 ISER conducted six fishery-related surveys. The 1993 surveys were done primarily for another pending ISER report, but for this study we used information collected from Southcentral Alaska residents. The 1994 surveys were all designed to collect information for this study. Table III-1 shows who was surveyed, numbers of respondents, methods of survey, and response rates.

Table III-1. ISER Sport and Commercial Fishing Surveys, 1993-1995

Survey Respondents	When	Method	Number of Responses	Response Rate	Margin of Error
Sport Anglers Alaska Statewide	June 1993	phone	1,355	83%	±4%
Sport Anglers Alaska Statewide*	Fall 1993	phone/panel	918	68%	±5%
Southcentral Alaska Sport	Winter 1994/95	phone (panel sample of 1993 respondents)	160	±57%	±11%
Southcentral Alaska Sport (new sample)	Winter 1994/95	phone	491	76%	±6%
Non-resident sport anglers	Winter 1993/94	mail	4,278	61%	±2%
Non-resident sport anglers (follow-up of 1994 survey)	Winter 1994/95	mail/panel	972	45%	±4%
Cook Inlet permit holders (pre-season)	May 1994	phone	487	85%	±4 per
Cook Inlet permit holders (post season)	Fall 1994	phone	320	90%	±6
Cook Inlet crew	Fall 1994	phone	213	84%	±10

**ADF&G conducted follow-up interviews with the same respondents interviewed in June.*

Economic Models

We constructed economic models to help us analyze potential changes in both net economic value and economic impacts. The models allowed us to calculate potential effects under a number of regulatory changes in the salmon fishery, assuming different run sizes, market prices, and other conditions. As discussed in detail later in this chapter, we used our models to examine the range of potential change under ten scenarios.

The model framework also provided us with a consistent format for discussing other potential effects of allocation changes that were not quantified in this study. Finally, it assured internal consistency of the analysis, since all elements were based on the same assumptions.

In building our economic models, we had to estimate how sport and commercial fishermen might change their behavior if there were a change in sockeye allocation. These estimated changes in behavior were the basis for calculating economic impacts and were important for calculating net economic value.

Estimating Changes in Net Economic Value

Remember that this study does not examine total net economic value of the Kenai River sockeye fishery, but rather *changes* in net economic value resulting from changes in fishery management. Practically speaking, looking at the total value of either the sport or the commercial fishery is not relevant to understanding the economic effects of a change.

Earlier we defined net economic value as benefits minus costs. Net economic value as defined by economists and as used in this study may not be familiar to many readers. So here we describe the broad concept of net economic value. In later chapters, we discuss in detail how the concept applies specifically to the sport and commercial fisheries.

What is the definition of cost? Economists define the cost of a good, service, or experience in terms of what we give up or forego to obtain it. What we give up includes the costs of anything we have to buy—such as the fuel a commercial fishermen buys for his fishing boat or a sport angler buys for his camper. It also includes the cost of any labor used in producing the good, service, or experience. The cost of labor equals the value the worker gives up to work in a particular job—not only the monetary income the worker would have earned in another job, but also any change in the net value of non-monetary benefits the worker derives from work and leisure. Cost also includes not only the cost of paid workers—such as commercial fishermen—but also the value of sport anglers' time. If a sport angler gives up a day of work to go fishing, from an economic perspective that is as much a cost of fishing as the cost of the gas used to get to the fishing site. Economists refer to these kinds of costs as "opportunity costs."[1]

What is the definition of value or benefit? Economists usually define the value of a good, service, or experience in terms of "willingness to pay" or "willingness to accept." *Willingness to pay* is the largest amount an individual would pay to be able to obtain an item or undertake an activity. That willingness to pay includes not only what he actually pays, but any additional amount he would be willing to pay, if he had to. Willingness to pay can measure the value of goods or activities that don't have a market price. For instance, if someone gives you a freshly caught sockeye salmon, the fact that you got it for free does not mean it has no value. Its value to you is whatever you would

[1]Another kind of cost, referred to as scarcity cost, is the cost of not using the resource in some alternative use. Thus the cost of foregone sport fishing opportunities may be considered a cost of the commercial fishery, while the cost of foregone commercial fishing opportunities may be considered a cost of the sport fishery. In effect, this study measures these costs at the margin—for incremental changes in the allocation of Kenai River salmon.

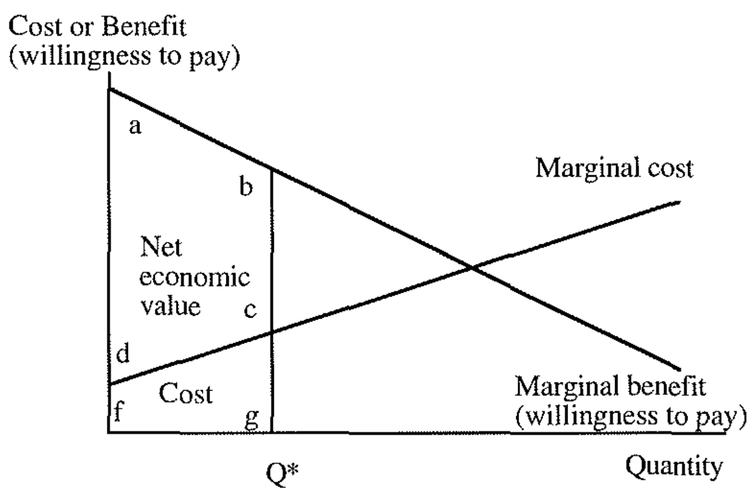
have been willing to pay for it. Thus, a good, service, or experience can have a value in dollars, even if no one actually pays.

Willingness to accept is the smallest amount an individual would need to be compensated for voluntarily giving up an item or an activity. For many goods or activities, willingness to accept is often larger than willingness to pay. That's because the premise for willingness to pay is that you don't yet have the good: how much would you be willing to pay to get it? Willingness to accept, on the other hand, starts with the premise that you have the good and are being asked to give it up.

For this study, we use primarily "willingness to pay." Several of our analyses—like the travel cost analysis, described in Chapter VI—rely on observed changes in behavior that indicate willingness to pay. In the contingent value analysis in Chapter IX, we do discuss commercial fishermen's willingness to accept the loss of a portion of their sockeye harvest. We base that discussion on specific willingness to accept questions we asked in a survey of commercial fishermen. The results were, as we might anticipate, that commercial fishermen said they would have to be compensated much more to give up some fish than they were willing to pay to get some additional fish.[2]

Figure III-3 illustrates the concept of net economic value. For any given quantity of some hypothetical good, there is an additional cost or benefit—known to economists as marginal cost or marginal benefit—from producing or consuming one more unit of the good. The marginal or additional cost is the cost of producing one more unit of the good. It is shown as an upward sloping line, because as quantity increases marginal cost usually rises. In other words, the more we have of a good, the higher the additional cost of adding one more unit. The marginal or additional benefit from consuming one more unit of the good is shown as a downward sloping line, because as quantity increases marginal benefits usually decline. In other words, the more we have of a good, the lower the additional benefit from having one more unit. (If this good is traded in markets, then the marginal benefit curve equals the market demand curve and the marginal cost curve equals the market supply curve.)

Figure III-3: Marginal Benefit, Marginal Cost, and Net Economic Value



For any given quantity of a good, service, or experience, the net economic value is the benefits minus the costs: the difference between the total benefit (the area under the marginal benefit curve) and the total cost (the area under the marginal cost curve). In Figure III-3, for quantity Q,* net

[2] Some economists would argue that in order for the net economic value of fishing to go up, willingness to pay among those who gain fish would have to be larger than willingness to accept among those who lose fish, because no compensation will actually take place.

economic value is shown by the trapezoid a-b-c-d (total benefits are shown by the trapezoid a-b-f-g, while total costs are shown by the trapezoid d-c-f-g).

In Chapters VI and IX, we'll talk in detail about how this general concept of net economic value applies to the sport and commercial fisheries.

In measuring net economic value it's crucial to define for whom we are measuring benefits and costs. For this study, we focused on net economic value to Alaskans. We ignored economic benefits of Cook Inlet fisheries that may accrue to other Americans or to foreigners—even though such benefits may be substantial. For example, residents of all the other states may enjoy benefits from sport fishing on the Kenai River, residents of Washington may enjoy benefits from commercial fishing in Cook Inlet, or residents of Japan may enjoy benefits from eating commercially harvested salmon from Cook Inlet. However, we focused on the benefits derived by Alaska sport anglers, Alaska commercial fishermen, and other Alaskans.

Focusing on net economic value to Alaskans has important implications for our study. For example, most of the salmon harvested in the Cook Inlet commercial fishery are consumed outside Alaska, mostly in Japan. Also, some of the commercial harvesters in the Cook Inlet fishery are not Alaska residents. Thus we exclude substantial portions of the economic value of the commercial fishery that would be included if we were measuring net economic value to a broader group. We also exclude a potentially significant component of economic value on the sport fishery side, because we do not measure net economic value for non-resident anglers. (We do, however, include the effects of non-resident angler spending in Alaska when we look at economic impacts.)

Estimating Changes in Net Economic Value of the Sport Fishery

For the sport fishery, we used two methods to estimate changes in net economic value—the travel cost and contingent value methods. The travel cost method *indirectly* estimates change in net value by observing changes in behavior, while the contingent value method *directly* estimates changes by using survey responses of sport fishermen about how they would value changes in fishing opportunities. For the travel cost method we used statistical analysis of survey data and other information to try to identify a break even point where an angler decides whether or not to take an additional sport fishing trip. These methods are described in detail in Chapter V and Appendix A.

Estimating Changes in Net Economic Value of the Commercial Fishery

For the commercial fishery, we used four methods of estimating changes in net economic value: the accounting method, the observed choices method, the contingent value method, and the job ranking method. Each of these methods looks at somewhat different aspects of net economic value.

The accounting method is a straightforward comparison of changes in the value of the harvest with changes in costs. The observed choices method is comparable to the travel cost method for the sport fishery, because it also indirectly estimates change by observing behavior changes. The contingent value method is similar to the contingent value method for the sport fishery, in that it relies directly on survey responses of commercial fishermen about how they would value changes in their harvests. The job ranking method specifically attempts to measure changes in net economic value for crew members; the other methods mainly measure changes in economic value for the permit holders. These methods are described in detail in Chapter IX and Appendix B.

Estimating Changes in Economic Impacts

At the outset of the chapter, we defined economic impacts as a measure of the level of economic activity in an area. Jobs and income are the most common measures of economic impacts, but any measure that is interesting and important to the policy or project being studied can be used. Other common measures of economic impacts include sales, value added, property values, tax revenues, and demand for government services. Economic impacts must be defined in terms of the geographic area in which they occur—such as a city, county, state, or country. In this study we estimate impacts for the state of Alaska.

Remember that in this study we do not estimate total economic impacts of either the sport or the commercial fishery. What we estimate is *change* in economic impacts that could follow a change in management of Kenai River sockeye. We used three measures of change in economic impacts of the sport and commercial fisheries:

- Changes in total value added of businesses operating in Alaska—the value of businesses' final sales, minus the value of any purchased inputs to the sales
- Changes in income earned in Alaska
- Changes in annual average employment in Alaska

Direct and Indirect Economic Impacts

Economic impacts result from expenditures. An initial expenditure in the sport or commercial fishery circulates through the economy and creates a chain reaction of additional expenditures. Economists generally refer to the effects of the initial expenditure as "direct" economic impacts and the effects of the additional expenditures as "indirect" economic impacts. Total economic impacts are the sum of direct and indirect impacts.[3]

Which impacts are classified as "direct" and which as "indirect" can vary, depending on the modeling framework being used in a given project. Where the line is drawn between direct and indirect impacts isn't as important as making sure that everyone understands the definition.

For this study, we defined direct economic impacts of the sport fishery as the value added, the income, and the employment in the Alaska firms that either sell goods and services to sport anglers or that manufacture or transport goods sold to sport anglers. We defined direct economic impacts of the commercial fishery as the value added, the income, and the employment in the Alaska commercial fishing and fish processing industries and in the Alaska firms that either sell goods and services to commercial fishermen and processors or that manufacture or transport goods sold to commercial fishermen and processors. We used this definition of direct impacts of the commercial fishery to make it consistent with the definition we used for the sport fishery. However, it would also have been possible to define direct economic impacts of the commercial fishery as just value added, income, and employment in the fishing industry itself.

[3]Sometimes economists separate the effects of the additional expenditures into two categories: "indirect" and "induced." We explain this distinction in Appendix I; we do not make this distinction in this study since our methodology calculates both "indirect" and "induced" impacts simultaneously.

Potential Changes in Economic Impacts

Changes in the management of Kenai River sockeye could have a wide variety of economic impacts on the sport and commercial fisheries. For both the sport and commercial fisheries, the change in economic impact depends, to a large extent, on two important factors:

(a) the extent to which expenditures "leak out" of the Alaska economy as a result of purchases made outside Alaska or income earned by non-residents

(b) the extent to which changes in expenditures in the Kenai River sockeye sport or commercial fisheries are offset by changes in expenditures in other Alaska fisheries or in other sectors of the Alaska economy.

Here we briefly review these factors. We discuss them in greater detail in Chapters VII and X.

An increase in the number of sockeye in the Kenai River would likely cause both resident and non-resident anglers to take additional trips to the Kenai River. In the course of these trips, the anglers would spend money on a variety of goods and services—fuel, food, and guide services, for example. That spending would directly generate value added, income, and employment in the businesses providing goods and services to anglers. In turn, as those businesses and their employees and owners spent the money earned from sales to anglers, additional indirect value added, income, and employment would be created.

At each stage in the spending, some of the money would leak out of the Alaska economy; how much leaks out depends on the kind of expenditure. For example, spending to hire resident Alaskans as guides would have a greater economic impact than expenditures to purchase tackle manufactured outside Alaska—because more of the money spent to hire Alaskans as guides would stay in the economy.

Another important factor to consider when looking at the economic impacts of putting more fish in the Kenai River is this: if anglers spend more fishing on the Kenai River, how would their other spending be affected? Having better fishing in the Kenai River does not give anglers any more money to spend. If they spend more on the Kenai, they have less to spend elsewhere—either less to spend on fishing or less to spend on other kinds of activities.

For resident anglers, spending more on the Kenai could mean either spending less elsewhere in Alaska or spending less outside the state. Say better fishing on the Kenai River causes an angler to fish there instead of on the Susitna River. If the angler spends exactly the same amount fishing the Kenai River as he would have spent fishing the Susitna (and purchases the same kinds of goods and services), then there would be no change in the economic impact on Alaska. Additional sales, income, and jobs would be created on the Kenai Peninsula—but those increases would be offset by losses in the Mat-Su Borough. If, on the other hand, the Alaska angler decides to spend more fishing on the Kenai River instead of taking a trip to Disneyland, then the economic impact on Alaska would increase—because more money would stay in the state.

How better fishing on the Kenai might affect the economic impacts of non-resident anglers would depend on why they came to Alaska. If a visitor was already in Alaska and decided to spend more fishing on the Kenai River because of better fishing conditions—but less on other things—then the impact on the Alaska economy would be small, because the visitor would spend about the same amount of money. But if better fishing conditions on the Kenai caused visitors to spend more money than they otherwise would have—or drew non-resident anglers who wouldn't have otherwise come to Alaska—then the economic impacts on Alaska would increase, because there would be new money in the economy.

On the commercial side, a decrease in the number of fish that commercial fishermen catch would reduce their income and that of workers in the processing industry. It would also reduce spending by fishermen and processors for supplies such as fuel and packaging. That in turn would reduce the indirect value added, income, and employment—because income earned by fishermen, processing workers, and workers in firms supplying the commercial fishing industry circulates through the Alaska economy. An important factor determining how much net value, sales, and employment in Alaska would be reduced is how many fishermen or processing workers are non-residents.

Methodology for Estimating Changes in Economic Impacts

Our calculations of changes in economic impacts are presented in Chapters VII (sport fishery) and X (commercial fishery). Those chapters also present detailed descriptions of our methodology for estimating economic impacts.

Our analysis in both chapters is based on an input-output model of the Alaska economy known as the Alaska Input-Output Model. The model was originally developed at ISER with funding from the ADF&G Division of Sport Fish, as part of a study of the statewide economic impacts of sport fishing. ISER has used the model to analyze the economic impacts of several other industries as well.

The Alaska Input-Output Model—together with a matrix relating changes in expenditures for specific fisheries goods and services to in-state expenditures for different Alaska industries—can be used to trace how expenditures for specific fisheries goods and services translate into direct and indirect impacts on net value, income, and sales in Alaska. Appendix I provides a detailed technical description of the model.

The Alaska Input-Output model relates changes in spending in a particular industry to impacts on the Alaska economy. It is custom designed to take account of unique characteristics of the Alaska economy. For this study, we used the model to develop a set of coefficients which directly relate changes in expenditures for fisheries-related goods and services to direct and indirect impacts on Alaska net value, income, and sales. We refer to this set of coefficients as the Cook Inlet Salmon Economic Impact Model. Appendix I describes the development of these coefficients.

After we developed the Cook Inlet Salmon Economic Impact Model, there were two stages to our analysis of the changes in economic impacts of the sport and commercial fisheries resulting from a change in management:

1. Estimating a vector of changes in expenditures, by type of expenditure, resulting from changes in management
2. Using the Cook Inlet Salmon Economic Impact Model to transform the vector of changes in expenditures to estimates of direct and indirect economic impacts

For both fisheries, we estimated changes in expenditures using the same methods we used to estimate changes in net economic value.

Study Scenarios and Assumptions

The Alaska Department of Fish and Game (ADF&G) asked us to examine the potential economic effects of increasing the management target for late-run Kenai River sockeye by 200,000 fish, measured at the sonar counter near the Soldotna bridge. There is no single answer to that question and no "best answer." For Kenai River sockeye, no two years are alike: the size and timing of the run varies, the management regulations vary, resident and non-resident sport and commercial fishing activities vary, prices vary, and many other factors vary.

So there are many possible answers to the question of what the economic effects might be, if the Alaska Board of Fisheries raised the management target. The answers depend in part on how ADF&G might define and implement such a policy change. For example, the economic effects on the commercial fishery would depend on how ADF&G changed commercial openings in any given year to put more fish in the river. The economic effects on the sport fishery would vary under different sport and dip net bag limits.

The answers would also depend on other factors beyond the control of ADF&G. For example, if the run size were large, it might not be necessary to cut back the commercial fishery at all to reach a higher management target. During low runs, very significant cutbacks might be required. The economic effects of reduced harvests on commercial fishermen would also depend on the price of salmon. Commercial losses would be greater when salmon prices were high—every fish given up would represent more money lost.

To explore the range of potential answers, we chose (in consultation with the ADF&G study team) a set of 10 hypothetical scenarios. Each combines assumptions about a ***change in management***—a specific change in the management target and the sport or dip net bag limit—and assumptions about a ***change in conditions***—most important, changes in run sizes and prices of salmon.

The scenarios we chose don't include all the possible combinations of changes in management and changes in conditions—theoretically, there are hundreds of such possible combinations. Also, there are many other assumptions in our analysis that could also be varied to produce still more scenarios. It was not feasible to analyze all these different possible scenarios. The limited time and resources for this study required thoughtful choices about our analytic priorities.

We chose scenarios that span the expected dimensions of variation. Adding many more scenarios would have made it difficult to present and interpret our results. We believe that fewer, more comprehensible scenarios provide more insight: we wanted to keep the study at a scale where readers can understand what is driving the results. Finally, before we turn to our detailed description of the scenarios, we want to re-emphasize an important point: our scenarios do not examine the *total* economic value or economic impact of the sport or commercial fisheries under the assumed conditions. They examine only the *changes* in net economic value and economic impacts.

Study Scenarios

Each of our scenarios models a ***change*** in management regulations under a ***given*** set of conditions—run size, price, and angler population. Table III-2 compares the assumptions for our 10 scenarios. None is a "best" or "most likely" scenario. None is intended as a prediction of what would actually happen, if the Alaska Board of Fisheries raised the management target for Kenai River sockeye. How realistic any scenario might be depends on how management regulations, run sizes, prices, and angler populations actually change in the future. All these changes are very difficult to predict.

The 10 scenarios we analyzed illustrate how economic effects can change under different conditions. From those scenarios we can infer results for other possible scenarios that we didn't analyze and draw some conclusions about the range of possible economic effects.

Scenarios A-E examine the potential economic effects of *various management changes,* while holding other conditions constant. Scenarios A1-A5 examine how the economic effects of a specific management change differ under *various conditions.* Our aim was to modify only one assumption at a time, so it would be clear what was driving the differences between scenarios.

Table III-2. Summary of Key Assumptions for Scenarios Analyzed in This Study

	+200K at sonar A	Higher sport bag limit B	Higher sport and dip net bag limits C	+100K at sonar D	-100K at sonar E	Low run, Low price A1	High price A2	Low run A3	High run A4	Low price A5
ASSUMPTIONS ABOUT MANAGEMENT										
Change in sonar target	+200,000	+197,189*	+152,576*	+100,000	-100,000	+200,000	+200,000	+200,000	+200,000	+200,000
Change in sport bag limit	no change	higher	higher	no change	no change	no change	no change	no change	no change	no change
Change in personal use bag limit	no change	no change	higher	no change	no change	no change	no change	no change	no change	no change
ASSUMPTIONS ABOUT CONDITIONS										
Run size	medium	medium	medium	medium	medium	medium	medium	low	high	low
Ex-vessel price	medium	medium	medium	medium	medium	low	high	medium	medium	low
Number of anglers	medium	medium	medium	medium	medium	medium	medium	medium	medium	medium

*Scenario is based on the same reduction in commercial harvests and increase in return to the river mouth as Scenario A. The increase in the sonar count target is less than 200,000 because sport harvests (Scenarios B and C, and dip net harvests (Scenario C) below the sonar are higher.

Note: Bold type indicates change from Scenario A.

Low Run: Less than 2 million
Medium Run: 2-5 million
High Run: More than 5 million
Low Ex-Vessel Price: $1.00/lb.
Medium Ex-Vessel Price: $1.43/lb.
High Ex-Vessel Price: $1.75/lb.

Assumptions About Management Changes

Management Target Assumptions

The current management target for late-run Kenai River sockeye is 450,000 to 700,000 sockeye at the sonar counter, below the Soldotna bridge and about 19 miles from the river mouth. Our scenarios include three assumptions about changes in the management target:

- **+200,000.** We were asked to do an analysis of the economic effects of increasing the management target by 200,000 sockeye. Scenarios A and A1-A5 all assume a sonar count increase of 200,000. In Scenarios B and C, the increase in the sonar count is somewhat less than 200,000, because those scenarios assume higher sport and dip net harvests between the river mouth and the sonar counter.

- **+/-100,000.** Scenarios D and E examine the effects of increasing or decreasing the management target by 100,000. We added these two scenarios mainly to help define a range of variation, so we could better understand and estimate the effects of changes in the management target. We also wanted to explore the possibility of asymmetric results—that is, what are the implications if sport and commercial groups don't place the same value on gaining 100,000 fish as they do on losing 100,000 fish?

Increasing or decreasing the number of sockeye at the sonar counter would mean reducing or increasing the commercial sockeye harvest in Upper Cook Inlet. The ADF&G study team told us to assume that any changes in the management target for Kenai River sockeye would be achieved through standard in-season commercial management. Once the management-target is set, management biologists try to hit that target by adjusting commercial openings and closings. ADF&G chose not to explore the less familiar alternatives of reducing harvesting effort or efficiency through gear or area restrictions or by buying back limited entry permits.

ASSUMPTIONS ABOUT SPORT AND DIP NET REGULATIONS

It's not obvious how sport and dip net regulations might change, if the management target for sockeye changed. The sport fishery is managed primarily by permanent regulations specifying area boundaries, bag limits, and gear restrictions by species. Late in the season, when managers are confident that enough sockeye have escaped upriver to spawn, they use emergency regulations to raise the sport bag limit from three per day and three in possession to six per day and six in possession. There is also a personal use dip net fishery at the mouth of the river; in recent years that fishery has been opened at different times during the season and under different regulations and bag limits. The question for this study was what sport and dip net regulations to model in our scenarios.

In consultation with the ADF&G study team, we decided to analyze three different approaches to sport and dip net regulation:

- **No change:** Scenarios A, D, E, and A1 through A5 assume no change in sport or dip net bag limits. These scenarios let us explore the effects of having more fish in the river, with sport and dip net limits held constant.

- **Higher sport bag limit:** Scenario B assumes a permanent increase in the bag limit for late-run sockeye to six per day and six in possession, seven days per week, with low likelihood of inseason restrictions.

- **Higher sport and dip net limits:** Scenario C assumes the same higher sport bag limits as in Scenario B, as well as an increase in the dip net bag limit from 6 to 12 per day and opening the fishery earlier.

Assumptions about Run Size, Prices, and Number of Sport Anglers

RUN SIZE ASSUMPTIONS

For several reasons, the economic effects of allowing more sockeye into the Kenai River are strongly influenced by the size of the run. Management biologists estimate that in a low run year—a run of less than 2 million sockeye—achieving an increase of 200,000 sockeye past the sonar would cost Central District commercial fishermen one regular opening (which is districtwide) and one or two emergency openings (which augment the regular openings but are typically restricted to some portion of the district). But in a high run year—a run of more than five million fish—more fish would escape into the river anyway, and commercial fishermen wouldn't have to give up any openings. Indeed, in a run that large, both the commercial and sport fisheries would be managed to maximize the harvest and try to keep too many salmon from spawning.

The size of other Cook Inlet salmon runs also affects the management of the commercial fisheries. Late-run Kenai sockeye intermingle in Upper Cook Inlet with other salmon species (coho, chum, pink, and king) and with sockeye bound for other rivers (the Kasilof, Susitna, and others)—so the area and duration of commercial openings in the inlet may be tailored to minimize the incidental catch of one of these other stocks for which a low run is projected.

Run size also affects commercial and sport catch and participation rates. When sport or commercial fishing is slow, fishermen may decide not to fish. On the commercial side, the catch rate, frequency, and location of openings may also affect the marginal and average costs of commercial fishing operations.

For all these reasons, the size of the run is an important variable in estimating the economic effects of changes in the management of Kenai River late run sockeye. For this study, we used three assumptions about size of the late run of Kenai River sockeye:

- **Medium run:** Seven of our scenarios assume a medium run size—between two and five million sockeye.
- **High run:** Scenario A4 assumes a high run—more than five million sockeye.
- **Low run:** Scenarios A3 and A5 assume a low run—less than two million sockeye.

In the 14 years since 1981, there have been four low run years, six medium run years, and four high run years for sockeye. We modeled the effects of different run sizes only for sockeye, since that species is our main focus. For king salmon and other species—which also are affected by management changes for sockeye and contribute to changes in economic value and impact—we assumed medium runs in all scenarios.[4]

PRICE ASSUMPTIONS

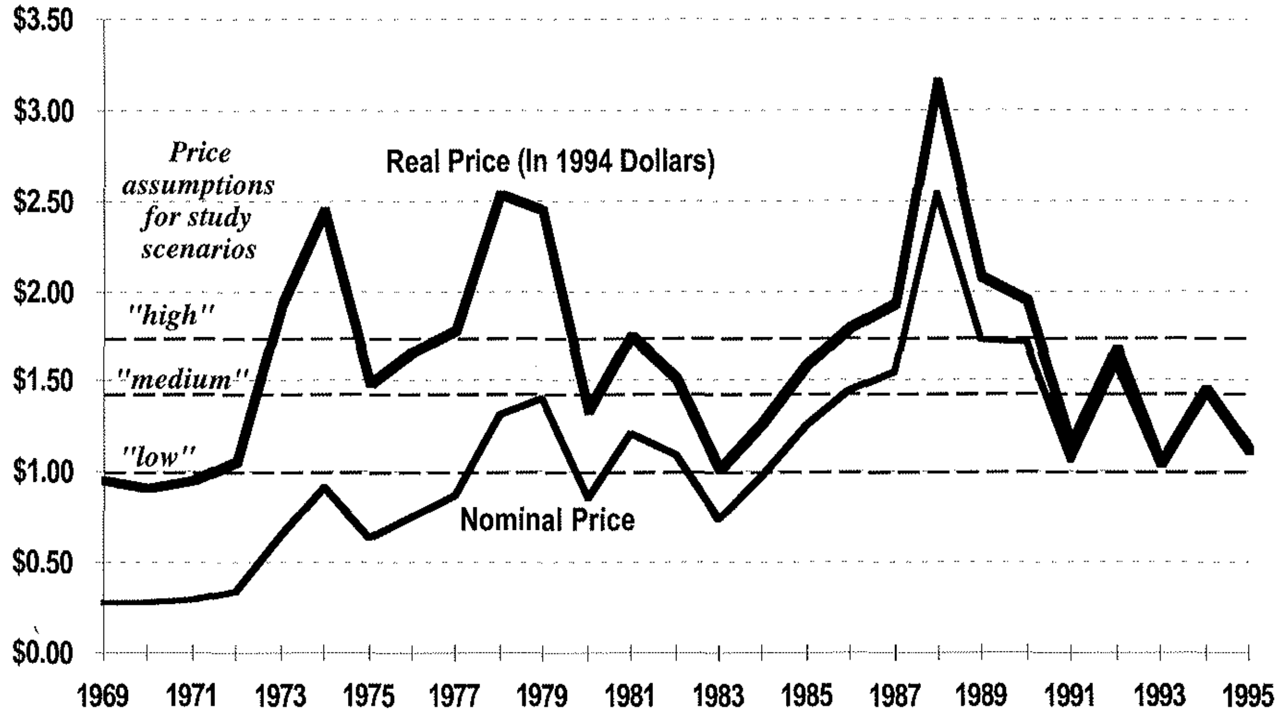
When we talk about salmon prices in this study, we mean the price commercial fishermen are paid—the ex-vessel price. Price obviously has a major influence on how economic value and economic impacts would change if management were changed. Ex-vessel prices can vary greatly from year to year and are not easy to predict. For this study, we used medium price, low price, and high price assumptions which we developed as follows:

- **Medium price:** Equal to the 1994 ex-vessel price for Cook Inlet sockeye. We assumed a medium price for Scenarios A, B, C, D, E, A1, and A2.
- **High price:** Equal to the highest ex-vessel price for Cook Inlet sockeye during the period 1989-1994, converted to 1994 dollars and rounded off to the nearest 5 cents. We assumed a high price for Scenario A3.
- **Low price:** Equal to the lowest ex-vessel price for Cook Inlet sockeye during the period 1989-1994, converted to 1994 dollars and rounded off to the nearest 5 cents. We assumed a low price for Scenarios A4 and A5.

Figure III-4 compares these assumptions about price levels with nominal and real (adjusted for inflation) ex-vessel prices for Cook Inlet sockeye in the past five years. Prices paid fishermen over the last five years have ranged from $1 to $1.60 per pound; real prices (converted to 1994 dollars) ranged from $1.02 to $1.76, with a mean of $1.40. The 1994 price of $1.43 was very close to the mean for the period. In Chapter IX we discuss our ex-vessel price assumptions in greater detail, and examine factors likely to affect future prices for Cook Inlet salmon.

[4] For some scenarios, changing our assumptions about run sizes for other species could have an important effect on the estimated economic effects. For example, the assumed proportion of incidental commercial harvest of other species approaches 200 percent in Scenario A2 (+200K, low run). Reducing the commercial harvest will have a greater economic effect in high-run years for other species, because the resulting reduction in harvests of these other species would be greater.

Figure III-4. Ex-Vessel Prices for Cook Inlet Sockeye Salmon, 1969-1995



ASSUMPTIONS ABOUT NUMBERS OF SPORT ANGLERS

The number of anglers in Southcentral Alaska and the number of non-resident anglers who visit Alaska also influence the economic effects of changes in sockeye management. For this study, we surveyed resident angler households in the Kenai, Anchorage, and Mat-Su areas, and non-resident (visitor) households that fished in those areas to gain information about where and when they fished and their sport fishing expenditures. Many of our projections for the sport fishery are based on multiplying "per-household" estimates derived from these surveys by the number of households.

For all 10 scenarios, we used the estimated 1993 numbers of resident and non-resident sport fishing households fishing in Southcentral Alaska—60,678 resident households and 57,958 non-resident households. Holding the number of sport-fishing households constant allowed us to examine just the economic effects of improved fishing conditions.

We also thought about how the number of resident and non-resident sport fishing households might change in the future. The annual rate of growth in the number of resident and non-resident sport licenses issued statewide averaged 0.9 percent and 6.3 percent during the period 1990-1993.

Our cross-section model is not designed for analysis of trends and changes over time. But because our net value analysis is for residents only, and available evidence is that growth in residents anglers will be rather small, this is a relatively minor limitation for the net value analysis.

By contrast, we know that there has been rapid growth in numbers of non-residents anglers fishing the Kenai River over the past 10 years. It's important to consider how growing numbers of non-resident anglers spending more money as a result of better fishing on the Kenai River could effects economic impacts of the sport fishery. In Chapter VII, we examine how different assumptions about growth in the number of non-resident sport anglers could affect our findings about changes in economic impacts.

Other Modeling Assumptions

To flesh out the detail of the scenarios for quantitative modeling, we had to make many other assumptions. ISER staff specified the assumptions for state and federal marginal tax rates, the definition of residency, and other particulars.

The two variables analyzed in scenarios A1 through A5—run size and price—were targeted because we anticipated a substantial range of variation that might make a significant difference in the results. Any assumption not modeled was excluded for one of four general reasons: its expected range of variation was small; its expected influence on the results was small; its effects were subsumed in one of the variables analyzed; or data were not available for modeling it explicitly.

Assumptions Provided by ADF&G

Some of the most important assumptions for this study were provided to us by ADF&G. Biologists at ADF&G provided us with assumptions for each scenario about the estimated number of commercial closures required to achieve the management target under stated run conditions; the dates, locations, and hours of such closures; the estimated commercial catch foregone by stock and gear type; the estimated change in sport and dip net harvests; and the average harvest weight per sockeye (6 pounds per fish). Chapter IV describes how biologists estimated changes in sport and commercial harvests and presents detailed assumption tables.

How Scenarios Are Used

Remember that the 10 scenarios are neither predictions nor recommendations. They are tools that help show the possible range of economic effects of different management policies under different conditions. Also remember that for each scenario we analyzed the effects of a hypothetical management change *relative to the management status quo.* The analysis for each scenario estimates the *net* economic effects of the management change under the given assumptions about other conditions. For example, the analysis of Scenario A estimates the *difference* between the economic value and economic impacts of the fisheries with and without increasing the management target by 200,000—in a hypothetical year with a sockeye run size of 3.5 million fish, an ex-vessel price of $1.43 per pound, and 60,678 resident angling households in Southcentral Alaska and 57,958 non-resident angling households visiting the region.

Implicit Assumptions and Limitations of Analysis

The economic measures we use in this study—changes in net economic value and economic impacts—provide useful insights into the economic contributions of the sport and commercial fisheries, and how they might be affected by changes in sockeye management. ADF&G directed us to focus on these measures, which are commonly used in economic studies addressing different potential uses of public resources.

However, it's important to understand that there are many inherent assumptions in both net economic value analysis and economic impact analysis. Understanding these assumptions is important to understanding the kinds of conclusions which can and cannot be drawn from this analysis.

Implicit Study Assumptions

- *The economic effects of a change in the allocation of Kenai River sockeye depend on how the fisheries are managed and how a change in allocation is put into effect.*

  In general, the net economic value and the economic impacts of the commercial and sport fishery depend on how they are managed. For example, if there were fewer limited entry permits, the net economic value of the commercial fishery might be higher (because of lower costs), while some economic impacts (employment, for example) might be far lower. Thus, with fewer commercial operations, re-allocating fish to the sport fishery might have a great effect on net economic value of the commercial fishery but a smaller effect on economic impacts of the commercial fishery.

  Different regulatory mechanisms change fishermen's behavior in different ways, with different implications for net economic value and economic impacts. For this study, we assumed that the method used to increase the number of sockeye entering the Kenai River would be reducing the number of commercial fishery openings. This change in management has certain implications not only for commercial fishermen's revenues but also for their costs.

  However, there are other ways the commercial share of the harvest could be reduced, which might have different effects on net economic value and economic impacts. In this study we do not examine all possible methods of implementing a change in allocation but rather just the methods most likely to be used within the existing laws and regulations.

- *Changes in net economic benefits and economic impacts may differ between the short run and the long run.*

  In the short term, fishermen and others have fixed costs they can't change, whether or not there is a change in sockeye allocation. If the profitability of a commercial fishing operation is permanently reduced, a fisherman might choose to reduce his fixed costs by not replacing a piece of equipment. By reducing his costs, a fisherman could reduce the impacts on his profits—but only in the long run.

  Since we are analyzing permanent changes in allocation, our calculations of changes in economic value and economic impacts for this study are done assuming fishermen and others have had a chance to completely respond to the allocation change.

- *The level of economic value and economic impact depend on the institutional structure in place at the time of the analysis.*

  The cost structure and level of profit in the commercial fishery, for example, depend on the number of limited entry permits for the salmon fishery. If there were fewer permits, average cost and average profit could both be higher. The change in net earnings in response to a change in allocation might also be larger.

- *Results of both net value and impact analysis depend on the current state tax and fee structure.*

  A large share of the net earnings of commercial fishermen and the net willingness to pay of sport fishermen goes to non-residents. These non-resident benefits are not counted in our economic value analysis, although the expenditures of non-residents visiting Alaska are an important part of the economic impact analysis. By increasing the fishing fees paid by non-residents, or imposing a fee or tax on both resident and non-resident fishermen, the state government could keep a larger share of the net earnings and net willingness to pay in the state. The increased fees or taxes would go to the state treasury, but they would be available to benefit residents through state spending, increased transfers, or reduced resident-specific taxes and fees.

- *Both economic value and economic impact analysis assume that each dollar has the same value.*

  Economic value analysis attempts to measure the enjoyment people get from different resource allocations. Money is used as the measure of welfare. But that assumes that the marginal benefit a high-income person can purchase with one more dollar is just as large as the marginal benefit that a low-income person can purchase with one more dollar. In real life, the more dollars you have, the smaller the value of an additional dollar.

Assumptions About Distribution

- *Economic value analysis ignores changes in distribution.*

  A dollar of value or benefit for each person receives the same weight when the benefits for persons with different incomes are added together. Also, the analysis doesn't look at whether relatively small numbers of people gain or lose most of the total.

- *Economic impact analysis provides a limited measure of distribution of benefits.*

  Economic impact analysis measures how spending creates income and jobs as it moves through the economy. So economic impact analysis provides some limited information about the distribution of benefits (through numbers of jobs created). It doesn't, however, address the total distribution of benefits.

- *The analyses estimate only aggregate and not individual effects.*

  A commercial fisherman might, for instance, stop fishing and sell his limited entry permit if there were a change in sockeye allocation. Another fisherman would likely buy the permit. Although a transitional change in the turnover rate of permits would be an important consequence of a change in allocation, the quantitative analyses are concerned with the differences in behavior of the fisherman who sells and the fisherman who buys the permit. If there is no difference in their behavior, there would be no net economic effect and no economic impact.

- *How much people value changes in the fishery depends on whether they feel they have property rights under the current allocation.*

  People tend to place a higher monetary value on goods if they feel they "own" them. Since property rights to a public resource like the fishery are not clearly defined, different valuations of fish given up and fish gained creates a source of uncertainty.

- *Since non-resident benefits are not counted in the economic value analysis, the definition of residence may be important.*

  Alaska residents may spend a large part of the year outside the state for various reasons. Non-residents, on the other hand, may spend a large part of the year in Alaska working. There is no single definition of what constitutes residence, and different definitions will influence the results of the analysis.

Limits on Use of Analysis in Public Policy

Although our net economic value and economic impact analyses can provide useful information, neither method can provide all the information needed to make fisheries allocation decisions. More broadly, economics can not provide all the answers to public policy questions. Other factors must also be considered in resource management decisions.

- *The distribution of gains and losses may be an additional consideration that is not addressed in either our economic value or economic impact analysis.*

  A policy that resulted in the rich getting richer and the poor getting poorer might pass the test of increasing economic value—but it would still be an undesirable social or political policy. In some cases, the question of who gains and who loses may be an important consideration in the decision to implement a policy choice based on an economic value analysis. Addressing this distribution of gains and losses would require an additional level of analysis.

- *Other allocation rules besides those that maximize economic value or economic impact are possible.*

  Allocation could, for example, be on the basis of historical shares or on a per capita basis. Other rules are also possible.

Limits on Data and Results

We close this chapter by acknowledging that a source of variation and possible error in our study results is the inherent imprecision in data collection and analysis. We discuss and when possible quantify the types of errors we expect in our statistical estimates of economic effects in the respective chapters where the statistical methods and their results are discussed. Key estimated parameters are subject to sensitivity analysis to assess how errors in their estimation might affect the results. Final estimates of economic effects are reported as high and low ends of the expected range or confidence interval.

Finally, although we tried to examine the likely range of change, other kinds of changes that we can't foresee would affect our results. For example, major regulatory changes in where, when, and how sport and commercial anglers are allowed to fish would certainly change our conclusions.

Chapter IV. Estimated Changes in Commercial and Sport Harvests

Our analysis of the economic effects of allowing more sockeye into the Kenai River is based on some crucial assumptions about how managers would make that change and how it would affect commercial and sport harvests. We asked biologists with the Alaska Department of Fish and Game (ADF&G) to develop the management and harvest assumptions for this study.

Such assumptions and estimates were difficult to make for complex, volatile fisheries like the Upper Cook Inlet salmon fisheries. Managers can't predict with certainty the results of a given management action under varying conditions from year to year. But estimated changes in harvests were crucial to our analysis—because how many fish we assume sport and commercial fishermen gain and lose is the starting point for determining economic gains and losses. This chapter explains ADF&G's management and harvest assumptions for each of the ten scenarios we examined. Because these assumptions strongly influence our results, it's important for readers to understand how biologists developed their estimates of harvest changes and what those estimates are.

Most of our study scenarios examine the economic effects of increasing the management target for late-run Kenai sockeye by 200,000. ADF&G biologists essentially worked backward from the proposed change in the sonar count to derive estimates of the changes in sport and dip net harvests, the required change in the total inriver return (the return to the river mouth), and therefore the required cutback in the commercial harvest of Kenai River sockeye. They then estimated the number of emergency and regular drift and setnet closures required in the Central District (see Map II-1, Chapter II) to achieve that cutback. Finally, they estimated the resulting cutback in the total Upper Inlet harvest of sockeye and other salmon.

Estimating Changes in Sport and Dip Net Harvests and Returns to River

Estimating Changes in Sport Harvests

Biologists estimated that under current bag limits (3 per day, 3 in possession), sport anglers would harvest 22.4 percent—or just over one in five—of any additional sockeye counted at the sonar. If the limits were increased to 6 per day, 6 in possession, the sport harvest would increase to about 26 percent of any additional sockeye.

To estimate the relationship between sockeye sport harvests and the sonar count, ADF&G biologists used historical harvest data. Assuming bag limits of 3 per day, 3 in possession (the current limits), biologists estimated relationships between the sonar count and sport harvests with the statistical technique of linear regression.[1]

They found that for every additional 100 fish past the sonar counter, sport anglers below the Soldotna bridge would harvest 10.5 fish, and anglers above the bridge would harvest 11.9 fish. Together, anglers above and below the bridge would harvest 22.4 of every additional 100 fish—or 22.4 percent.

ADF&G biologists also estimated the effects of raising the bag limits to 6 per day, 6 in possession: sport harvests both below and above the bridge would increase by 15 percent, for any given sonar count.[2] So anglers below the bridge would catch about 12.1 of every additional 100 fish, and anglers above the bridge would catch about 13.7—for a total of 25.8 of every 100 additional fish, or 25.8 percent of any given increase at the sonar counter.

Estimating Changes in Dip Net Harvests

For all but one of the scenarios, biologists assumed the annual personal use dip net harvest would remain at its current level.

Unlike with sport harvests, ADF&G biologists have no consistent historical data that could provide a reasonably reliable means of estimating how dip net harvests might change if more fish came into the river. As we discussed in Chapter II, regulations governing the subsistence and personal use dip net harvests have changed frequently in recent years.

For nine of the ten scenarios, biologists simply assumed that the personal use dip net fishery would continue to be managed for an annual harvest of around 50,000. However, for Scenario C (which includes higher sport and dip net limits), the biologists assumed that dip net harvests would double from 50,000 to 100,000.

Estimating Changes in Returns to the River Mouth

The return of sockeye to the mouth of the river must be 10.5 percent larger than any given increase at the sonar counter. For most scenarios, an increase of 200,000 sockeye at the sonar counter would require 221,000 sockeye returning to the mouth of the river.

The total return to the Kenai River is the number of sockeye that come in at the mouth of the river. This is a bigger number than the sonar count—because the sonar counter is about 20 miles up from the mouth of the river, and sport anglers and dipnetters harvest sockeye between the river mouth and the sonar counter. The Department of Fish and Game is not able to count fish at the river mouth, but we can estimate the total return by working backward from the sonar count—which is the total return minus sport and dip net harvests before the fish reach the sonar counter:

Sonar count = return to river mouth - sport harvest below sonar - dip net harvest

It's clear that increasing the sonar count by any given amount would require increasing the total return to the river by a larger amount. We can use the equations detailed in the endnotes to this chapter to calculate that the increase in the return at the mouth must be 10.5 percent more than the desired increase in the sonar count, under current sport fishery regulations and assuming no change in the dip net harvest.[3]

Table IV-1 shows how the return at the river mouth would have to change to achieve a given change in the sonar count target under our ten scenarios. If sport fishery management regulations remain the same and dip net harvests do not change, then increasing the sonar count target by 200,000 (Scenarios A, A1-A5) requires increasing the return to the river mouth by 221,000. Similarly, increasing the sonar count target by 100,000 (Scenario D) requires increasing the return to the mouth by 110,500.

Table IV-1. Change in Return to River Mouth

Scenarios	Change in target for sonar count	Change in return to river mouth
A, A1-A5	200,000	221,000
D	100,000	110,500
E	-100,000	-110,500
B, C	(see note)	221,000

Note: For scenarios B and C, the return to the river mouth is assumed to be the same as for Scenario A. Higher sport and dip net harvests below the sonar result in correspondingly lower increases in the sonar count than for Scenario A.

Decreasing the sonar count target by 100,000 (Scenario E) requires reducing the return to the mouth by 110,500.

Unlike most of the scenarios, Scenarios B and C are not based on change in the sonar count; instead, they are based on the same return to the mouth as in Scenario A. That's because Scenarios B and C examine the economic effects of liberalizing sport and dip net regulations. For these scenarios, ADF&G biologists assumed that higher bag limits would increase the sport harvest 15 percent over what it would be with current bag limits. We estimated sport harvests below the Soldotna bridge and the sonar count based on that assumption and related calculations.[4]

Increases in Sport and Dip Net Harvests

If 221,000 more sockeye came into the Kenai River, sport anglers would catch an estimated 40,000 to 50,000, depending on bag limits and the size of dip net harvests. If personal use dip net limits were increased, dipnetters could take 50,000 of the additional fish. Between 130,000 and 170,000 of the additional sockeye would move upriver to spawn.

Table IV-2 shows, for the ten scenarios, what biologists assumed about changes in sport harvests, personal use dip net harvests, sonar counts, and spawning escapement. Scenarios A, B, and C are all based on the same increase in the return of sockeye to the mouth of the Kenai River—221,000. However, the three scenarios result in quite different patterns of change in sport harvests.

Scenario A assumes sport regulations remain the same as at present, with bag limits of 3 per day, 3 in possession. Of the 221,000 more sockeye coming into the river, sport anglers would harvest 21,000 below the Soldotna bridge and 23,800 above the bridge; the remaining 176,200 would escape to spawn.

In Scenario B, with higher sport bag limits (6 per day and 6 in possession), the sport harvest is assumed to increase 15 percent—to a harvest of about 23,800 sockeye below the bridge and 27,000 above the Soldotna bridge, leaving about 170,000 to spawn.

In Scenario C, which assumes both higher sport bag limits *and* a liberalized personal use dip net fishery, dipnetters would take 50,000 of the additional sockeye at the mouth of the river. As a result, even though sport bag limits are higher, the increase in sport harvests would be lower than in Scenario A, with anglers below the Soldotna bridge harvesting about 18,400 additional sockeye and anglers above the bridge around 21,000. There would also be fewer of the additional fish moving upriver to spawn—about 132,000.

Under scenarios A, B, and C, about 1,600 more king salmon would move past commercial nets and into the Kenai River at the same time the additional sockeye came in. Biologists estimate sport anglers would catch about 500 of those additional kings. In Scenario A3, which assumes a smaller sockeye run, commercial openings would be reduced more to increase the inriver return of sockeye, and as a result about 1,800 additional Kenai kings would move into the river.

Table IV-2. ADF&G Scenario Assumptions for Changes in Sport Harvests and Escapement

	Scenario Name and Code									
	+200K at sonar A	Higher sport bag limit B	Higher sport and dip net bag limits C	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in return to Kenai River mouth										
Sockeye	**221,000**	221,000	221,000	110,500	-110,500	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Chinook	**1,600**	*same as "A"*	*same as "A"*	1,050	-1,050	*same as "A"*	*same as "A"*	1,800	0	(f)
Change in sockeye sport harvest										
below bridge (a)	**21,000**	23,811	18,424	10,500	-10,500	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Change in sockeye dipnet harvest										
lower river (b)	**0**	0	50,000	0	0	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Change in sonar count	**200,000**	197,189	152,576	100,000	-100,000	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Change in sockeye sport harvest										
above bridge (c)	**23,800**	26,985	20,880	11,900	-11,900	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Change in chinook harvest (d)	**530**	*same as "A"*	*same as "A"*	350	-350	*same as "A"*	*same as "A"*	600	0	(f)
Change in escapement to spawn										
Sockeye (e)	**176,200**	170,204	131,696	88,100	-88,100	*same as "A"*	*same as "A"*	*same as "A"*	0	(f)
Chinook	**1,070**	*same as "A"*	*same as "A"*	700	-700	*same as "A"*	*same as "A"*	1,200	0	(f)

(a) The sport harvest below the bridge is calculated as: For scenarios A, D and E, which assume current regulations, (change in sport harvest, below bridge) =(.105/1.105) * (change in return to river mouth - change in dipnet harvest) . For Scenarios B and C, which assume higher sport bag limits, (change in sport harvest) = (.12075/1.12075) * (change in return to river mouth-change in dipnet harvest).
(b) The dipnet harvest is fixed at 50,000 (change = 0) for all scenarios except C, where it is doubled to 100,000 (change = +50,000).
(c) The sport harvest above the bridge is calculated as: For Scenarios A, D and E, which assume current conditions, (change in sport harvest, upper river) = .119 x (change in sonar count). For Scenarios B and C, r which assume higher sport bag limits, (change in sport harvest, upper river) =1.15 x .119 x (change in sonar count).
(d) The chinook harvest is calculated as one third of the inriver run.
(e) Since the Russian River harvest by assumption does not change, the change in spawning escapement is the change in the sonar less the change in the harvest above the bridge.
(f) While the initial assumption is that this scenario will look like A3, what makes this scenario interesting is the possibility that poor incentives for commercial fishermen will change the pattern of commercial participation such that the pattern of closures and perhaps the mix of stocks will differ. See ISER's analysis of this in Chapter VI.
(g) ADF&G biologists did not provide estimates of harvest for this scenario. For ISER's analysis, see Chapter V.

ISER file: Scenario Assumptions.

Estimating Change in Commercial Harvests

ADF&G biologists assumed managers would allow more sockeye into the river by eliminating two or three openings for the commercial driftnet and eastside setnet fisheries in the Central District during the peak of the run. The extent of the closures would depend on the size of the run.

It was difficult for the biologists to specify precisely how the number and timing of commercial openings might change to allow a given number of sockeye into the mouth of the Kenai River. Each year is different. In general, the bigger the run, the more fish are caught in each opening. Thus, the bigger the run, the less extensive the closures needed to allow the higher return to the river. The lower the run, the more extensive the closures needed.

To develop assumptions about how many commercial openings would have to be eliminated to achieve higher returns to the river mouth, biologists looked at historical drift and setnet catches of each species during openings at the peak of the run, for runs of different sizes. Their analysis was complicated by the fact that sockeye harvests in any given opening also include fish headed for other river systems. So to achieve a given increase in Kenai River sockeye returns, the total Upper Inlet commercial harvest of salmon would have to be reduced by a larger number.

In practice, the extent to which the commercial harvest of salmon from other rivers would have to be reduced, as well as the area and timing of commercial closures, would depend on the strength of runs to other rivers. For this reason, the actual effects on the commercial sockeye harvest of increasing the Kenai River return would vary from year to year, even if the Kenai run were always the same and managers could achieve the exact targeted increase.

Reductions in Commercial Harvests

The size of the run makes a big difference in how many sockeye commercial fishermen in the Central District of Upper Cook Inlet would have to give up to increase the sonar count by 200,000 and in how the loss would be divided between drift and eastside setnetters. Biologists estimate that during a medium run, eastside setnetters would give up 185,00 sockeye and driftnetters 60,000—for a total of 245,000. During a small run, driftnetters would give up 307,000 sockeye and eastside setnetters 110,000, for a total loss of 417,000. During a high run, Central District fishermen would not have to give up any fish.

Table IV-3 shows ADF&G estimates of changes in the number of commercial openings and in commercial harvests under the ten scenarios. To increase the Kenai River sonar count by 200,000 during a medium sockeye run (Scenarios A, B, C, A1, and A2), biologists assumed that it would be necessary to have two or three fewer emergency openings of the corridor north of mid-Kalifonsky beach between July 15 and 25 for both the drift and setnet fisheries.

Fewer emergency openings would reduce the Central District harvest—the driftnet harvest by 60,000 sockeye and the east side setnet harvest by 185,000. The loss of emergency openings of the corridor—a relatively narrow area of the inlet on the east side of the Central District, as shown on Map II-1 in Chapter II—would be relatively harder on setnetters. That's because in an emergency opening of just the corridor north of mid-Kalifonsky Beach, most of the sockeye caught would be Kenai River sockeye relatively close to shore. In that kind of an opening, the driftnet fleet is excluded from the middle of the inlet, where the bulk of the fish returning to all the Upper Inlet rivers are found. Of the total 245,000 sockeye commercial fishermen would give up during a medium run, an estimated 221,000 sockeye would be Kenai River sockeye and 24,000 would be bound for other rivers.

Table IV-3. ADF&G Scenario Assumptions for Changes in Commercial Harvests

	Scenario Name and Code									
	+200K at sonar A	Higher sport bag limit B	Higher sport and dip net bag limits C	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Sockeye run size assumptions										
Kenai River	**3,500,000**	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	1,500,000	5,000,000	1,500,000
Other rivers	**2,200,000**	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*	*same as "A"*
Change in driftnet openings between July 15 and 25										
Regular openings	**No change**	*same as "A"*	*same as "A"*	No change	No change	*same as "A"*	*same as "A"*	1 fewer	No change	*
Emergency openings in the corridor north of mid-K beach	**2-3 fewer**	*same as "A"*	*same as "A"*	1-2 fewer	1-2 more	*same as "A"*	*same as "A"*	1-2 fewer	No change	*
Change in setnet openings between July 15 and 25										
Regular openings	**No change**	*same as "A"*	*same as "A"*	No change	No change	*same as "A"*	*same as "A"*	1 fewer	No change	*
Emergency openings north of mid-K Beach	**2-3 fewer**	*same as "A"*	*same as "A"*	1-2 fewer	1-2 more	*same as "A"*	*same as "A"*	1-2 fewer	No change	*
Change in driftnet harvest										
Sockeye	**-60,000**	*same as "A"*	*same as "A"*	-30,000	30,000	*same as "A"*	*same as "A"*	-307,000	0	*
Chinook	**-100**	*same as "A"*	*same as "A"*	-50	50	*same as "A"*	*same as "A"*	-300	0	*
Coho	**-1,000**	*same as "A"*	*same as "A"*	-500	500	*same as "A"*	*same as "A"*	-33,500	0	*
Chum	**-6,000**	*same as "A"*	*same as "A"*	-3,000	3,000	*same as "A"*	*same as "A"*	-47,000	0	*
Pink	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	-14,000	0	*
Change in eastside setnet harvest										
Sockeye	**-185,000**	*same as "A"*	*same as "A"*	-92,500	92,500	*same as "A"*	*same as "A"*	-110,000	0	*
Chinook	**-1,500**	*same as "A"*	*same as "A"*	-750	750	*same as "A"*	*same as "A"*	-1,500	0	*
Coho	**-3,000**	*same as "A"*	*same as "A"*	-1,500	1,500	*same as "A"*	*same as "A"*	-3,000	0	*
Chum	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	0	0	*
Pink	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	0	0	*
Change in total commercial harvest										
Sockeye	**-245,000**	*same as "A"*	*same as "A"*	-122,500	122,500	*same as "A"*	*same as "A"*	-417,000	0	*
Chinook	**-1,600**	*same as "A"*	*same as "A"*	-800	800	*same as "A"*	*same as "A"*	-1,800	0	*
Coho	**-4,000**	*same as "A"*	*same as "A"*	-2,000	2,000	*same as "A"*	*same as "A"*	-36,500	0	*
Chum	**-6,000**	*same as "A"*	*same as "A"*	-3,000	3,000	*same as "A"*	*same as "A"*	-47,000	0	*
Pink	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	-14,000	0	*
Change in return to Kenai River mouth										
Sockeye	**221,000**	*same as "A"*	*same as "A"*	110,500	-110,500	*same as "A"*	*same as "A"*	221,000	0	*
Chinook	**1,600**	*same as "A"*	*same as "A"*	1,050	-1,050	*same as "A"*	*same as "A"*	1,800	0	*
Coho	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	0	0	*
Chum	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	0	0	*
Pink	**0**	*same as "A"*	*same as "A"*	0	0	*same as "A"*	*same as "A"*	0	0	*

** While the initial assumption is that this scenario will look like A3, what makes this scenario interesting is the possibility that poor incentives for commercial fishermen will change the pattern of commercial participation and potentially increase inriver returns. See ISER's analysis of this in Chapter VI.*

ISER file: Scenario Assumptions.

The loss of emergency openings would also reduce the commercial harvest of Kenai River kings by 1,600. Commercial fishermen would also give up an estimated 4,000 coho and 6,000 chum headed for other river systems.

Under Scenario D (+100,000 sockeye at the sonar), the loss in the number of openings and the reduction in the commercial harvest would be only half as large. Scenario E (-100,000 sockeye at the sonar) is the mirror image of Scenario D, resulting in an increase in commercial harvests to reduce the sonar count.

In a low-run year (Scenario A3), ADF&G biologists assumed that both driftnetters and east side setnetters in the Central District would lose one regular opening and one or two emergency openings to increase the return to the mouth of the Kenai by 221,000 sockeye. However, losing a regular opening (in addition to emergency openings) would cost both the drift and the setnetters many more sockeye—417,000 as compared with the estimated 245,000 they would lose in a medium-run year.

The loss of a regular opening would be relatively harder on driftnetters, who would give up 307,000 of the total 417,000 sockeye lost to commercial nets in a low-run year. That's because a regular opening is districtwide—that is, the drift fleet can operate in the middle of the inlet, where they are likeliest to catch sockeye bound for other rivers. So if managers eliminated a regular opening, the driftnetters would lose not only more Kenai River sockeye but many more sockeye bound for other river systems (for which the run strength is assumed to remain the same as in Scenario A). However, in this case, setnetters in the Northern District would benefit—because some of the salmon the drift fleet would give up if they lost a regular opening would be Susitna River stocks. We were not able to estimate how many they would harvest.

A second difference between the low-run scenario (A3) and the medium-run scenarios is that ADF&G biologists assumed that in a low-run year the driftnet fleet would catch fewer king salmon, increasing the inriver return of Kenai kings by 1,800, or 200 more than in the medium-run scenarios.

In a year when the Kenai sockeye run was high (Scenario A4), no commercial closures would be needed to increase the sonar count by 200,000. That's because in a high-run year, the sonar count would exceed the high end of the target range—even if the high end of the range were increased to 900,000. As a result, the higher sonar target would have no effect on the management of the commercial fishery or on the number of fish in the river. In a high-run year, the problem for ADF&G—regardless of whether the sonar count target was increased by 200,000—would not be getting more fish in the river but rather keeping too many fish from escaping to spawn.

ADF&G biologists did not provide us with harvest assumptions for the scenario (A5) that looks at the potential effects of a low sockeye run combined with low prices. Instead, in Chapter IX we discuss whether the combination of a low run and a low price might result in a significant reduction in commercial fishing effort, leading to a different reduction in the commercial harvest than that for Scenario A3, which examines just the effects of a low run.

Relationship Between Estimated Change and Economic Effects

We emphasized at the beginning of this chapter that the assumptions provided by ADF&G biologists about changes in commercial and sport harvests (as well as total inriver returns) drive our entire analysis of the economic effects of each scenario. As we move on to the chapters describing economic effects, keep in mind that some of the most important differences in the *economic effects* of various scenarios can be seen directly from the differences in *commercial and sport harvests* in various scenarios. These relationships are illustrated in Table IV-4 and Figure IV-1. Two major points stand out:

- *Increasing the sport (or dip net) harvest by any given amount would require a significantly larger reduction in the commercial harvest.* Kenai River sockeye would make up anywhere from 50 percent to 90 percent of all the sockeye commercial fishermen would give up under the various scenarios, as the top row of Table IV-4 shows. There are two ways of calculating what share of additional fish sport anglers and dipnetters would harvest: the share of all the Upper Inlet sockeye that commercial fishermen give up, or the share of just those sockeye that return to the Kenai River.

  Of the additional sockeye that would come into the Kenai River under various scenarios, anglers and dipnetters would harvest from 20 to 40 percent (as the second row of Table IV-4 shows), depending on management regulations, while 60 to 80 percent would move upriver to spawn.

  If we look at the proportion sport anglers and dipnetters would harvest of all the sockeye commercial fishermen would give up—including not only Kenai River sockeye but also sockeye returning to other rivers—the percentages are slightly smaller (as shown in the bottom row of Table IV-4). Those percentages vary from as little as 10 percent in the low-run scenario (A3) to as high as 36 percent in the scenario that combines higher sport limits with a liberalized dip net fishery (Scenario C).

  It should be noted, however, that changes in sport and dip net harvests are not the only factors affecting the net economic value and the economic impacts of the sport fishery. Even if sport anglers and dipnetters harvest the same number of sockeye, having more fish in the river can increase economic benefits if the fish are easier to catch.

- *The smaller the Kenai River sockeye run, the greater the economic losses—in both relative and absolute terms—for commercial fishermen if their harvest were reduced.* In relative terms, any cutback in the commercial harvest during a small run would represent a bigger percentage of the harvest than it would during a larger run. In absolute terms, commercial fishermen would lose more sockeye during a small run than during a larger run. That's because during a small run managers would likely ensure that more fish escaped into the Kenai River by eliminating a regular commercial opening—which is districtwide, and would therefore cost commercial fishermen in the Central District not only more Kenai River sockeye but also more sockeye headed for other river systems.

Projected and Actual Changes in Harvests and Economic Effects

As we pointed out earlier, commercial fisheries management is a blunt tool, especially for complicated mixed-stock fisheries like those of Upper Cook Inlet. That's why the current management target for Kenai River sockeye is a range—450,000 to 700,000 past the sonar counter—rather than a single figure. Raising this target range by any given amount would not make commercial fisheries management any more precise. As in the past, in some years the return would be near the lower end of the new range, and in other years near the upper end.

That difference between setting a theoretical target and actually hitting the target in the complex real world of fisheries management also influences our analysis. Our findings about economic effects under each scenario are based on specific assumptions about increases in the number of sockeye in the Kenai River and reductions in the commercial harvest.

But since we know that fisheries management isn't that precise, we also know that our projections of economic effects can't be that precise either: in any given year the economic effects would be greater or smaller than we project, depending on how close managers came to their targets. Still, the economic effects we project under different run sizes, prices, and other factors provide a good picture of how increasing the management target for Kenai River sockeye could affect the sport and commercial fisheries.

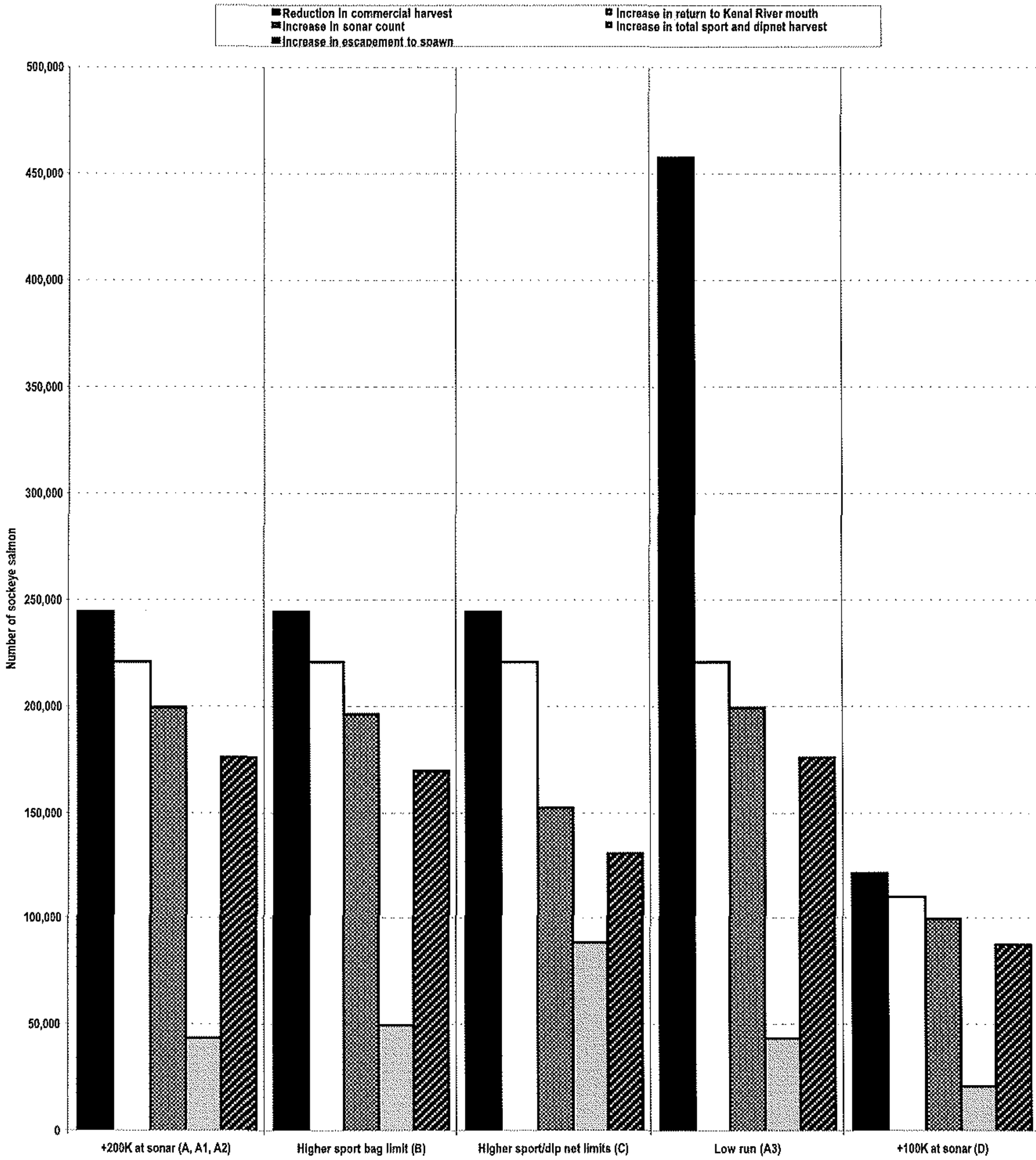
Table IV-4. Comparison of ADF&G Assumptions for Reduction in Commercial Harvests with Increase in Return to River Mouth and Increase in Sport and Commercial Harvests

	Scenario Name and Code									
	+200K at sonar	Higher sport bag limit	Higher sport and dip net bag limits	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	B	C	D	E	A1	A2	A3	A4	A5
Total change in commercial sockeye harvest	-245,000	-245,000	-245,000	-122,500	122,500	-245,000	-245,000	-459,000	0	(a)
Change in return to Kenai River mouth	221,000	221,000	221,000	110,500	-110,500	221,000	221,000	221,000	0	(a)
Increase in return to Kenai River mouth as a percentage of reduction in commercial harvest	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**48%**	**0%**	(a)
Change in return to Kenai River mouth	221,000	221,000	221,000	110,500	-110,500	221,000	221,000	221,000	0	(a)
Change in total sport harvest	44,800	50,796	39,304	22,400	-22,400	44,800	44,800	44,800	0	(a)
Change in dip net harvest	0	0	50,000	0	0	0	0	0	0	(a)
Change in total sport and dip net harvests	44,800	50,796	89,304	22,400	-22,400	44,800	44,800	44,800	0	(a)
Change in sport and dip net harvests as a percentage of change in return to Kenai River mouth										
Sport harvest	**20%**	**23%**	**18%**	**20%**	**20%**	**20%**	**20%**	**20%**	**0%**	(a)
Dip net harvest	**0%**	**0%**	**23%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	(a)
Sport and dip net harvest	**20%**	**23%**	**40%**	**20%**	**20%**	**20%**	**20%**	**20%**	**0%**	(a)
Increase in sport and dip net harvests as a percentage of reduction in commercial harvests										
Sport harvest	**18%**	**21%**	**16%**	**18%**	**18%**	**18%**	**18%**	**10%**	**0%**	(a)
Dip net harvest	**0%**	**0%**	**20%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	(a)
Sport and dip net harvest	**18%**	**21%**	**36%**	**18%**	**18%**	**18%**	**18%**	**10%**	**0%**	(a)
Change in escapment to spawn	176,200	170,204	131,696	88,100	-88,100	176,200	176,200	176,200	0	(a)

(a) Estimated by ISER as part of study analysis.

ISER file: Scenario Assumptions.

Figure IV-1. Comparison of Scenarios: Effects on Harvests and Escapement



[1]The relationships under current bag limits are:

(IV-1) Sport harvest below the Soldotna bridge = .105 (sonar count) - 30,879
(IV-2) Sport harvest above the Soldotna bridge = .119 (sonar count) -10,136

[2] Multiplying equations IV-1 and IV-2 by 1.15 gives the relationships under bag limits of 6 per day, 6 in possession:

(IV-3) Sport harvest below the Soldotna bridge = .121 (sonar count) - 35,511
(IV-4) Sport harvest above the Soldotna bridge = .137 (sonar count) -11,656

The linear regression equations are presented in Figure 2 of Doug McBride and Steve Hammarstrom, "Assessment of Sockeye Salmon Returns to the Kenai River: Estimation of Total Return, Projection of In-River Fishing Power, and Evaluation of Management Options." They are also included in the documentation of ADF&G assumptions in Appendix A.

[3]In deriving the relationships below, we use the following notation:

L = sport harvest below Soldotna bridge
R = return to river mouth
S = sonar count
D = dip net harvest

Let the sport harvest below the bridge be linear in the sonar count given by the regression line

(1) $L = aS - b$

The sonar count is the return to the river mouth minus the sport harvest below bridge and the dip net harvest, giving us:

(2) $S = R-L-D$

Calculating change in the sport harvest below the bridge as a function of the change in the return to the river mouth:

Combining these two equations gives us:

(3) $L = a(R-L-D)-b$

Adding aL to both sides of the equation gives us:

(4) $L + aL = a(R-D) - b$, or

(5) $(1+a)L = a(R-D) - b$

Dividing both sides of the equation by (1+a) gives us:

(6) $L = [a/(1+a)] (R-D) - b/(1+a)$

This may be used to calculate the following formula for the change in the sport harvest below the bridge:

(7) change in L = [a/(1+a)] (change in R) - [a/(1+a)] (change in D)

The ADF&G regression assumes that when the sport regulations are 3 per day, 3 in possession, we have:

$a = .105$

and $a/(1+a) = .09502$, giving us:

(8) change in L = .09502(change in R) - .09502 (change in D)

ADF&G assumes that sport harvests would be 15% higher if sport regulations are 6 per day, 6 in possession. This would give us

$a = .105 * 1.15 = .12075$

and $a/(1+a) = .10774$

(9) change in L = .10774(change in R) - ..10774 (change in D)

Calculating change in the return to the river mouth as a function of the change in the sonar count:

From (2) and (1), we have:

---

(10) $R = S + L + D$

$= S + (aS - b) + D$

$= (1+a) S + D - b$

Therefore

(11) change in R = (1+a) (change in S) + (change in D)

With sport regulations of 3 per day, 3 in possession, a = .105. Therefore if dip net harvests do not change, then (change in R) = 1.105 (change in S).

[4]See equation 8 in the previous note.

Chapter V. Profile of Sport Fishing in Southcentral Alaska

To set the stage for Chapters VI and VII, which discuss changes in net economic value and in economic impacts of the sport fishery, this chapter briefly profiles sport fishing in Southcentral Alaska, based on ISER surveys of resident and non-resident anglers.

Resident Sport Fishing

In 1993, ISER surveyed 1,355 sport anglers in households statewide. We asked Alaska anglers where they fished, how often, how they reached their favorite fishing sites, and how much they spent on fishing trips. About 615 of those we surveyed live in Southcentral Alaska, which we define as including the Kenai Peninsula Borough, Anchorage, and the Mat-Su Borough. We also surveyed 4,278 non-residents who had previously fished in Southcentral Alaska.

We used survey responses from Southcentral residents as a primary source of data in estimating potential change in net economic value of the sport fishery, and non-resident survey responses were important in the economic impact analysis. Map V-1 and Table V-1 show where Southcentral residents sport fish, and Figure V-1 profiles resident and non-resident sport fishing.

Almost half the households in Southcentral Alaska (about 60,700 of the estimated 121,700 households) went sport fishing in 1993. Those households made nearly 626,000 sport fishing trips in the summer of 1993—an average of about 10 trips per fishing household. More than half the 1993 trips (57 percent) were to the Kenai Peninsula. About 38 percent were to other areas of Southcentral, and 5 percent were outside the region. The most popular fishing sites in 1993 were the Kenai and Russian rivers, where 24,000 Southcentral households—or about 40 percent of households with anglers—accounted for 25 percent of all trips. The next most popular sites were the Homer area (12 percent of trips) and Resurrection Bay at Seward (8 percent of trips).

Southcentral resident and visiting households spent about $136 million for sport fishing trips in 1993, with $34 million of that total for trips to the Kenai and Russian rivers. The average trip to all fishing sites cost residents $155 and non-residents $400. Trips to the Kenai and Russian rivers costs resident households on average $105 while non-residents spent $460. The biggest costs for Kenai River trips for visiting households were guides and charters and transportation; residents spent the most for transportation and food.

Southcentral fishing households made an average of nearly 7 trips to the Kenai and Russian rivers in 1993; visiting households made an average of about one trip. Visiting households made longer trips—an average of close to 3 days; the average trip by resident households lasted less than 2 days.

Table V-1. Sport Fishing Sites for Southcentral Anglers

Aggregated Sites	Type of Fishery	Primary Access Mode
1. Willow Creek	fresh	vehicle
2. Willow to Cantwell lakes and streams	fresh	vehicle
3. Little Susitna River	fresh	vehicle
4. Wasilla Creek (Rabbit Slough)	fresh	vehicle
5. Kepler Lake complex and Wasilla area lakes	fresh	vehicle
6. Fish Creek	personal use dip net	vehicle
7. Big Lake and tributaries	fresh	vehicle
8. Other Mat Su (Area K) lakes & streams	fresh	vehicle
9. Ship Creek	fresh	vehicle
10. Other Anchorage area lakes and streams	fresh	vehicle
11. Deshka River (Kroto Creek)	fresh	boat
12. W. Susitna and W. Cook Inlet lakes and streams	fresh	boat, plane
13. Knik and Turnagain Arms, W. Cook Inlet	salt	vehicle
14. Anchor River, Deep Creek, and Whiskey Gulch areas	salt	vehicle, boat
15. Resurrection Bay (Seward)	salt	vehicle, boat
16. Kachemak Bay (Homer)	salt	vehicle
17. Homer Spit (shoreline)	salt	vehicle
18. Kenai Peninsula other saltwater	salt	vehicle, boat
19. Kenai Peninsula dip net fisheries	dipnet	vehicle, boat
20. Kenai River above Skilak Lake	fresh	vehicle
21. Kenai River (Skilak Lake and below)	fresh	vehicle
22. Russian River	fresh	vehicle
23. Kasilof River	fresh	vehicle
24. Ninilchik to Anchor River	fresh	vehicle
25. Swanson River and Swan Lake Canoe Route	fresh	vehicle
26. North Kenai lakes and streams	fresh	vehicle
27. Kenai Peninsula other lakes and streams	fresh	vehicle, boat
28. Management Areas I and J (Glennallen), fresh water	fresh	vehicle
29. Management Areas I and J (PWS), salt water	fresh	vehicle
30. Other Alaska	fresh or salt	vehicle

Study sites are shown in bold. See Appendix A for details of locations included in each site.

Map V-1. Sport Fishing Sites for Southcentral Residents

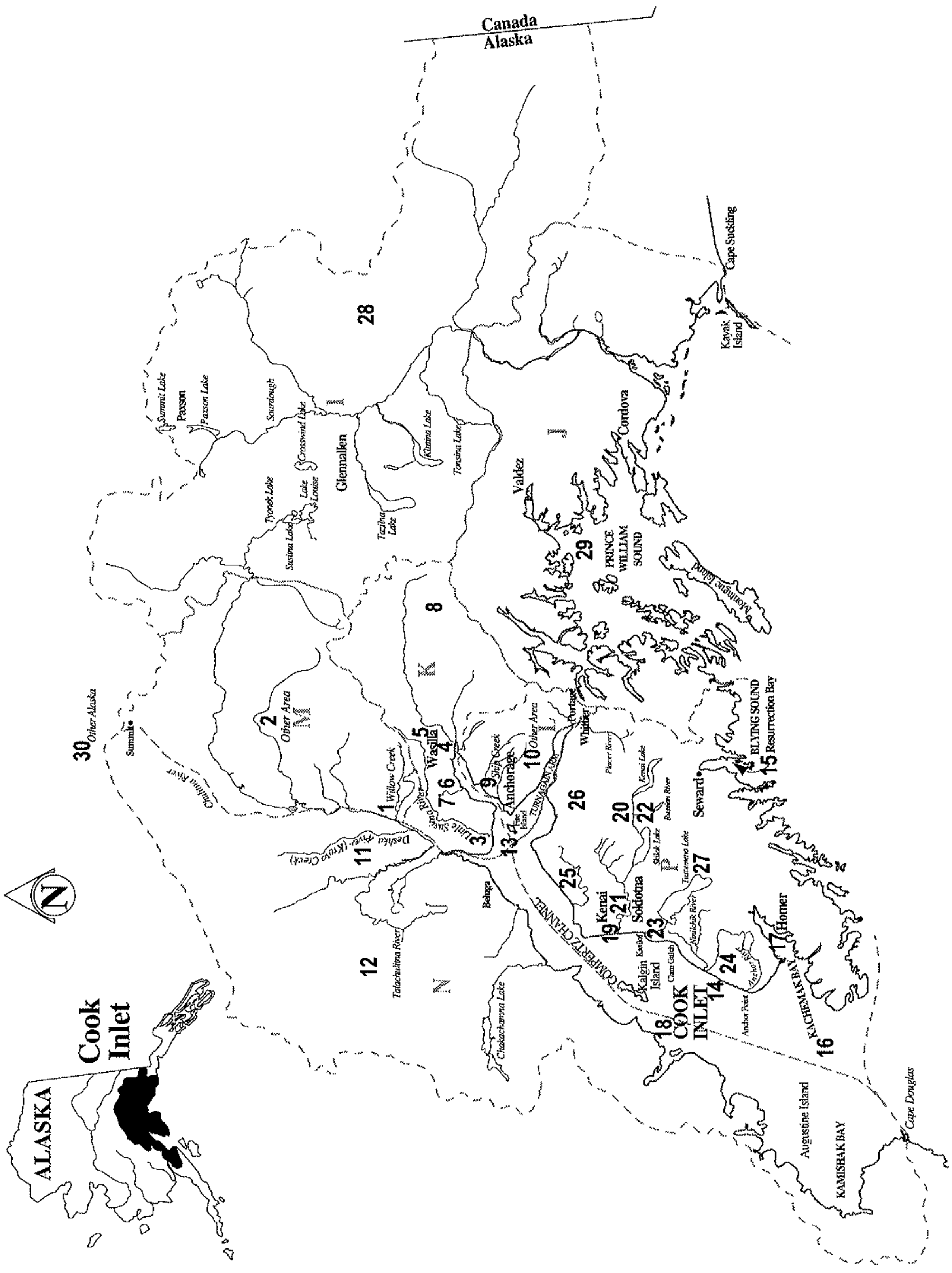
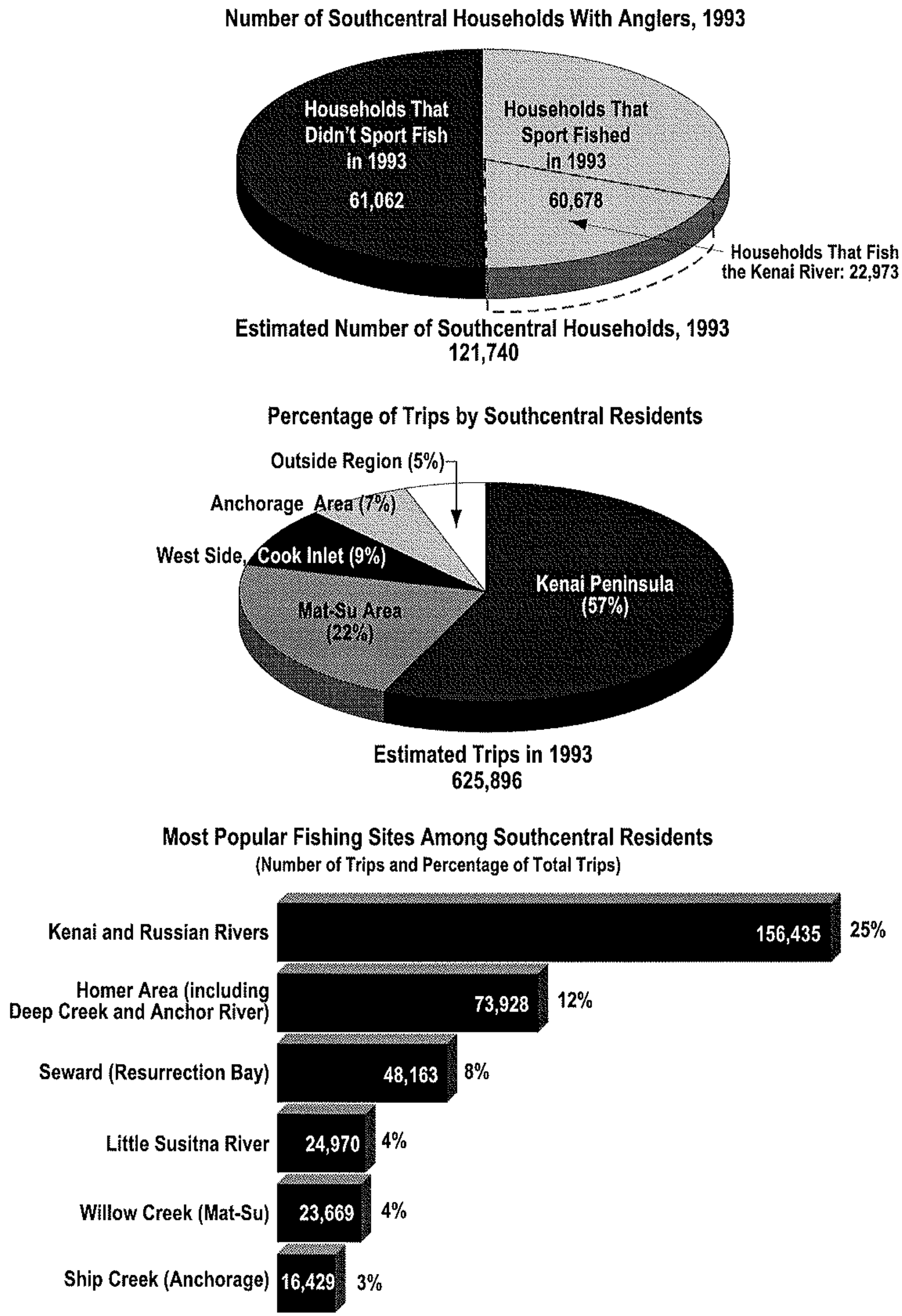
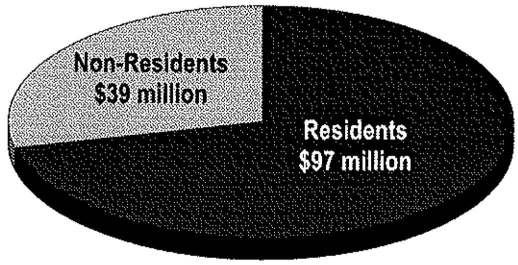


Figure V-1. Profile of Sport Fishing by Southcentral Residents and Visitors, 1993



Spending for Sport Fishing Trips, Southcentral Residents and Visitors

All Southcentral Trips

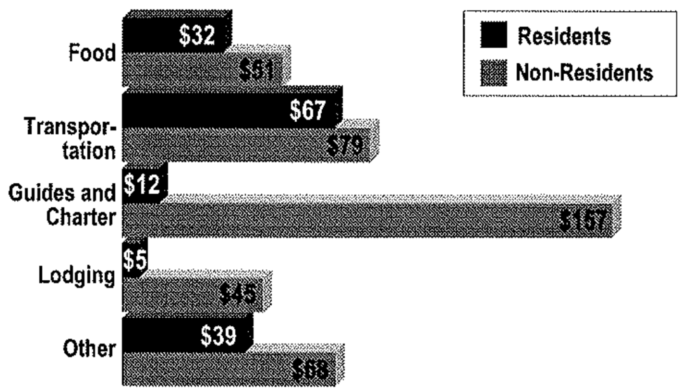


Total $136 million

Kenai and Russian River Trips

Total $34 million

Per Trip Spending, All Southcentral Trips



Per Trip Spending, Kenai River Trips

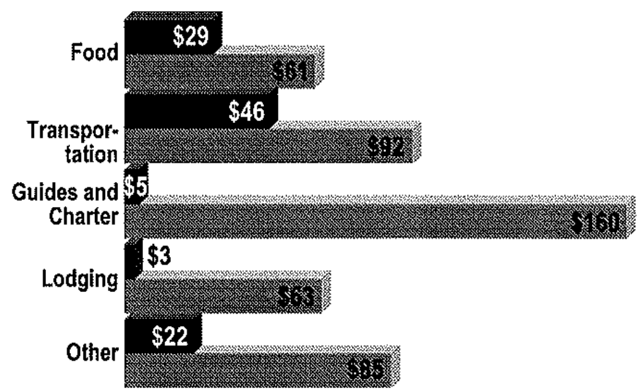


Table 1. Cost and Length of Sport Fishing Trips, 1993

	Resident Households	Non-Resident Households
All Southcentral Trips		
Average Per Trip Spending	$155	$400
Average Number of Trips per Household	10	1.7
Average Length of Trip	1.8 days	2.9 days
Trips to Kenai and Russian Rivers		
Average Per Trip Spending	$105	$460
Average Number of Trips per Household	6.7	0.7
Average Length of Trips	1.6 days	2.7 days

Chapter VI. Change in Net Economic Value of the Sport Fishery

This chapter talks about how an increase in the number of sockeye in the Kenai River could change the net economic value of the sport fishery for resident anglers and businesses. Net economic value is benefits minus costs: the difference between the benefits of the sport fishery and the costs of enjoying those benefits.

Defining Economic Value of the Sport Fishery

In Chapter III we defined net economic value broadly as benefits minus costs. Table VI-1 shows benefits and costs of the Kenai River sport fishery for resident anglers and businesses. Since this is a policy study for the State of Alaska, we were asked to study only net economic value to Alaska residents. (However, expenditures in Alaska by non-residents are taken into account in the analysis of the economic impacts of the sport fishery in Chapter VIII.)

The benefits of sport fishing to the anglers are obvious: the fish harvested and the enjoyment of fishing. Out-of-pocket costs (including costs of bait, tackle, guides, charters, licenses, or launch fees) for fishing are also clear, as are trip-related expenses for things like food, lodging, gas, depreciation on vehicles, commercial fares, or entry fees.

Table VI-1. Benefits and Costs of the Sport Fishery

	Benefits	Costs
Anglers		
Resident sport anglers	Fish harvested	Expenditures on angling: bait, tackle, guides, charters, licenses, launching fees
	Enjoyment of fishing	Travel and trip related costs: food, lodging, gas, depreciation on vehicles, commercial fares, other expenses
		Time costs: lost income from not working, other activities foregone
Non-resident sport anglers	(Not included)	(Not included)
Dip net anglers	Fish harvested	Expenditures on angling: nets, licenses, ice
	Enjoyment of fishing	Travel and trip related costs: food, lodging, gas, depreciation on vehicles
		Time costs: lost income from not working, other activities foregone
Businesses Serving Anglers		
Guides	Revenues from guiding operations ; job satisfaction	Costs of operations; income and satisfaction from alternative employment
Suppliers	Revenues from sport fishing sales; job satisfaction	Costs of operations; income and satisfaction from alternative employment

That anglers' time is less obvious, but is also a cost of fishing, and time costs are harder to define. For anglers who could have been working for pay, the income they forego by not working is clearly a cost of going fishing. For people who are retired or on vacation, or who fish after working hours, the analogous cost is the foregone pleasure of other leisure activities. This cost is difficult to measure in dollars. Another issue is whether the time anglers spend traveling to and from the fishing site is inherently pleasurable—and therefore adds to the benefits of the fishing trip—or whether travel time is purely a cost of going fishing. The net value to the angler is the degree to which the benefits of fishing outweigh the costs. Dipnet anglers enjoy similar benefits and incur similar costs as sport anglers.

Also part of the economic value of the sport fishery are benefits and costs to businesses that provide services to sport anglers—guides, tackle shops, and others. We discuss net economic value to businesses serving sport anglers later in this chapter.

Changes in Economic Value to Sport Anglers

If net economic value is benefits minus costs, how do we measure benefits to begin with? As we discussed in Chapter III, economists use *willingness to pay* (WTP) as the basic measure of these benefits for items—like sport angling—that are not sold in markets. Willingness to pay is a dollar measure of the value an angler attaches to the fishing experience or opportunity. Even though sport-caught fish don't have a market price, the value of the fish to anglers can be measured by anglers' willingness to pay for fishing trips.[1] Net willingness to pay is anglers' willingness to pay for sport fishing, over and above what they actually pay. This net willingness to pay—total willingness to pay minus costs—is economists' measure of net economic value.

If the number of sockeye in the Kenai River in late July were increased, the change would increase sport catch rates and harvest. This change would increase the benefits of fishing without directly affecting the costs, thereby increasing the net value to anglers. Presumably, sport anglers would be willing to pay more for better fishing. Better fishing would also likely draw more anglers to the Kenai. Figure V1-1 illustrates how improved fishing would increase the net economic value to sport anglers.

The downward-sloping line, D (demand), represents anglers' initial willingness to pay (WTP) for fishing trips for Kenai River sockeye in late July. Anglers who value the fishery the most—that is, who would be willing to pay the most—are represented at the left of the graph, while anglers who value the fishery the least are at the right. The higher line—D*—represents the increase in anglers' willingness to pay when there are more fish in the river. (Other characteristics of the fishery, sites, and anglers are held constant.)

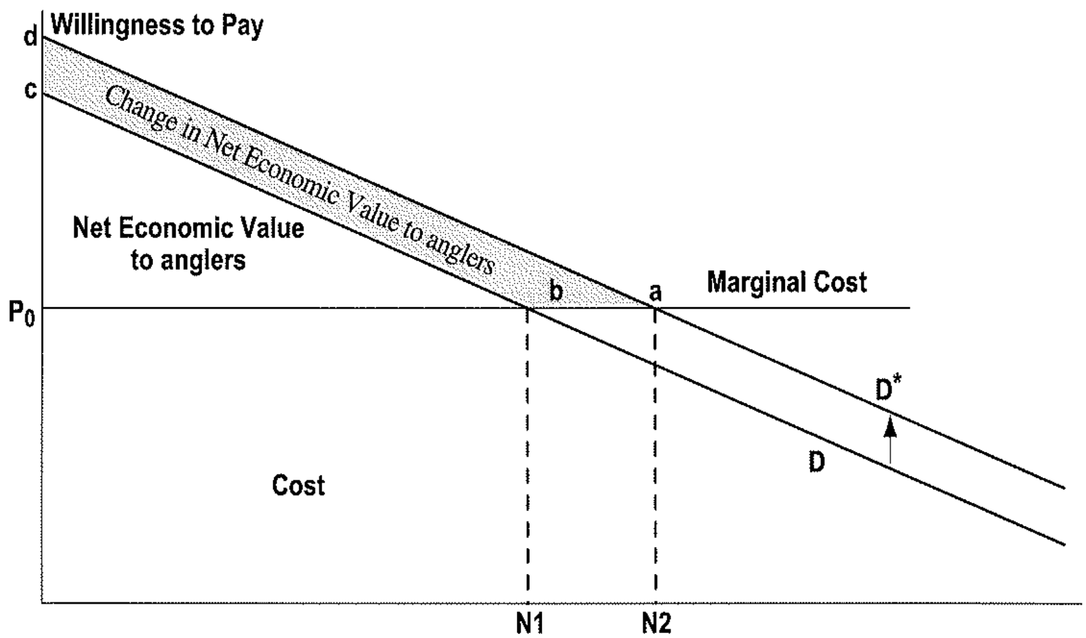
The horizontal line represents the marginal cost of a fishing trip. Marginal cost includes all the out-of-pocket costs of one more fishing trip to the Kenai, as well as the opportunity cost of the angler's time. (In this case, the opportunity cost may be a foregone fishing trip to another site.) These are the costs the individual angler considers when deciding whether to take a fishing trip to the Kenai River. We show the marginal cost as a horizontal line because we assume the costs of a fishing trip would stay the same. (The marginal cost line could, however, slope upward if more anglers at a given time and place did mean increased costs—like increased waiting time, parking distance from

[1]This important point was emphasized in a National Marine Fisheries Service study: "Economic value and demand exist even when markets and prices are nonexistent. Markets and prices actually emerge from the collective behavior of consumers and businesses when property rights are well-defined, exclusive, and enforced. When available, prices help to reveal the maximum that consumers are willing to pay for fish or fishing. However, prices do not, as is commonly thought, create demand or economic value. Indeed, the opposite is true—demand, or willingness to pay, is necessary for markets and prices to emerge. Accordingly, anglers derive economic value from resources such as fish stocks even when access to beaches, piers and boat launches is not rationed by markets." Cited from Steven F. Edwards, "An Economics Guide to Allocation of Fish Stocks between Commercial and Recreational Fisheries," National Oceanographic and Atmospheric Administration Technical Report NMFS 94.

the site, and perhaps guide fees, food, or lodging costs.) If the expected benefits exceed the expected costs, the angler will make the trip. N1 represents the aggregate number of trips for which the expected benefits exceed the expected costs.

With an increase in salmon available for sport anglers to harvest, sport fishing would become more appealing, and willingness to pay would shift upward to D*. Benefits exceed costs, so anglers decide to take more trips. The equilibrium number of trips rises to N2, and net economic value increases. The increase in net economic value resulting from the increase in willingness to pay is shown by the area of the trapezoid *abcd* in Figure VI-1.

Figure VI-1. Changes in Net Economic Value for Sport Anglers



Travel Cost Analysis

How do we measure changes in net economic value to sport anglers and dipnetters? In this study we used two independent approaches: the travel cost method and contingent valuation. This section explains the travel cost model methodology, our application of the methodology, and our resulting estimates of the change in net economic value for sport anglers. The next section explains the contingent value approach.

We developed a travel-cost demand model for Southcentral Alaska (defined as Anchorage, the Mat-Su Borough, and the Kenai Peninsula Borough) to estimate potential changes in sport anglers' participation and willingness to pay (WTP) as a result of changes in the management of Kenai River sockeye. We modeled dipnet fishing as a choice in the travel cost model.

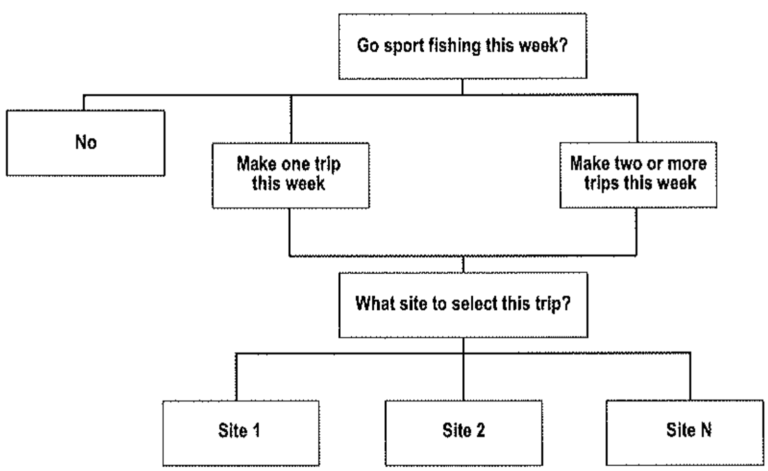
The travel cost method is a standard technique frequently used to estimate anglers' future fishing decisions and their willingness to pay for fishing. It involves a detailed analysis of where anglers go fishing and how much it costs them to get there. (Detailed documentation of our travel cost analysis appears in Appendix A.) Our application of the travel cost method makes use of observations on anglers' actual choices among the available fishing opportunities to estimate the value of sites, species, or characteristics of the fishery. Variables that explain anglers' choices about how often and where to go fishing include site and angler characteristics and the travel cost to the site. Since travel cost is expressed in dollars, it is part of the price anglers pay for fishing trips and is a key variable for determining value.

Three main steps were involved in estimating the travel cost models. First, we collected data on fishing behavior over the course of the 1993 season[2] from representative samples of resident angler households. Then, using statistical methods to analyze the data, we estimated a set of equations predicting anglers' choices about when and where to go fishing, based on travel costs to alternative sites, attributes of the site, information about conditions each week, and household characteristics. Finally, we derived an estimate of willingness to pay (WTP) from the estimated equations.

Our model is vary similar to, and patterned after, the model Jones and Stoked used in their Southeast Alaska Sport Fishing study (Jones and Stokes, 1991). This approach models the decision to go fishing as a two-stage problem. Anglers decide whether to go fishing based on the expected quality of fishing in a given week. then they decide where to fish. Given a decision to go fishing, anglers choose a site based on characteristics of the site, including the availability and abundance of various species, weather, and other fishing conditions and site characteristics. Past studies of non-market values of Alaska sport fishing (Jones and Stokes, 1987, 1991) analyzed whether an angler took one or several fishing trips each week. A significant number of anglers, however, take only a few fishing trips each year. In addition, there are anglers who own fishing tackle and occasionally go fishing, but for one reason or another, did not fish during some arbitrary study period.

So for this study we estimated two participation models: one for *frequent anglers* who make weekly choices about fishing, and another for *infrequent anglers*. Infrequent anglers make monthly rather than weekly decisions about whether to fish, how often to go, and which fishery to participate in. We stratified our resident angler sample into the two categories by using the distribution of the number of summer fishing trips anglers expected to take when we talked to them in May 1993. Figure VI-2 depicts the decision tree for our model of frequent angler decisions.

Figure VI-2. Frequent Anglers' Decision Tree



[2] 1993 was an unusual year in two respects: the Kenai River sockeye run was quite late, and the sockeye season opened with a reduced bag limit of two fish per day, which increased to three and finally to 6 at season end. In our model there is no tome variable; rather, each week is modeled as an independent observation. Therefore, the timing of the 1993 run wouldn't affect our model results. The changes in the bag limit, which show angler behavior over a wider than usual range, only strengthen the model's statistical power to measure the effects of that variable.

Model Estimation

We built the travel cost model by first estimating an equation to predict where anglers would fish and then estimating an equation to predict how often they would fish. Below we describe the preparation of the data used in estimating the site choice equation: the sites, site data, travel costs, and expenditures on food, bait, lodging, and guide costs. A report on the equation as estimated follows that description. Discussion of the estimated inclusive value and participation equations and the calculation of net willingness to pay complete the analysis. (Appendix A provides more detail.)

Sites and Site Data

To feasibly estimate the site choice equation, we had to consolidate the hundreds of sport fisheries in the region into a small number of exhaustive and mutually exclusive alternatives. The guidelines we used were: to keep the most popular sites in each management area narrowly defined, so that site characteristics could be meaningfully identified; to cluster sites geographically and by primary means of access (plane, boat, or car) so that travel costs could be meaningfully assigned to the group; and to group sites by type of fishing. We aggregated all the fishing sites into 30 sites, listed in Table V-1 and displayed on Map V-1 (pages V-2 and V-3).

Next we constructed a set of variables to explain why an angler selects a particular site. Using ADF&G data, newspapers, *The Alaska Atlas and Gazetteer,* U.S. Weather Bureau data, key informants, and other sources, we constructed a data file with over 100 variables for each of the 30 sites. These variables include: what species are available at each site by week; which weeks are the peak for the several species of salmon; catch per hour data for selected sites and species from ADF&G creel surveys; harvest data by site and species from the ADF&G statewide sport harvest survey; fishing quality data by site, species, and week from newspaper reports; crowding by site and week; site facilities, including boat ramps, public cabins, commercial lodging, campgrounds, fuel, and water; holidays and major fishing derbies; temperature, precipitation, wind, and tides; and sport fishing regulations by site, species, and week, including open dates, bag limits, size limits, and gear restrictions. The fourteen species included in the full model were king salmon, silver salmon, sockeye salmon, other salmon, trout, Dolly Varden or arctic char, steelhead, grayling, whitefish, herring, halibut, groundfish and other finfish, clams, and crab and shrimp.

Angler and Trip Data

Our angler and trip data for this study derived from ISER surveys of Alaska households regarding their 1993 fishing activities and expenditures, as discussed at the beginning of the chapter. We used information on 1,298 sport fishing trips by 251 anglers over 27 weeks, from April 29 to November 3. Weeks were defined from Thursday to Wednesday to include a weekend. The distribution of sport fishing trips taken by week is displayed in Table A-1 in Appendix A, and the distribution by trip origin is in Table A-2.

Trip Costs

The most important variable in a travel cost model is the trip cost, which is the sum of the travel cost and other trip expenditures. For some trips we had detailed expenditure information from survey respondents, and for those trips we used reported travel costs. To estimate costs of trips for which we didn't have detailed information, we developed a travel matrix by trip origin (using 17 origination sites), by destination (using 30 aggregated sites), and by vehicle ownership (road vehicles, motorized boats over 14 feet, and airplanes), containing estimated road miles and water and air time. We estimated trip costs with this matrix, in conjunction with gas prices for each community and fuel use for survey respondents' vehicles. We also used the matrix to estimate costs of trips not taken. For every fishing trip an angler takes to one site, he in effect decides not to take a trip to the other 29 sites. In modeling how anglers' make decisions about where to fish, it's important to compare what anglers chose with what they didn't choose. We used data on 1,718 summer fishing trips statewide to estimate food, bait, lodging, and guide expenditures for all trips. (See Appendix A, Tables A-5 through A-8, for regression results.)

Site-Choice Equation

Before we could estimate the site choice equation, we had to estimate on-site fishing time and trip expenditures. In contrast to previously published studies of Alaska sport fishing, our study treats on-site fishing time as endogenous—which means that the time spent fishing is a choice anglers make along with when and where to fish. It is part of the angler's behavior that we need to model, not a fixed factor external to the model. We believe treating on-site fishing time as an exogenous independent variable in the expenditure and site choice equations provides inefficient and biased regression results and therefore inaccurate estimates of willingness to pay. In this study we constructed an instrument for on-site time—a method for eliminating the potential bias.[3] The results of our instrumental variable regression are reported in Appendix A, Table A-5.

Our study also differs from previously published studies of Alaska sport fishing in that we include as a part of trip costs the lost wages for those who could have worked. We believe that leaving out the wage value of travel and on-site time substantially underestimates the costs of a recreational visit and therefore underestimates the value anglers place on fishing—their willingness to pay.

Once we had estimated on-site fishing time and trip expenditures, we were able to develop the site choice equation. The site-choice equation estimates the probability (P_{it}) that an angler selects site i in week t. Modeling a discrete choice—such as the angler's decision of where to fish—requires a complex, nonlinear functional form ("logit") that we discuss in Appendix A. To estimate the equation we tried a large number of variables. We tested weekly and annual fishing quality, annual catch, peak fishing times, household-site interactions, site characteristics, and bag limits.

For the final equation, we kept only those variables that were statistically significant—at least a 90 percent probability that the estimated coeffcients were not zero. The one exception—on-site fishing time by anglers who could have worked (Yifhours)— was kept in the equation because it is the counterpart to another variable in the equation—on-site fishing time for anglers who didn't have the option of working (Nifhours). These two variables measure the value of on-site time. Table VI-2 lists and defines the variables that appear in our final equation. Regression statistics are reported in Table A-10 in the Appendix.

The middle column in Table VI-2 shows either positive or negative signs for coefficients of each equation variable. Those signs indicate how different variables affect anglers' choices about where to fish. A positive sign on the coefficient for an explanatory variable means that the higher the value of the variable, the more likely it is that an angler will select site i over the alternative sites. A negative sign means the higher the value of the variable, the less likely the site i will be chosen.

The estimation results are plausible. The cost and hour variables all had negative coefficients. The harvest and quality variables all had positive coefficients. Bag limits, availability of campgrounds, and the Seward Silver Salmon Derby all had positive coefficients, while the crowding variable had a negative coefficient. The most important variables in predicting the variance in and over all level of the probability of choosing a site were campground facilities and crowding, followed by trip costs, on site fishing hours by those who could not have worked, and travel time for those who could have worked.

[3] The instrumental variable is constructed from the fitted value of a regression equation explaining on-site fishing time as a function of all the exogenous independent variables.

Table VI-2. Variables Appearing in the Site Choice Equation

Variable	Coefficient Sign	Definition
Cost and Time Variables		
$Tripcost_i$ (for those who could not have worked)	-	trip cost to site i: fuel cost + food cost + bait cost + lodging cost + guide cost + vehicle depreciation cost
$Tripcost_i$ (for those who could have worked)	-	trip cost to site *1 as above* + lost wages for travel and on-site time
$Travtime_i$	-	travel time to site i for those who could not have worked
$Nifhours_i$	-	estimated on-site fishing hours by anglers who couldn't have worked
$Yifhours_i$	-	estimated on-site fishing hours by anglers who could have worked
Total Harvest Variables		
$Trout_i$	+	annual total harvest[a] for trout at the ith site
$Dolly_i$	+	annual total harvest for Dolly Varden at the ith site
$Silver_i$	+	annual total harvest for Silver salmon at the ith site
$Sockeye_i$	+	annual total harvest for Sockeye salmon at the ith site
$PinkChum_i$	+	annual total harvest for Pink or Chum salmon at the ith site
Fishing Quality Variables		
$Kingdf_i$	+	annual fishing quality for King salmon at site i: total annual harvest for King salmon divided by angler days at site i
$Sockdf_i$	+	annual fishing quality for Sockeye salmon at site i: total annual harvest for Sockeye salmon divided by angler days at site i
$Kingrept_{it}$	+	reported fishing quality for King salmon at site I in week t, as published in the Anchorage Daily News. The data was coded 0 (closed or no report) to 6 (fishing quality is top)
$Ksonar_{it}$	+	Sonar count at mile 19 of the Kenai River during week t (for the two Kenai River sites and the Russian River site only)
$Halipeak_{it}$	+	Halipeak=1 if Halibut is peak available at site i in week t, otherwise 0. This data was developed from the ADF&G brochures
Other Variables		
$Troutbag_{it}$	+	Bag limit for Trout at site i in week t
$Campgr_i$	+	Campgr: 1 if a camp ground is available at site i, otherwise 0
$Crowding_{it}$	-	Crowding: 1 if the ith site is rated as "combat fishing" in week t, otherwise 0 (rated by ADF&G biologists)
$Sewdby_{it}$	+	Sewdby: 1 for Resurrection Bay in week 17 (Silver Salmon Derby) otherwise 0

All harvest and quality data from the 1992 ADF&G statewide sport harvest survey

Participation Equation

The participation equation estimates anglers' decisions about when and how often to go fishing. It requires a different set of explanatory variables than the site choice equation. The most important variable is an index of overall fishing quality available to the angling household that week or month called the "inclusive value". This index is calculated for each household each week from the site choice equation. The equation is evaluated for each of the 30 sites, and the values combined as shown in the formula below. The inclusive value for angler *j* in week *t* is:

$$inclu_{jt} = \log\left(\sum_{i=1}^{30} e^{X_{ijt}\beta} \right)$$

$X_{ijt\beta}$ is the linear combination of the site choice equation coefficients and the values of the variables for that household, site and week. So all of the variables in the site choice equation — including trip cost, travel time, the availability and abundance of several fish species — are reflected in the inclusive value. Other site and household characteristics, including bag limits, site amenities, weather and angler skill, which don't appear directly in the site choice equation, are still reflected in the inclusive value because they are used to calculate on-site time, which is one variable in the site choice equation.

Other explanatory variables in the participation equation include weather—measured by temperature, wind, and precipitation for week *t*—and personal characteristics of the anglers such as income, number of anglers in a household, the amount of money an angler could have earned by working instead of fishing, and the angler's level of fishing skill.

As we noted earlier, we divided our sample of anglers into two groups—frequent anglers and infrequent anglers. We classified as frequent anglers those who in pre-season interviews said they expected to take six or more fishing trips during the summer of 1993. Infrequent anglers were those who said they expected to take fewer than six fishing trips. We used a weekly time interval for analyzing the participation decisions of frequent anglers, and a monthly time interval for analyzing the participation of infrequent anglers. For the frequent anglers we modeled three choices about the number of weekly trips—zero; one; or two or more trips. For the infrequent angler we modeled two choices about monthly trips—zero; or one or more trips. A detailed description of our methodology appears in Appendix A.

The Frequent Anglers' Weekly Participation Equation

The frequent anglers' weekly participation equation estimates the probabilities that a frequent angler will make zero, one, or two or more trips in week *t*. Again, modeling a discrete choice such as this requires a complex, nonlinear functional form which we discuss in detail in Appendix A. The equation was estimated on 5,716 household weeks. The variables we found to significantly predict anglers' participation decisions are listed in Table VI-3.

Table VI-3. Variables Appearing in Frequent Anglers' Participation Equation

Variable	Coefficient Sign One Trip	Coefficient Sign More Than One	Definition
$Incs_t$	+	+	Inclusive value that represents overall fishing quality index in week t (constructed from the site-choice equation)
Boat		+	Boat=1 if an angler owns a boat, otherwise Boat=0
Skill	+	+	Skill=1 if an angler is experienced angler, otherwise Skill=0
Many	+	+	Many=1 if the number of anglers in a household exceeds 2, otherwise Many=0
Avgearn		-	the amount of money that an angler could have earned if he did not take a fishing trip, averaged over all reported trips that season
Avgreasn	+	+	the percentage by which fishing activities explain the purpose of a trip, averaged over all trips a household reported that season
Tg40_1t	+	+	the number of days in week t that the mid-range temperature exceeded 40°F
$Anctemp_t$	+	+	the average temperature in Anchorage in week t
$Wind20_t$	-	-	the number of days in week t that average wind speed exceeded 20 knots
Winter	+	+	Winter=1 if an angler took one or more fishing trips during the winter, otherwise Winter=0
Trips92		+	the number of fishing trips taken by the angler in 1992
Pg10_1	-	-	number of days during the study week that precipitation exceeded 0.1 inches

The most important variables in predicting participation for frequent anglers are the temperature variables (*Tg40_1t* and *Anctemp*). The model shows—as we would expect—that frequent anglers are more likely to go fishing in warmer weather. Precipitation *(Pg10_1)* and high winds *(Wind20)* discourage fishing. Overall fishing quality in week *t* is also important. An angler is more likely to make a fishing trip or several trips when the quality index *($Incs_t$)* is high. On average, anglers for whom fishing is the primary purpose of their trips *(Avgreasn)* are more likely to participate in any given week than anglers who made the trip for some other reason but who also went fishing. And on average, anglers who could have worked instead of fishing *(Avgearn)* are less likely to make one or more trips than anglers who didn't have the option of working.

Other variables that affect the decision to go fishing in any given week include personal characteristics and past fishing activity. Not surprisingly, anglers who own boats make more trips than ones without boats *(Boat)*. Anglers with more fishing skill make more trips than unskilled anglers *(Skill)*. The more anglers in a household, the more fishing trips the household makes *(Many)*. The model shows that an angler is more likely to go fishing in week *t* if he took one or more trips in the winter *(Winter)*. And the more fishing trips an angler made in 1992 *(Trips92)*, then the more likely the angler is to make one or more trips in week *t* in 1993.

The model estimates probabilities for the two fishing alternatives—one trip or more than one trip: the probability for zero trips is the residual. We therefore estimated two separate and somewhat different sets of coefficients. For example, three of the variables that are significant predictors for taking more than one trip in a week are insignificant for taking exactly one trip. Boat ownership *(Boat)* makes an angler more likely to fish more than once a week, but makes no difference on the decision to participate just once. Anglers with paid work as an alternative to their trip *(Avgearn)* are not discouraged from fishing once, but are significantly less likely to fish two or more times in a week. The number of fishing trips taken in 1992 helps predict the probability of taking multiple trips in week *t* in 1993, but has no apparent impact on the decision to take one trip in week *t*. The inclusive value *($Incs_t$)* is a significant predictor for multiple trips during the week, but for just one trip per week it is not as strong a predictor.

The Infrequent Anglers' Monthly Participation Equation

The infrequent anglers' monthly participation equation estimates the probability that an angler who fishes infrequently will make zero or one or more trips in month *k*. The form of the equation we estimate is discussed in Appendix A. The equation was estimated on 2,078 household weeks. The variables that predict how often an infrequent angler will go fishing differ from those that predict how often a frequent angler will go fishing. The fishing quality index *($Incs_k$)*, boat ownership *(Boat)*, fishing skill *(Skill)*, and the average temperature *($Anctemp_k$)* are still important predictors, but the other weather and fishing history variables, angler earnings, and reasons for the trip do not seem predict fishing trips for households that make only a few trips all season. Two new variables are significant: camper ownership *(Camper)* and the number of daylight hours *($Daylight_k$)*. The variables for the infrequent anglers' equation are described in Table VI-4.

Like frequent anglers, infrequent anglers are influenced by weather. The average temperature *($Anctemp_k$)* and the average length of a day *($Daylight_k$)* are quite important in explaining the infrequent angler's decision to go fishing. The model shows that infrequent anglers fish more often when the temperature is high and the daylight is long. An infrequent angler is more likely to make a fishing trip when the overall fishing quality is good. The regression results indicate that anglers who own boats *(Boat)* or campers *(Camper)* make more trips than anglers without boats or campers. Anglers with higher levels of fishing skills *(Skill)* make more trips than anglers with lower levels of fishing skills. The more anglers in a household *(Many),* the more fishing trips the household makes.

Table VI-4. Variables Appearing in the Infrequent Anglers' Participation Equation

Variable	Coefficient Sign	Definition
$Incs_k$	+	Inclusive value that represents overall fishing quality index in month k
Boat	+	Boat=1 if an angler owns a boat, otherwise Boat=0
Skill	+	Skill=1 if an angler is experienced angler, otherwise Skill=0
Many	+	Many=1 if the number of anglers in a household exceeds 2, otherwise Many=0
Camper	+	Camper=1 if an angler owns a camper, otherwise Camper=0
$Anctemp_k$	+	the average temperature in Anchorage in month k
$Daylight_k$	+	the average length of daylight in month k

Modeling Changes in Net Economic Value

Once we had estimated site choice and participation equations for the travel cost analysis, we could estimate willingness to pay. Consider the demand curve from Figure VI-1. The demand curve represents the number of fishing trips as a function of their cost. The area *abcd* represents the change in net economic value to anglers. For straight line demand curves, the area would be the area of the triangle adP_0 minus the area of the triangle bcP_0, or algebraically:

$$\Delta NEV = \frac{N2(d - P_0) - N1(c - P_0)}{2}$$

For more complex functional forms, as in our travel cost model, the area is:

$$\Delta NEV = \int_{P0}^{\infty} D^*(p)dp - \int_{P0}^{\infty} D(p)dp.$$

We used the formula below, developed by Jones and Stokes in 1991 for their model, which used the same choice structure, to evaluate this integral: (Jones and Stokes, 1991, p. 5-33).

$$\Delta NEV_i = \frac{x^* I^* - xI}{\beta}$$

where x and I represent the estimated number of fishing trips and the inclusive value, respectively, before the change, x^* and I^* represent the same quantities, after the change, and β represents minus one times the coefficient on trip cost in the site choice equation. This may be understood by considering that the β measures the marginal utility of money, that is, how anglers balance the money they have to spend on another trip against the benefits of taking the trip. Those benefits are modeled by the other variables in the site choice equation. The inclusive value is an index of the overall fishing quality available in a given week. When we divide that value by the minus one times the cost coefficient (the coefficient is negative because costs subtract from the value), we are calculating how high the trip cost would have to be to completely balance all the benefits of fishing available that week. That amount is the maximum an angler would be willing to pay for a fishing trip—hence, willingness to pay. Since the amount anglers actually paid for their trips was included in calculating the inclusive value, the willingness to pay is a net amount: how much they would be willing to pay to fish, above what they actually do pay.

The equations of the travel cost model were estimated on microdata: each household was kept as a separate record in the database. This approach was not feasible for modeling the various scenarios, so we constructed a spreadsheet version of the model which incorporated the expenditure, site choice and participation equations, but used mean rather than individual household data. We grouped households into 7 origins and two types: frequent and infrequent anglers. Our model evaluated participation, site choice, and willingness to pay based on the "typical angling household" in each of these 14 groups. We calculated the relevant household characteristics (those that are variables in one of our model equations) for each group as the weighted mean of households in that group. The weight was the product of the household weight (from the survey) and the number of fishing trips each household took in 1993.

The core of the spreadsheet model is a worksheet that:

- evaluates the probability of choosing each site, given that a fishing trip will take place
- estimates the inclusive value (an index of fishing quality),
- calculates per trip expenditures across 30 sites
- evaluates the participation equations (for both frequent and infrequent anglers) to estimate the probability of taking one or more trips, based on the inclusive value and other participation variables
- estimates an index of willingness to pay per household per week for frequent and infrequent anglers, based on inclusive value and the probability of taking a trip
- multiplies the estimated probabilities of taking a trip and the index of willingness to pay by the number of frequent and infrequent fishing households to estimate total trips and trips to sites, based on site-choice probabilities
- estimates total expenditures, based on number of trips to each site and modeled per trip expenditures

Among the variables that appear in the site choice and participation equations, only a few change in our scenarios and fewer still strongly contribute to the change in the economic value of the sockeye fishery. By far the most important is the sonar count in the Kenai River *(Ksonar),* which is our best measure of change in fishing quality. A higher (or lower) fish count at the sonar contributes three quarters of the change in net economic value modeled in our scenarios. Other variables that also significantly contribute to the change in economic value are total sockeye catch *(Sockeye);* the sockeye catch per angler day *(Sockdf);* and the king salmon catch per angler day *(Kingdf).*

Another potentially important variable is crowding *(Crowding).* We believe that more crowding on the Kenai River would discourage anglers from making some trips, but our measure of crowding variable was not precise enough to quantify changes in our scenarios. [4] We also considered the fishing report for Kings *(Kingrept),* but again found the variable not precise enough to predict change.

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[4] Our measure of crowding is simply a yes or no indicator. We asked ADF&G biologists to identify sites and times when conditions are crowded. The Kenai River sites were already crowded during the weeks when fishing would change in our scenarios.

The bag limits for sport and dipnet sockeye harvests vary in our scenarios, but we could model this change only indirectly—through higher harvests—because the sockeye bag limit wasn't a significant variable in the site choice or participation equations. A change in the bag limit could increase or decrease trips—it might make fishing more attractive and increase trips, or it might allow anglers to harvest all they want in one day, so they would fish fewer days.

Because the sonar count variable is responsible for most of the predicted change in net economic value, we tested the sensitivity of our results to variations in the sonar count coefficient. The coefficient on any given variable is a measure of how much that variable contributes to the change in economic value. Using the estimated most likely value for the coefficient on the sonar count variable and its standard error, we generated a 90 percent confidence interval for the sonar count coefficient. We ran the model using the upper and lower bounds of the confidence interval in place of our estimated coefficient. Sensitivity testing using the lower and upper bounds on this crucial coefficient produced high and low estimates of changes in economic value. This analysis suggests that the net value could be as much as 68 percent higher or 43 percent lower than the most likely value.

For all our scenarios we used ADF&G's assumptions (as detailed in Chapter IV) about changes in the Kenai River sonar count and the sport harvest of kings and sockeye. The base year for the model and most of the scenarios was 1993—a mid-run year. For the low run scenarios (Scenarios A3 and A5), we simulated a low-run sonar count and harvest; we scaled the 1993 weekly sonar count down to the 1991 total and used the 1991 sockeye harvest as our base. We did not model Scenario A4 (high run)—we adopted ADF&G's conclusion that in a high run year the number of sockeye in the river would exceed the existing management target by more than 200,000 fish, without any management change.

Travel Cost Results

Table VI-5 reports the estimates from our travel cost model for each scenario. For Scenario A, the results are summarized as follows:

- *If managers allowed 200,000 more sockeye into the Kenai River, net economic value of the sport fishery would most likely increase a total of about $1.3 million.* This is the increase in resident anglers' net willingness to pay for the benefits of the sport fishery. Remember that "net willingness to pay" is the additional amount anglers would be willing to pay, over and above what they now spend, for sport fishing.

- *But our ability to measure net economic value is not very precise.* Our ninety percent confidence range for one variable alone—the coefficient on the sonar count—yields a range of estimated net economic values for this scenario from $.8 million to $2.3 million.

- *Net economic value per fishing household in Southcentral Alaska might increase about $22.* This is the total change in net value, divided by the nearly 61,000 Southcentral households with sport anglers in 1993. (The range estimated from the confidence interval on the sonar count is about $13 to $37.)

- *Net economic value per fish might increase about $7.* This calculation assumes 200,000 additional sockeye in the river, divided by the total change in net value. (The range estimated from the confidence interval on the sonar count is about $4-$11.)

- *Southcentral anglers would make 4,045 additional trips to Kenai River sites during July—but 3,399 fewer trips to other Alaska fishing sites—if managers allowed 200,000 more sockeye into the Kenai River.* So the *net increase* in trips by Southcentral residents would be only 646

(Table VI-5, Scenario A). In other words, about 80 percent of the increase in resident trips to Kenai River sites would be offset by reductions in trips to other Alaska fishing sites.

- *Southcentral fishing households would pay less than $2 in increased expenditures for the $22 increase in value.* Much of the increase in value would occur because Southcentral households would be taking more trips to Kenai sites and fewer trips to other fishing sites. On average, trips to Kenai sites cost less (about $105), compared with trips to other sites (about $155).

Table VI-5. Results of Travel Cost Analysis by Scenario

	Scenario Name and Code					
	+200K	Increased sport bag	Liberalized dip net	+100K	-100K	Low run
	A	B	C	D	E	A3
Change in Net Economic Value						
Total Change with sonar coeff.at upper 5%	$2,262,791	$2,327,911	$1,751,620	$975,617	$(729,516)	$1,899,714
Most Likely Value (MLV)	$1,345,291	$1,408,119	$1,111,499	$606,065	$(492,636)	$1,142,268
with sonar coeff.at lower 5%	$770,991	$829,626	$699,034	$360,660	$(314,034)	$657,698
Change per Household (MLV)	$22.17	$23.31	$18.32	$9.99	$(8.12)	$18.83
Change per Fish (MLV)	$6.73	$7.04	$5.56	$6.06	$(4.93)	$5.71
Change in Expenditures	$1.79	$1.91	$1.58	$0.79	$(0.63)	$1.44
Change in Trips						
Net Change	646	677	535	292	(238)	551
Change in Trips to Kenai/Russian Rivers	4,045	4,235	3,379	1,856	(1,549)	3,512
Change in Trips to Other Sites	-3,399	-3,558	-2,844	-1,564	1,311	-2,962

For scenarios other than Scenario A, the change in net value would vary somewhat. Scenario B assumes not only an increase of 200,000 sockeye in the river but also an increase in the bag limit from 3 to 6. Using the most likely measure, the value of this bag limit change is an additional $63,000 over Scenario A. But because the bag limit change is modeled only indirectly, this is likely to be an underestimate of how much sport anglers would value the larger bag limit.

Scenario C increases the dipnet bag limits as well, increasing the dipnet harvest by 50,000 fish. Because the dipnet harvest is largely at the mouth of the river, this harvest reduces the number of sockeye available to sport anglers and the number past the sonar. While the results in Table VI-5 suggest that sport anglers may lose more value than dipnetters gain, we believe our model probably does not accurately value this increase in the dipnet harvest—primarily because our survey sample of dipnetters was small[5]. However, we also have information about dipnet value from our contingent value analysis (discussed in the next section), which may provide more accurate estimates of how residents would value changes in the dipnet fishery.

The impact of an additional 200,000 past the sonar in a low run year (Scenario A3) would be less than the same change in a mid-run year (Scenario A). In a low-run year, fishing is poor and anglers put a lower value on fishing the Kenai. Starting from a lower base—sonar count, trips, expenditures, WTP and everything—adding 200,000 fish would have a smaller impact than it would starting from a higher base.

[5]See Table A-3 in the Appendix for a breakdown of trips by site.

Scenarios A1, A2, and A5 are not shown. We assumed that changes in the price of commercially caught salmon would have no effect on the sport fishery, so the results for Scenarios A1 and A2 (high and low price) are identical to Scenario A; results for A5 (low run-low price) are identical to A3 (low run).

Our model does not project changes over time. Yet a potential increase in angling households is unlikely to have much effect on these results. Based on growth rates in recent years, we estimate that the number of resident angling households might grow 5 percent in the foreseeable future. If we roughly estimate the increase in total willingness to pay as proportional to the increase in the number of households, a five percent increase in angler households would result in a five percent increase in willingness to pay. This may be generous, since as the number of anglers increased, their willingness to pay could drop if fishing quality declined. Either way, this increase is not large enough to make a significant difference in the model results.

Limits of Travel Cost Estimates

The main strength of the travel cost method is that it is based on behavior: on what people actually do, rather than on what they say they might do, in some hypothetical circumstance. It measures the value of anglers' time as well as their out-of-pocket expenses. It implicitly takes into account what people are actually able to pay for sport fishing.

Our travel estimates are not precise. One of these, the Kenai River sonar count, is the basic measure of the management changes we're examining. The importance of the sonar count in explaining where people fish is measured by the coefficient on the variable. If we look at a reasonable range of coefficients for the Kenai river sonar variable, the estimated change in willingness to pay ranges anywhere from 60 percent to 170 percent of the value we report as most likely. So while we believe our results are of the correct magnitude, they are not precise: if managers put 200,000 more sockeye in the Kenai River, the increase in net economic value of the sport fishery could be anywhere from $800,000 to $2.3 million, but is most likely around $1.3 million (Table VI-5).

Another limit of the model is the way it measures the effects of crowding. If allowing more sockeye into the river increased crowding, there might be a corresponding reduction in value for sport anglers. But as we explained earlier, data on crowding is so imprecise that we can not quantify changes in sites that are already crowded.

The travel cost model relies on statistical association between the pattern of fishing trips and variations in fishing quality and trip costs to predict how anglers might respond to management changes. If the proposed management change would affect a factor that varied across sites, or over the season, in 1993—the year for which we had data—then the travel cost model can provide good estimates of its effects. The Kenai River sonar count is such a variable. But if the proposed management change would affect a factor that did not vary much in 1993, then the model may not provide a good estimate.

The model may not provide a good estimate of anglers' willingness to pay for increases in the bag limits for sport and dipnet harvests (Scenarios B and C). No bag limit variable directly appears in the site choice equation. The variable was tried, but was not significant in association with fishing behavior. The sport bag limit in 1993 was set at two fish per day for most of the season, only to be increased after most sport fishing had already occurred. Only the indirect effects of the assumed increase in harvest and catch per unit effort appear in the model. Also, few dipnetters were in our survey sample—so there is a great deal of uncertainty about our model estimates of the effects of increasing the dipnet harvest.

Finally, some households that don't fish right now might decide to go fishing because of the extra fish in the Kenai River. Our model doesn't include those households—because the travel cost model is estimated with data from households that actually fish.

Contingent Value Method

A second method we used to measure changes in net economic value is called contingent valuation. This is another way of estimating the value of non-market goods; under this method, researchers directly ask potential consumers what they would be willing to pay for a specific good under a hypothetical payment mechanism. In this study we asked resident anglers whether or not they would be willing to pay certain dollar amounts to hypothetically increase the Kenai River sockeye bag limit or increase fish runs so as to reduce the average time it takes to catch fish. We also asked respondents who indicated an interest in dipnetting whether they would pay to dipnet earlier or to increase dipnet bag limit.

Contingent valuation (CV) remains controversial in the economics profession. (See Portnoy 1994; Diamond and Hausman, 1994; Hanemann, 1994; Mitchell and Carson, 1991) Detractors argue that the hypothetical valuation of a non-market good is often meaningless because respondents do not have developed preferences for such goods that can be measured in dollars; they cite extensive literature showing the theoretical and empirical inconsistencies of CV results. Defenders assert that properly done, CV studies can provide meaningful measures of value and cite equally extensive research indicating that CV results are sensible and compare well with other measures of value. Either way, it is undeniable that contingent valuation is being used extensively by public and private agencies throughout the world.

Some of the criticisms of contingent valuation have been addressed through refinements in the methodology. The dichotomous-choice methodology we use is state of the art. Another strength of our CV study is that the goods and payment mechanisms we asked about—improved catch rates, higher bag limits, earlier openings, fish stamps and permits—were familiar to the respondents. Yet potential sources of bias remain. For example, travel cost models of recreational demand generally yield higher estimates of WTP than do CV studies. There is no general agreement as to which is the "correct" measure. For some other kinds of goods, CV studies have generated higher estimates of WTP than experimental markets where the participants actually pay to receive the benefit. CV results have also been shown to be sensitive to the wording or context of the questions, and insensitive to the quantity of the good. Our study results fit these patterns.

Data Collection

We collected data for the sport fish contingent value assessment in a January 1995 telephone survey of 650 Southcentral Alaska households. The survey included questions about household characteristics and fishing activities in 1994 and earlier years. The sample frame consisted of two separate subsamples: a random sample of 490 households, and a panel sample of 160 households. The panel households comprised part of a random sample of Alaska households originally interviewed in 1993. Appendix E describes the sample frame and survey methods in detail.

We asked the CV questions only of those respondents who said their households had fished the Kenai River for sockeye salmon during the three prior years, or would in the future if fishing improved. Consequently, the values we estimate do not include existence or option values for households unlikely to use the resource, but do include the value of the option to fish for those households that had not fished in the past but said they might in the future. This is particularly important for the dipnet fishery[6]. About three times as many respondents said they might consider participating in the dipnet fishery under an expanded Kenai River fishery as actually had participated in the three years we asked about.

Each survey household had the opportunity to respond to three specific scenarios. Two pertained to sport fishing for sockeye with rod and reel, and one pertained to dipnet fishing. The two sport fish questions asked about a higher bag limit and a higher inriver return that would reduce the average time it takes to catch fish. Respondents were then asked whether they had recently participated in the Kenai River dipnet fishery or might be interested if state managers expanded the fishery. Those who had, or who said they were interested were asked whether they preferred an earlier season opening or an increased bag limit as the best way to expand the fishery. Then respondents were asked a question pertaining either to a change in the dipnet bag limit or a longer fishing season.

We used a two-stage dichotomous-choice valuation framework for the four contingent value questions we asked sport anglers. We first asked respondents whether they would be willing to pay a randomly chosen amount—called the bid value—for the harvest change. If respondents answered yes, interviewers then asked if respondents would agree to a higher bid. If anglers answered no to the first question, interviewers asked if respondents would agree to a lower bid. The random bids ranged from $1 to $50. Table VI-6 lists the contingent value survey questions

Table VI-6. Contingent Value Survey Questions

1. *Sport fish higher bag limit.* "The Department of Fish and Game could raise the bag limit if managers could watch the run more closely. Anglers could pay for this extra work through a fish stamp. Those who wanted to keep 6 fish per day instead of 3 would buy the stamp, and the money would go to the Department of Fish and Game. Would your household pay $[random bid] for a fish stamp to increase your bag limit from 3 to 6 ?"
2. *Sport fish higher catch rates.* Anglers were asked one of two variations on the question:
   a. "One way the Department of Fish and Game could put more fish in the river would be to buy out some commercial permits, and reduce the commercial allocation. Sport anglers could pay to buy out commercial permits if they had to buy a fish stamp to fish for Kenai red salmon. Would your household pay $[random bid] for a fish stamp if there were [100,000 or 200,000] more red salmon in the Kenai River?"
   b. "One way the Department of Fish and Game could put more fish in the river would be to increase run size by improving salmon habitat. Anglers could pay for these improvements if they had to buy a stamp to fish for Kenai red salmon. Would your household pay $[random bid] if there were [100,000 or 200,000] more red salmon in the Kenai River?"
3. *Dipnet earlier season.* "Suppose anglers who wanted to dipnet the earlier opening had to buy an early season permit. Would your household pay $[random bid] for a permit?"
4. *Dipnet higher bag limit.* "Suppose dipnetters who wanted to keep 12 fish per day instead of 6 had to buy a permit. Would your household pay $[random bid] for a permit?"

For full text of survey instrument, see Appendix F.

[6]We did not distinguish between personal use and subsistence dipnetting in our surveys, although we did ask respondents how much of their dipnet harvest was under subsistence regulations.

Contingent Value Analysis

Tables VI-7 through VI-10 describe the variables we found that significantly predict willingness to pay for each of the four questions. Statistical details on how we used the survey responses to calculate willingness to pay are provided in Appendix B.

The estimated willingness to pay for the higher sport bag limit differs, depending on whether the respondent household had fished the Kenai River area during the three previous years (1992-1994) and on how long the household had been in Alaska.

Among all households that had fished in the study area within the past three years (*Fished*), the estimated willingness to pay for a bag limit increase of 3 sockeye was $7.80. However, we observed that willingness to pay among fishing households declined about 1.8 percent for each year they had lived in Alaska (*Fresyear*). Among households that had fished and also owned boats or nearby cabins used for fishing (*Fboatcabin*), respondents were willing to pay 51 percent more, and those households where the respondent was over 45 (*Fsenior)* were willing to pay 50 percent more.

Among households that had not fished in the study area (*Notfished*), estimated willingness to pay for the increased bag limit was $4.60. Among households that did not fish the study area, willingness to pay increased 2.9 percent for each year lived in Alaska (*Nfresyear*).

Table VI-7. Variables Predicting Willingness to Pay for Increased Sport Bag Limit

Variable	Sign	Definition
Fished	+	1 if household went fishing in the Kenai River area at least once within the last three years, 0 otherwise
Notfished	+	1—Fished
Fresyear	-	Number of years respondent lived in Alaska times Fished
Nfresyear	+	Number of years respondent lived in Alaska times Notfished
Fboatcabin	+	1 if household owns either a boat or a cabin used for fishing and Fished, 0 otherwise
Fsenior	+	Senior and Fished

Differences among fishing and non-fishing households in estimated willingness to pay for a higher inriver return of sockeye were less pronounced. Households that had fished the Kenai River area during 1992-1994 were willing to pay $8.68 for a higher inriver return, while those who had not fished were willing to pay $7.70. For each additional angler in both kinds of households, willingness to pay went up 7.7 percent. Among households that had fished, respondents over 45 were willing to pay 43 percent more. In addition, households that reported they did not get enough fish because it took too long to catch them were also willing to pay 23 percent more.[7]

In the question about a higher inriver return, respondents were randomly given several quantitative measures associated with the change. Respondents were told the potential change in the return—either 100,000 or 200,000 more sockeye at the sonar counter—and the percentage reduction in average time it would take to catch a sockeye. Respondents were also told to expect a

[7]Only those who had fished could report not catching enough fish because the fishing was too slow. The t statistic for the coefficient on fishlong in Table VI-8 is only 1.1. We include it in the equation, however, because it was positive and significant in the bid function estimated from the first-stage question, using Cameron and James' (1987) method.

randomly varying percentage increase in number of anglers as a result of better fishing. None of these variables turned out to have a significant effect on willingness to pay.

The results suggest that anglers are willing to pay more for higher sockeye catch rates than they are for increased bag limits. If some anglers rarely catch their limit, then it makes sense that they would not be willing to pay much to increase the limit.

Table VI-8. Variables Predicting Willingness to Pay for Higher Inriver Return

Variable	Sign	Definition
Fished	+	1 if household went fishing in the Kenai River area at least once within the last three years, 0 otherwise
Notfished	+	1—Fished
Nanglers	+	Number of anglers in the household
Fsenior	+	Senior times Fished
Fishlong	+	1 if household reported not getting enough fish because it took too long to catch a fish, 0 otherwise

Table VI-9 describes the variables that explain willingness to pay among respondents who preferred an earlier dipnet season to a higher dipnet bag limit. Respondents aged 45 or younger said their households were willing to pay an average of $9.34 for an earlier opening. Respondents who were over 45 indicated that their households would be willing to pay $16.41. Households that indicated lack of fishing time prevented them from catching enough fish were willing to pay about one-third more than other households.

Table VI-9. Variables Predicting Willingness to pay for Earlier Dipnet Season

Variable	Sign	Definition
Constant	+	1
Senior	+	1 if age of respondent exceeded 45 years, 0 otherwise
Notime	+	1 if household reported not getting enough fish because of inadequate time to go fishing, 0 otherwise

Table VI-10 describes the variables that predict willingness to pay among dipnetters who preferred a higher bag limit to an earlier season. Apparently, large households have a greater interest in higher dipnet bag limits. Households that preferred the higher bag limit would pay $11.67, plus 8.6 percent for each household member, unless they felt that a short dipnet season prevented them from getting enough fish. Households that reported not getting enough fish because the fishery was not open enough days, but who still preferred a higher bag limit, would pay less than half as much as other households of the same size.

Table VI-10. Variables Predicting Willingness to pay for Increased Dipnet Bag Limit

Variable	Sign	Definition
Constant	+	1
Npeople	+	Number of people in the household
Fishdays	-	1 if household reported not getting enough fish because the fishery was not open enough days, 0 otherwise

Half the survey respondents were told that the money they paid for expanded sport fishing opportunities would be used to buy back limited entry permits to reduce the commercial harvest. The remainder were told that the money would be applied to acquisition of habitat. How the money would be used showed no significant relationship to respondents' willingness to pay in any of the contingent value questions.

Contingent Value Estimates of Net Economic Value

We did not ask survey respondents who did not fish for Kenai River sockeye and showed no interest in fishing for sockeye in the future whether they would pay more for a higher bag limit or higher catch rates. Nor did we ask the people who said they would not fish, or did not know if they would fish, for Kenai sockeye even with higher catch rates. To estimate aggregate values, we assume these households had a zero value for these questions. We only asked the dipnet questions of respondents who expressed an interest in dipnetting and assume contingent values are positive only for this group.

The total value estimate is the product of the number of households and the estimated willingness to pay per household. Table VI-11 shows the estimated total values for the four contingent value questions. Total values range from $167,000 for an dipnet earlier season to $565,000 for an improved sockeye catch rate. Each of these values is for a separate potential change in management of the Kenai River sockeye fisheries, so it is not appropriate to add them.

Table VI-11. Contingent Value Estimates of Changes in Net Values for Improved Sport and Dip Net Fishing

	WTP per household	Number of households	Total value
Higher sockeye sport bag limit	$7.41	62,826	$465,855
Increased sockeye sport catch rate	$10.37	54,505	$565,287
Earlier dipnet season opening	$11.14	14,956	$166,586
Higher dipnet bag limit	$14.80	17,833	$263,868

We calculated confidence intervals for our contingent value estimates. Table VI-12 shows the lower 5 percent and upper 5 percent per household values for estimated willingness to pay for each of the four questions. For example, if we were to repeatedly re-estimate willingness to pay using the same methods but with fresh data, we estimate that the value per household of the higher sockeye bag limit would lie between $6.47 and $8.49 ninety percent of the time.

Table VI-12. 90 Percent Confidence Intervals for Contingent Value Estimates of Changes in Sport Fishing Net Value per Household

	Lower 5 percent	Most Likely	Upper 5 percent
Higher sockeye sport bag limit	$6.47	$7.41	$8.49
Increased sockeye sport catch rate	$9.08	$10.37	$11.85
Earlier dipnet season opening	$9.84	$11.14	$12.60
Higher dipnet bag limit	$12.86	$14.80	$17.02

The corresponding confidence intervals for the total value of the four hypothetical changes in management are shown in Table VI-13. The confidence intervals suggest a margin of error of 10 and 20 percent for the various contingent value estimates.[8]

Table VI-13. 90 Percent Confidence Intervals for Contingent Value Estimates of Changes in Sport Fishing Net Value

	Lower 5 percent	Most Likely	Upper 5 percent
Higher sockeye sport bag limit	$407,000	$466,000	$534,000
Increased sockeye sport catch rate	$495,000	$565,000	$646,000
Earlier dipnet season opening	$147,000	$167,000	$189,000
Higher dipnet bag limit	$229,000	$264,000	$304,000

Application of Estimates to Scenarios

Unfortunately, the time constraints for the study required us to complete survey field work before the study scenarios had been finalized. Therefore the valuation questions do not apply as directly to the scenarios as we would have liked. Nevertheless, the answers do provide valuable information about the net values of increasing opportunities in the sport and dipnet fisheries. The sport fish catch rate question applies equally to the nine scenarios with increased sport harvests. The sport fish bag limit question applies only to Scenario B, and it does not include the effects of the sonar increase. The dipnet results apply only to Scenario C (the other scenarios assume no change in dipnet harvest) and they do not include the effects of the sonar increase and the sport bag limit increase that are also assumed in Scenario C.

Each of the estimates is for a separate potential change in management of the Kenai River sockeye fisheries, so it is not appropriate to add them. We cannot estimate Scenario B, for example, by adding the willingness to pay for a change in bag limit to willingness to pay for an increased sport catch rate. We can't add them together because we don't know if the survey respondents' willingness to pay for a higher bag limit would go up or go down if the inriver return also increased. It could go up because anglers would be more likely to catch their limit when there are more fish in the river. However, it could also go down, if anglers would respond to more fish in the river by going fishing more often—in which case they might be able to get enough fish without an increase in the bag limit.

We asked the two dipnet contingent value questions to separate groups of survey respondents. The number of households shown in Table VI-11 indicates the population represented by these survey households. Although these two portions of the population do not overlap, it would not be appropriate the two dipnet contingent values together to produce an overall value for a liberalized dipnet fishery. The values refer to the portion of the population that prefers this option. State fishery managers must choose one or the other option. Our results suggest that more households prefer an increased dipnet bag limit. The majority that prefers this option also values it more highly than those who prefer the longer season.

Since we know that those who answered the earlier opening question preferred an earlier opening, their WTP for an earlier opening is an upper bound for their WTP for the increased bag limit. The lower limit estimate is of course zero. We can construct upper and lower bound estimates for the

[8]The numbers in Table VI-13 assume that the population of anglers represented by the survey is precisely known. In fact, this is not the case; we must estimate the proportion of the population that is interested in Kenai River fishing options from our sport fish surveys. The survey sampling error introduces an approximately 3 percent additional margin of error that is not included in the table.

liberalized dipnet fishery by adding zero at the low end and adding $167,000 at the high end to the $264,000 estimated WTP for the bag limit change. This of course does not include the value of changes in the sonar count which also enter into Scenario C.

Limits of Contingent Value Estimates

The contingent value estimates of willingness to pay appear to be much more precise than the travel cost estimates: the 90 percent confidence interval ranges no more than 15 percent on either side of the central measure of willingness to pay.

At the same time, the contingent value results are much more limited in their application. This means that we can estimate precisely what amount survey respondents on average *say* they would pay for specific management changes. We do not know that they would actually pay such amounts. In the travel cost model, by comparison, we observe people actually taking fishing trips and spending money—so in that sense the travel cost method is a more reliable method. Also, we cannot rule out the possibility that the answers were influenced by prices for fish stamps in other fisheries, rather than the value of the management change alone.

Contingent valuation estimates willingness to pay for specific, well defined, readily imagined alternatives. Respondents must be able to construct in their minds a concrete image of the alternative they are valuing and relate it to their prior experience before they can provide a realistic estimate of their willingness to pay for it. Values cannot be inferred for alternatives that were not asked.

The sport bag limit question in our survey apparently met these criteria: willingness to pay estimates and the variations across angler characteristics look reasonable. The problem is that we asked about bag limit changes, without the proposed increase in the number of sockeye in the river. So we can't infer that respondents would pay that much for increased bag limits, in addition to what they would pay for more fish in the river. We also don't know whether willingness to pay would change if we had asked about different bag limits; we only asked about a change from three to six.

The willingness to pay for an improved harvest rate and how it varied across angler characteristics also looks reasonable; however, respondents were valuing the *idea* of an improved harvest rate rather than a specific improvement in harvest rate. Respondents who were asked to assume a much better harvest rate were not willing to pay significantly more than those who were asked to assume only a small improvement in harvest rates. So we can't tell whether the results apply more to Scenario A than to E (which assume increases of 200,000 or 100,000 sockeye in the river).

The dipnet contingent value analysis has another problem: selection bias. Each dipnet question was asked only of respondents who preferred that management option. Clearly, those who answered value that option higher than those who did not answer. All we can infer about the valuation of those who did not answer the question is that their willingness to pay is lower than their willingness to pay for the question they did answer. Adding the two estimates together therefore provides an upper bound estimate of willingness to pay for the combined population on either policy option for dipnetting. It provides a lower bound estimate of willingness to pay for the two policy options together. Either value also provides a lower bound estimate of that option implemented by itself.

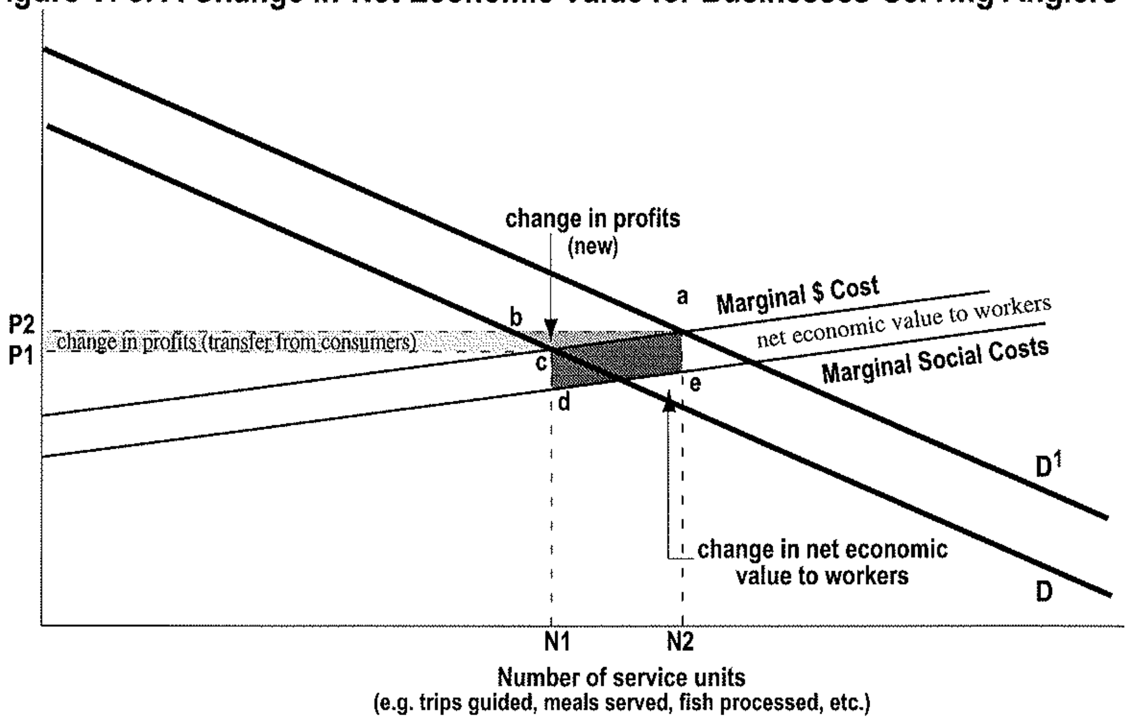
Changes in Net Economic Value for Businesses Serving Anglers

So far we have looked at how a change in management of Kenai River sockeye could change net economic value for sport anglers and dipnetters. We were also asked to assess how a management change could affect net economic value for businesses serving anglers.

Net economic value for businesses consists of all the benefits they receive, minus their costs. The basic measure of net economic value is net profits. In industries where there are also significant non-monetary costs and benefits for businesses, another element of net economic value is job satisfaction.

More fishing trips to the Kenai River could mean greater demand for fish processing, retail purchases of fishing supplies, food and lodging, and other kinds of services to sport anglers. This shift in demand is illustrated in Figure VI-3.

Figure VI-3. A Change in Net Economic Value for Businesses Serving Anglers



The downward-sloping line, D (demand), represents anglers' initial willingness to pay for various fishing services. The upward-sloping line, M$C, represents the marginal cost of providing those services. Marginal dollar cost includes wages, supplies, business services, depreciation on capital goods, interest on capital, and a return to the owners' labor.[9] Low cost firms are on the left of the graph and high cost firms are on the right. As long as an angler's willingness to pay for a service exceeds the market price, the angler will make the purchase. As long as the dollar cost to the business of providing additional services is at or below the revenue it receives, the business will stay open. If the cost per unit of service is actually below the revenue received per unit of service, businesses earn a net profit in excess of the normal returns to the owners' labor and capital, so competing firms will open. New entry and price competition will adjust the supply and the market price for services until the demand for fishing services at that price just covers the costs of the

[9] Job satisfaction might be treated either as an additional benefit of the job or as a factor that reduces the cost of workers' time. Whichever way we treat it does not affect the net value. In Figure VI-3, job satisfaction is shown as a factor that reduces costs to society below the dollar costs of the business.

marginal firm. At the equilibrium price P1, N1 units of service are sold. The triangular area between the price line P1 and the marginal cost curve M$C represents net economic value to angler serving businesses (not counting job satisfaction).

When fishing quality improves, anglers take more fishing trips to the Kenai River and want to buy more fishing services. This increased demand is represented by the line D^1, which has shifted to the right of original demand D. The equilibrium number of trips rises to N2. Note that at N2 the marginal supplier has higher costs to stay in business, so the price must rise to P2.

The change in net economic value (excluding job satisfaction) is represented by the area of the trapezoid *acP1P2*. There are two components to this change: the trapezoid *bcP1P2,* and the triangle *abc.* As the price rises, anglers pay more and the businesses reap the windfall. The trapezoid *bcP1P2* is merely a transfer from existing anglers to existing businesses; it represents no net change. The triangle *abc* is the portion that is new.

There is also potentially another element to net economic value to businesses: job satisfaction. If there are non-monetary costs or benefits to guiding or other kinds of businesses serving anglers—relative to work in other sectors—and these non-monetary differentials are not fully offset by differences in the monetary compensation, then these non-monetary costs or benefits must be accounted for. Job satisfaction is usually represented as an adjustment to the marginal cost curve. While the monetary costs of guiding may be M$C, counting the enjoyment of the work itself lowers the net cost as perceived by the worker to the marginal social cost curve, MSC. Using the MSC curve to estimate the change in economic value adds the trapezoid *acde.*

This is a conceptual introduction to the potential changes in net economic value for businesses serving anglers, if there were more sockeye in the Kenai River. In the next section we argue that the potential is not realized; from an aggregate perspective of all Alaska businesses, the change in net profits and the change in job satisfaction are likely to be negligible.

Change in Net Economic Value for Guides

Requirements for Sport Fishing Guides

Since 1984, the Kenai River has been part of a special management area within the Alaska state park system. Anyone who wants to become a sport fishing guide on the river has to get a permit from the Alaska Division of Parks and must register with the Alaska Department of Fish and Game. For certain parts of the river, guides are also required to get permits from the U.S. Forest Service or the U.S. Fish and Wildlife Service, but this is generally not necessary on the most heavily fished areas, below Skilak Lake.

The division doesn't limit the number of permits it issues. To get a permit, applicants must pay a fee of either $500 (for residents) or $1,400 (for non-residents) and have liability insurance; first aid training; a state business license; a sales tax account from the Kenai Peninsula Borough; licenses from the Commercial Fisheries Entry Commission and the U.S. Coast Guard; and a sport fishing license from the Alaska Department of Fish and Game.

The Division of Parks reports that numbers of fishing guides vary considerably with the strength of the salmon runs—especially king salmon runs. Table VI-14 shows the numbers of guides since 1990. Numbers in the 1990s have varied from a low of 222 in 1993 to a high of 314 in 1995.

Table VI-14. Numbers of Sport Fishing Guides on the Kenai River, 1990-1995

1990	310
1991	290
1992	238
1993	222
1994	257
1995	314

Source: Alaska Division of Parks

Special Use Permits from the Fish and Wildlife Service

Guides who put in or land on the Kenai National Wildlife Refuge—primarily on the upper Kenai from the confluence of the Kenai and Russian rivers to Skilak Lake—also have to get a permit from the U.S. Fish and Wildlife Service. Refuge managers restrict the number of special use permits to 20. Those permits allow guides 10 trips per week; guides who don't have special use permits can apply for incidental use permits that allow them 3 trips per season.

The Fish and Wildlife Service has similar license and insurance requirements as the Division of Parks; it also requires guides to have safety plans and to provide workmen's compensation coverage for their employees. The service charges all permit holders (resident or non-resident) a fee of $100 at the start of the season and adds a $2 per client charge at the end of the season.

The wildlife refuge began restricting numbers of permits in the early 1980s, when more people began fishing on the upper river. It's a refuge policy to try to keep fishing pressure and crowding on the upper river below levels on the lower river, according to managers of the Kenai National Wildlife Refuge. Refuge employees who issue permits report that most of the 20 guides who have special use permits have had them for years; there is very little turn-over from year to year.

Refuge managers believe there is pent-up demand for the special use permits, and have discussed changing the system to allow more guides a chance at the limited number of permits—but so far they haven't made any decision. One of the things that keeps permit demand on the upper river below that on the lower river is that sport anglers can't keep chinook (king) salmon caught above Skilak Lake—and guides make the most money from sport anglers fishing for kings. Sport anglers on this part of the river fish mainly for sockeye salmon.

Special Use Permits from Forest Service

The U.S. Forest Service requires guides who land in the Chugach National Forest—roughly, between Mile 74 and Mile 79—to get a special use permit. Its permit requirements are much the same as those of the Fish and Wildlife Service; it charges all permit holders a flat fee of $100 per season.

The Forest Service doesn't limit the number of permits it issues, but still issues relatively few—14 in 1994 and possibly 20 in 1995. The demand for guides is not as high in this part of the river, because it is above the best fishing areas. Also, Forest Service personnel believe that some guides who land on the national forest (and therefore should get permits) don't apply for them. The Forest Service has considered limiting the number of permits but has not made any decision.

Potential Changes in Net Economic Value for Sport Guides

If fishery managers decide to let more sockeye come up the Kenai River, what would be the possible effects on the profitability of sport fish guiding on the Kenai River? Or, stated another way, how would the availability of more sockeye change the net economic value of sport guiding?

Most anglers who hire guides on the Kenai River are targeting king rather than sockeye salmon; they catch some sockeye while fishing for kings, but they hire guides to help them catch kings. In 1993, for example, only a little more than 10 percent of the sockeye harvest was taken by guided anglers, while more than half the king catch went to guided anglers.

We saw in Table VI-14 that the number of guides on the Kenai River has varied sharply during the 1990s, depending on the strength of salmon runs—particularly king salmon runs. According to ADF&G, increasing the number of sockeye in the Kenai River by 200,000 in late July would (in an average year) increase the number of kings in the river by about 1,600—or about a three percent increase. The change in demand for guide services would be small.

Furthermore, competition in the guiding business means that the change in net economic value—the change in profits and job satisfaction—would be close to zero. If guides did enjoy any higher profits or greater job satisfaction as a result of the policy change, those changes would be short-lived. More people would become fishing guides and cut into the profits of existing guides.

Another possibility is that the demand for guides could decline. Our travel cost model suggests that as sockeye fishing gets hot, many anglers target sockeye instead of kings and expenditures for guides decline.

In general, as long as the number of permits issued for most of the river remains unrestricted, it seems likely that the number of guides will go up and down with conditions in the fishery. In Figure VI-3 this would be represented by a nearly horizontal M$C line ("perfectly elastic supply") and an MSC line lying virtually on top of it. So the change in the net economic value of guiding would likely be close to zero.

Net Economic Value of Other Businesses Serving Sport Anglers

If more sockeye in the Kenai River caused anglers to take more trips and spend more money, other Kenai Peninsula businesses serving sport anglers—including retailers selling fishing supplies, processors of sport-caught salmon, restaurants, RV parks, and others—would likely also benefit. Yet it is unlikely there would be an increase in economic value for Alaska businesses as a whole, for reasons which parallel those described above for guides.

Service industries are highly competitive, and at the margin, after the compensation of labor and a normal return to capital, there is no net profit. On the whole, these businesses do not earn any more than they would in their next best alternative, say, retailing to skiers. There is no net gain to society that they serve Kenai anglers instead of Mat-Su anglers or skiers or tourists.

Also, the competitive nature of these businesses also means that at the margin there is no net worker satisfaction bonus. If this kind of work were inherently more enjoyable than other service work, workers would be willing to take these jobs for less pay than in other service sectors, and the benefits of increased enjoyment would be offset by the decrease in wages. For the marginal workers who gain or lose jobs as the fishing business ebbs and flows, there would be no net advantage to these jobs serving anglers, relative to other service jobs.

Summary and Discussion

This chapter has presented the results of two state-of-the-art quantitative models for estimating potential changes in net economic value of the Kenai River sport fishery. What can we conclude from our analysis?

The two methods are entirely independent estimates of net economic value to anglers. The travel cost estimates are based on observations about anglers' behavior. The contingent value estimates are based on asking anglers to value specific changes in fishery management. Each method has different strengths and weaknesses. Unfortunately, they are comparable only for two scenarios: A (+200,000) and D (+100,000).

For Scenario A, the most likely travel cost measure is $1.3 million, with a range of $ .8 million to $2.3 million calculated from the 90 percent confidence interval on the sonar count coefficient. For Scenario D, the most likely travel cost measure is $.6 million, with a similar range of $.4 million to $1.0 million. The contingent value results do not distinguish between Scenario A and D. The economic value estimate of $.6 million applies generically to any increase in the sonar count. The 90 percent confidence interval one the contingent value estimate is quite narrow, ranging from $495,000 to $646,000. The contingent value estimate is a little below the low end of the travel cost range for Scenario A, but right in the middle for Scenario D. This corroboration increases our confidence in our results.

For our summary analysis in Chapter X we prefer to use the travel cost estimates of net economic value. The contingent value estimates do not really match our scenarios on the sport fish side. Furthermore, the travel cost method is directly analogous to the method we use to estimate net economic value on the commercial side.

The one qualification is for Scenario C, which models liberalizing the dipnet fishery as well as increasing the sport bag limit and increasing the sonar count. The travel cost model does not estimate well the value of changes in the dipnet fishery because the sample of dipnetters was small. Their distinctive pattern of fishing choices is lost among the large numbers of sport anglers used in estimating the equations. The contingent value method addresses dipnetters separately and produces a better estimate of the value of dipnetting. For Scenario C, we use the travel cost model to calculate the net economic value of the changes in the sonar count and the increase in the sport bag limit for the 29 sport fishing sites in the model, leaving out the dipnet site. We then add in the contingent value estimate of net value for the dipnet fishery.

The contingent value estimate we chose to use was the value of the higher dipnet bag limit. As discussed earlier, this underestimates the total value of liberalizing the dipnet fishery because it assigns zero value to those households that preferred the earlier opening. The alternative estimate—assigning the upper bound value of $167,000 to these households—clearly over estimates the total value. When aggregated with the travel cost model, the difference between the two is insignificant.

We estimated that the management changes under study would yield zero net economic value to sport fishing guides and other angler serving businesses across the region. This new spending on Kenai sport fishing trips doesn't represent much new economic activity —but rather a shift in economic activity from other fishing trips or other activities.

Chapter VII. Change in Economic Impacts of the Sport Fishery

This chapter examines potential changes in economic impacts of the Kenai River sport fishery, if managers allowed more sockeye into the river. The current management target for Kenai River sockeye is 450,000 to 700,000; we are mainly examining the potential effects of increasing that target by 200,000.

Impacts are jobs, income, or other measures associated with an activity. We calculate changes in economic impacts by looking at changes in spending by sport anglers: more spending increases economic impacts; less spending decreases economic impacts. This is quite different from net economic value, which we examined in Chapter VI. Below we first describe how we measured economic impacts before presenting the results in detail.

Potential Changes in Economic Impacts of the Sport Fishery

We focused on three kinds of potential changes in direct and indirect economic impacts of the sport fishery that might result from more sockeye in the Kenai River:

- Changes in value added of businesses operating in Alaska; value added is the sales of those businesses, minus the wholesale value of goods they purchase outside Alaska.
- Changes in payroll in Alaska
- Changes in annual average employment in Alaska

We define "direct" economic impacts of the sport fishery as the value added, income, and employment in the Alaska firms that either sell goods and services to sport anglers or manufacture or transport goods sold to sport anglers. "Indirect" economic impacts are the additional impacts created as income earned from direct impacts circulates through the economy. Total economic impacts are the sum of direct and indirect impacts.

More sockeye in the Kenai River would likely cause both Alaskans and non-resident anglers to take more trips to the river. In the course of these additional trips, the anglers would spend money on goods and services such as fuel, food, and guide services. These expenditures would generate additional value added, income, and employment in the businesses providing these goods and services, as well as additional indirect effects as the spending circulated through the economy. Most of the direct impacts would occur on the Kenai Peninsula, while indirect effects would be more widely spread across Alaska. We can't, however, simply say that increased spending by Kenai River anglers represents the increase in economic impacts. We also have to consider how more spending on the Kenai affects spending elsewhere in Alaska.

Better fishing on the Kenai River doesn't make any anglers—resident or non-resident—any richer. If either residents or non-residents spend more for fishing on the Kenai, they must reduce their other spending by a corresponding amount.[1] That could mean they would spend less for fishing at other Alaska locations, or for other activities in Alaska, or for activities outside Alaska. The extent to which more spending by anglers fishing the Kenai River might be offset by reduced spending by anglers elsewhere *within Alaska* is an important factor affecting the change in economic impacts.

[1]Technically, they could also reduce their savings. However, this seems more likely to occur in the short-run than in the long-run. It is unlikely that a change in Kenai River fishing would have a permanent effect on anglers savings rates.

If better fishing on the Kenai River caused anglers to take more trips there, they might reduce their spending for fishing trips elsewhere in Alaska—for instance, they might spend less for fishing trips to the Mat-Su Borough. As we reported in Chapter VI, our travel cost model predicts that resident anglers would respond to better fishing on the Kenai River not only by taking more trips to the Kenai River but also by taking fewer trips to other Alaska fishing sites.

Another possibility is that anglers spending more to fish the Kenai River might spend less for other, non-fishing activities in Alaska. For example, they might spend less on sightseeing trips, eating out, seeing movies, or going bowling.

Still another possibility is that anglers spending more to fish the Kenai River might spend less outside Alaska. If extra spending on Kenai River fishing trips would otherwise have been spent outside Alaska—for example, on trips to Disneyland—then the net economic impact on Alaska would be much greater. That's because money spent in Alaska instead of outside the state represents additional money in the economy. Money that would have been spent elsewhere in Alaska doesn't add to the overall economy—it's just a shift of money from one place to another.

For Alaska residents, a substantial portion of any increase in their Kenai River fishing expenditures would likely be offset by reductions in other fishing and non-fishing expenditures within Alaska. Similarly, for those non-residents who would have visited Alaska even without better fishing on the Kenai, increases in Kenai River fishing expenditures would also likely be partly offset by less spending for other fishing and non-fishing activities within Alaska.

However, if some non-residents visited Alaska specifically because of the better fishing on the Kenai River, any increase in Kenai River fishing expenditures would represent an increase in total Alaska expenditures (and would likely be further multiplied by other expenditures these visitors might make while in Alaska). Thus an important issue for understanding potential changes in economic impacts of the sport fishery is the extent to which additional non-resident anglers would be attracted to Alaska by better fishing on the Kenai River.

In the rest of this chapter, we examine potential changes in the economic impacts of the sport fishery due to changes in two kinds of expenditures:

- Fishing expenditures by Alaska residents
- Fishing expenditures by non-residents

Another kind of expenditure that could change is non-fishing expenditures by Alaska residents. We were not able to estimate how this kind of spending might change if management of Kenai River sockeye changed. However, since our travel cost analysis suggests that total fishing expenditures by Southcentral Alaska residents would not increase substantially—as we discuss in the next section—it seems unlikely that non-fishing expenditures by Alaskans would change substantially either.

Resident and Non-Resident Sport Fishing Expenditures

Table VII-1 provides an overview of resident and non-resident fishing sport fishing trips to the Kenai River in July 1993, based on our surveys of Alaska residents and non-residents. (The surveys are described in Appendixes E and F.) Together, resident and non-resident sport fishermen took about 217,000 trips to fish the Kenai River in 1993 (a trip may include one or more anglers from a single household).

Table VII-1. Overview of Resident and Non-Resident Fishing Trips and Expenditures

	Alaska Residents				Non-Residents			
	All Southcentral Alaska trips	All Kenai River trips	All Kenai River July trips	Kenai July trips for "red salmon" or "salmon" (a)	All Southcentral Alaska trips	All Kenai River trips	All Kenai River July trips	Kenai July trips for "red salmon" or "salmon" (a)
Estimated number of households which took trips	60,678	24,464	14,071	7,603	57,985	32,074	13,022	7,872
Estimated total trips	625,896	163,204	77,887	52,278	98,645	37,616	15,263	8,406
Average trips per household	10.3	6.7	5.5	6.9	1.7	1.2	1.2	1.1
Estimated total fishing days	1,138,946	266,023	147,354	105,201	285,370	131,997	53,742	37,381
Average number of days per trip	1.8	1.6	1.9	2.0	2.9	3.5	3.5	4.4
Average number of days per household	18.8	10.9	10.5	13.8	4.9	4.1	4.1	4.7
Estimated expenditures								
Food	$20,016,367	$4,650,834	$2,117,121	$1,858,172	$5,015,227	$2,307,687	$772,143	$536,164
Lodging	$3,358,807	$533,092	$198,966	$165,227	$4,439,637	$2,363,099	$980,164	$582,580
Guide and Charter Services	$7,401,687	$793,938	$173,095	$86,548	$17,209,708	$6,672,171	$3,135,207	$1,251,271
Transportation	$42,196,320	$8,100,015	$3,843,264	$2,570,176	$7,783,621	$3,485,224	$1,531,486	$1,023,273
Other	$24,442,375	$3,035,472	$1,438,840	$1,018,132	$5,050,625	$2,488,969	$979,951	$634,663
TOTAL	$97,415,556	$17,113,351	$7,771,286	$5,698,255	$39,498,818	$17,317,150	$7,398,951	$4,027,951
Estimated expenditures per trip								
Food	$31.98	$28.50	$27.18	$35.54	$50.84	$61.35	$50.59	$63.78
Lodging	$5.37	$3.27	$2.55	$3.16	$45.01	$62.82	$64.22	$69.31
Guide and Charter Services	$11.83	$4.86	$2.22	$1.66	$174.46	$177.38	$205.41	$148.85
Transportation	$67.42	$49.63	$49.34	$49.16	$78.91	$92.65	$100.34	$121.73
Other	$39.05	$18.60	$18.47	$19.48	$51.20	$66.17	$64.20	$75.50
TOTAL	$155.64	$104.86	$99.78	$109.00	$400.41	$460.37	$484.76	$479.18
Estimated total expenditures per day	$85.53	$64.33	$52.74	$54.17	$138.41	$131.19	$137.68	$107.75

(a) Includes anglers who said they were fishing for "red salmon" or "salmon"; excludes anglers who said they were fishing for "king salmon" or other salmon species.
Source: ISER resident and non-resident surveys, 1993. For definitions, sample sizes, confidence intervals and more detailed expenditure data, see Appendix C, Table C-1. ISER file: Res & Non-Res Profile.

Of the total trips to the Kenai River, about 94,000 were in July. Survey respondents said that for about 61,000 of these trips, they were fishing for either sockeye (red) salmon or salmon in general, not specifying a species. Residents accounted for 86 percent of July trips for red salmon or salmon, while non-residents accounted for about 14 percent.

Kenai River anglers fished a total of 143,000 trip days in July for red salmon or salmon in general. The average trip length was 2 days for residents and 3.4 days for non-residents. Because the average number of days per trip was higher for non-residents, they accounted for a higher share—26 percent—of total trip days than of trips.

Residents spent an average of $109 per July trip for salmon, while non-residents spent an average of $479—more than four times as much. There were two main reasons for this big difference. First, non-residents spent substantial amounts for lodging and for guide and charter services, while residents spent very little. Second, non-resident trips on average lasted longer. Altogether, residents and non-residents spent about $9.7 million for July fishing trips to the Kenai River for red salmon or salmon. Non-resident spending was about $4 million, or 41 percent of the total.

Table VII-2 provides a more detailed overview of resident anglers' 1993 spending per trip for July trips. (Note that the data for Kenai River trips in Table VII-2 are for all July trips to the Kenai River, not just for red salmon and salmon trips; the figures correspond to those in the third column of Table VII-1).

Resident expenditures for trips to the Kenai River in July averaged $100, while expenditures for trips to other sites averaged $155. Anglers fishing the Kenai River spend substantially less for fuel, boat charters, boat maintenance and investment, and other trip-related expenses (including tackle and miscellaneous other costs). The fact that relatively more anglers fish from the bank on the Kenai River than on average at other sites appears to be a major reason for the lower average costs for Kenai River trips.

Measuring Changes in Economic Impacts of Resident Expenditures

We derived estimates of changes in fishing expenditures by Alaska resident anglers from the travel cost model discussed in Chapter VI. As described more in that chapter, we used our travel cost model equations to project changes in anglers' willingness to pay. We also used these equations to project changes in the number of trips to the Kenai River, the number of trips to other Southcentral Alaska fishing sites, and the expenditures associated with those trip changes. In the model, anglers' decisions about how often to fish and where to fish change when the quality of fishing at any particular site, such as the Kenai River, changes. The probability that a household will take a trip in a given week is a function of household characteristics, the weather, and fishing quality that week at all sites. The model equations simultaneously estimate (a) how many total trips will occur in each week and (b) how those trips will be distributed across sites. Within our model structure, improving the quality of Kenai River fishing causes both an increase in the total number of trips taken as well as an increase in the share of those trips which are taken to Kenai River sites. Chapter VI and Appendix A provide detailed information on the model equations.

The travel cost model predicts household fishing behavior based on average household characteristics reported in our survey. It cannot predict the fishing behavior of unusual households—such as households that take five or ten times more than the mean number of fishing trips. This limitation means that the total number of trips the model predicts, and the predicted expenditures based on those trips, are below the levels indicated by our 1993 survey of sport anglers. Therefore, we scale the model's predictions of changes in trips and expenditures up by the ratio of the actual July trips to model-generated July trips.

Table VII-2. July Trip Expenditures of Southcentral Residents For Trips to the Kenai River and Other Sites, 1993

	Expenditures per Trip		Share of Trip Expenditures	
	Kenai River	Other Sites	Kenai River	Other Sites
Food	$27.18	$29.11	27.2%	18.8%
Lodging	$2.55	$5.61	2.6%	3.6%
All other trip-related expenditures (a)	$18.47	$33.46	18.5%	21.6%
Commercial transport	$1.84	$0.09	1.8%	0.1%
Fuel	$12.64	$23.08	12.7%	18.1%
Air charter	$0.00	$2.34	0.0%	1.5%
Boat charter	$2.22	$10.90	2.2%	7.0%
Guide services (b)	$0.00	$1.99	0.0%	1.3%
Personal transportation, repair	$0.40	$1.24	0.4%	0.8%
Personal transportation, parts	$0.40	$1.24	0.4%	0.8%
Boats, new investment	$4.09	$7.60	4.1%	4.9%
Boat maintenance	$4.29	$7.91	4.3%	5.1%
Plane maintenance	$1.00	$0.62	1.0%	0.4%
Vehicles, new investment	$14.57	$14.57	14.6%	9.4%
Vehicle maintenance	$10.28	$10.23	10.3%	6.6%
TOTAL	$99.78	$155.03	100.0%	100.0%

(a) Includes tackle, bait and all other trip-related expenditures not shown in other categories. In some cases, survey respondents included expenditures for fuel and fishing licenses in their expenditure estimates for this category.
(b) Of the randomly selected 1,800 trips by Alaska residents in 1993 for which we collected detailed expenditure information, there were 3 July trips to Kenai River sites, by 2 households, which reported using guide services. For all 3 trips, the households reported zero expenditures for guides (these households may have been given guided trips as presents from friends or the guides, resulting in no expenditures by the angling household). Substantial numbers of resident anglers do in fact fish for king salmon using guides; the fact that no expenditures were included in our trip sample may be attributed to random sampling error.
ISER file: Sport Analysis.

The model generates expenditures in five categories: food, lodging, guide and charter, fuel and vehicle maintenance, and all other trip-related expenditures (including tackle and bait).To separate these broad categories into narrower ones for our economic impact model, we used the spending patterns Southcentral survey respondents reported for July fishing trips. For example, we separated predicted "guide and charter" expenditures into air charter, boat charter, and guide services expenditures.

The model also estimates the dollar amount of wages lost when anglers choose to fish instead of work; however, the total change in lost wages is very small and we therefore do not include it in our economic impact analysis.

After we developed vectors of changes in expenditures by resident anglers, we used ISER's Cook Inlet Salmon Economic Impact Model to transform changes in expenditures to estimates of changes in direct and indirect economic impacts. Appendix I provides a technical description of the Cook Inlet Salmon Economic Impact Model and the Alaska Input-Output Model from which it was derived.

Estimated Changes in Resident Sport Fishing Expenditures

Table VII-3 shows estimated changes in resident sport fishing expenditures projected by our travel cost model. In Scenario A, an increase of 200,000 sockeye at the river sonar counter would result in 4,045 additional trips by residents to the Kenai River, and additional expenditures by resident anglers of $557,000 for Kenai River fishing trips, or approximately $40,000 more per day over a two-week period in July.

Table VII-3. Estimated Changes in Resident Trips and Expenditures ($)

	Scenario Name and Code					
	+200K at sonar A	Higher sport bag limit B	Higher sport and dip net bag limit C	+100K at sonar D	-100K at sonar E	Low run A3
TRIPS TO THE KENAI RIVER						
Change in number of trips	4,045	4,235	3,379	1,856	-1,549	3,512
Change in expenditures						
Food	158,978	167,058	133,149	72,519	-59,901	135,819
Lodging	24,869	26,071	20,419	11,293	-9,261	21,245
All other trip-related expenditures	91,834	96,197	75,948	41,936	-34,722	79,147
Commercial transport	3,008	3,105	2,299	1,367	-1,122	2,680
Fuel	73,180	76,665	62,075	33,558	-27,974	63,417
Air charter	0	0	0	0	0	0
Boat charter	3,636	3,754	2,779	1,652	-1,356	3,240
Guide services	0	0	0	0	0	0
Personal transportation, repair	2,057	2,155	1,745	943	-786	1,783
Personal transportation, parts	2,057	2,155	1,745	943	-786	1,783
Boats, new investment	23,697	24,825	20,101	10,867	-9,058	20,535
Boat maintenance	24,579	25,749	20,849	11,271	-9,396	21,300
Plane maintenance	5,685	5,956	4,822	2,607	-2,173	4,927
Vehicles, new investment	84,453	88,474	71,637	38,727	-32,283	73,186
Vehicle maintenance	59,307	62,130	50,307	27,196	-22,670	51,395
TOTAL	557,341	584,296	467,876	254,881	-211,489	480,457
TRIPS TO OTHER SITES						
Change in number of trips	-3399	-3558	-2844	-1564	1311	-2962
Change in expenditures						
Food	-117,196	-122,352	-97,081	-53,986	45,324	-102,722
Lodging	-15,268	-15,944	-12,658	-7,034	5,907	-13,381
All other trip-related expenditures	-62,958	-65,751	-52,201	-29,006	24,360	-55,172
Commercial transport	-157	-164	-129	-72	61	-138
Fuel	-88,477	-92,388	-73,343	-40,764	34,233	-77,548
Air charter	-4,247	-4,426	-3,503	-1,955	1,639	-3,726
Boat charter	-19,560	-20,386	-16,135	-9,004	7,549	-17,163
Guide services	-3,607	-3,759	-2,975	-1,660	1,392	-3,165
Personal transportation, repair	-3,811	-3,979	-3,159	-1,756	1,475	-3,340
Personal transportation, parts	-3,811	-3,979	-3,159	-1,756	1,475	-3,340
Boats, new investment	-24,139	-25,207	-20,010	-11,122	9,340	-21,158
Boat maintenance	-25,038	-26,145	-20,756	-11,536	9,688	-21,946
Plane maintenance	-2,127	-2,221	-1,763	-980	823	-1,864
Vehicles, new investment	-45,968	-48,000	-38,105	-21,179	17,786	-40,290
Vehicle maintenance	-32,307	-33,735	-26,781	-14,884	12,500	-28,316
TOTAL	-448,671	-468,438	-371,759	-206,694	173,550	-393,269
NET CHANGE						
Change in number of trips	646	677	535	292	-238	550
Change in expenditures						
Food	41,782	44,706	36,068	18,533	-14,577	33,097
Lodging	9,600	10,126	7,760	4,259	-3,354	7,863
All other trip-related expenditures	28,876	30,446	23,747	12,930	-10,362	23,975
Commercial transport	2,851	2,942	2,170	1,295	-1,061	2,542
Fuel	-15,296	-15,724	-11,268	-7,206	6,259	-14,131
Air charter	-4,247	-4,426	-3,503	-1,955	1,639	-3,726
Boat charter	-15,924	-16,632	-13,356	-7,352	6,192	-13,923
Guide services	-3,607	-3,759	-2,975	-1,660	1,392	-3,165
Personal transportation, repair	-1,754	-1,824	-1,414	-812	688	-1,557
Personal transportation, parts	-1,754	-1,824	-1,414	-812	688	-1,557
Boats, new investment	-443	-382	90	-255	282	-622
Boat maintenance	-459	-396	94	-265	292	-645
Plane maintenance	3,558	3,735	3,059	1,627	-1,350	3,062
Vehicles, new investment	38,485	40,474	33,532	17,549	-14,497	32,896
Vehicle maintenance	27,000	28,396	23,526	12,312	-10,170	23,079
TOTAL	108,669	115,858	96,116	48,186	-37,939	87,188

ISER file: Sport Analysis.

However, the better fishing on the Kenai would also result in 3,399 fewer trips to other Alaska sites and would reduce resident expenditures for fishing at other Alaska sites by $449,000. The net increase in resident angler expenditures—the difference between the increase for Kenai trips and the decrease for other trips—is $109,000. Thus about 80 percent of the increase in resident anglers' spending for additional Kenai River trips would be offset by reduced spending for fishing at other sites. Put differently, only about 20 of the total increase in resident spending for fishing the Kenai River would be a net increase in resident angler spending statewide.

For which other sites would angler trips and expenditures be reduced? There are a wide variety of other sport fishing opportunities for Southcentral Alaska sport anglers in July. Based on our resident angler survey, we estimate that in 1993 about 40 percent of July trips by Southcentral resident anglers were to Kenai River sites and 60 percent of July trips were to other sites. (Table A-3 in Appendix A provides a list of these sites).

Technically, our model projects that the reallocation of trips to the Kenai River would occur from all other Southcentral Alaska sites in proportion to the number of trips taken to those sites. To see why the model works that way, recall that our travel cost model equations predict that two changes would occur as a result of improved Kenai River fishing:

- Since Kenai River fishing improves, the overall quality of fishing opportunities available to Southcentral residents improves, resulting in an increase in the total number of trips taken.
- Since there is no change in the fishing quality at other sites, the quality of Kenai River fishing improves relative to other sites, and thus a larger share of all trips are taken to the Kenai River.

Since there is no change in the quality of fishing at other Southcentral sites relative to each other, in the model's projections there is no change in the proportion of trips taken to those sites relative to each other. So, for example, if fishing in Anchorage lakes (1,272 trips in week 13) was about three times as popular as fishing in the Ninilchik and Anchor Rivers (439 trips in week 13), the model projects that Anchorage lakes will still receive three times as many trips as the Anchor and Ninilchik rivers if Kenai River fishing improves. However, Anchorage lakes, the Anchor and Ninilchik rivers, and all other non-Kenai River sites will share a smaller portion of the total predicted trips, because the Kenai River sites will have taken a larger share.

In reality, it is unlikely that the reallocation from other sites would occur in exact proportion to the number of trips that each receives. For example, we might expect that anglers who are already traveling to the Kenai Peninsula to fish for sockeye in the Ninilchik and Anchor rivers might be much more likely to switch to the Kenai River in response to improved fishing there than would anglers who are taking their young children to fish in Anchorage lakes. Put differently, the Ninilchik River is a much closer substitute for the Kenai River than is Taku-Campbell Lake. Thus a strictly proportional reallocation from other sites is not likely to be a good predictor of the actual reallocation from each site—which is why we do not report these projections for individual alternative sites. However, our estimate of the magnitude of the total reallocation from all other sites to the Kenai River is much more reliable and statistically valid.

How would the change in fishing quality affect angler expenditures under other scenarios? A higher sport limit combined with 200,000 additional sockeye (Scenario B) would increase net expenditures slightly. An increase of just 100,000 sockeye (Scenario D) would generate about half the net increase in expenditures. Reducing the number of sockeye in the river by 100,000 (Scenario E) would cut spending for Kenai trips and increase spending for trips elsewhere.

Estimated Changes in Economic Impacts of Resident Expenditures

The next step in estimating changes in economic impacts is multiplying the changes in expenditures shown in Table VII-3 by the coefficients of the Cook Inlet Salmon Economic Impact Model, shown in Table VII-4. These coefficients show the economic impacts per $1,000 of expenditures. They were derived using ISER's Alaska Input-Output Model, as described in Appendix I.

Table VII-4. Cook Inlet Salmon Economic Impact Model: Economic Impacts per $1,000 of Expenditures

	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Food	$547	$333	$880	$191	$89	$280	0.0104	0.0035	0.0139
Lodging	$1,000	$656	$1,656	$304	$174	$478	0.0195	0.0066	0.0261
All other trip-related expenditures	$588	$394	$982	$251	$104	$355	0.0131	0.0041	0.0172
Commercial transport	$1,000	$692	$1,692	$257	$167	$424	0.0073	0.0064	0.0136
Fuel	$606	$505	$1,112	$136	$96	$232	0.0062	0.0032	0.0094
Air charter	$1,000	$521	$1,521	$257	$128	$385	0.0166	0.0051	0.0217
Boat charter	$1,000	$521	$1,521	$257	$128	$385	0.0166	0.0051	0.0217
Guide services	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Personal transportation, repair	$1,000	$702	$1,705	$519	$209	$728	0.0224	0.0085	0.0309
Personal transportation, parts	$506	$374	$879	$210	$99	$309	0.0107	0.0038	0.0145
Boats, new investment	$225	$130	$355	$84	$35	$118	0.0040	0.0014	0.0054
Boat maintenance	$718	$503	$1,220	$371	$150	$521	0.0160	0.0061	0.0221
Plane maintenance	$347	$243	$590	$180	$72	$252	0.0077	0.0030	0.0107
Vehicles, new investment	$25	$19	$44	$11	$5	$16	0.0006	0.0002	0.0008
Vehicle maintenance	$214	$150	$363	$111	$45	$155	0.0048	0.0018	0.0066

Note: These coefficients were derived using the Alaska Input-Output Model, as described in Appendix I.
ISER file: Sport Analysis.

Some kinds of expenditures have a much higher economic impact on Alaska than others, per dollar spent—depending on how much of the expenditure leaks out of the economy. For example, $1,000 of expenditures on boat charters, guide services, lodging, and automobile repair generates $1,000 in value added for Alaska businesses. By contrast, $1,000 in expenditures for food, fuel, bait, or tackle generates only about half as much value added for businesses operating in Alaska, because a large share of expenditures for those items goes to non-resident producers.

The direct effects of $1,000 in expenditures on payroll in Alaska depend on the labor component of providing the goods or services. So, for example, $1,000 in expenditures for lodging generates more than twice as much payroll as $1,000 in expenditures for fuel.

Our model calculates effects on employment in Alaska as effects on payroll, divided by average annual earnings per worker. Therefore, $1,000 in expenditures has a greater effect on employment, the greater the share that goes to payroll and the lower the average wage. Some kinds of expenditures create much more direct employment than others. Only $44,000 in expenditures for guide services is needed to create a direct guide job (annual average equivalent), while $161,000 in expenditures is needed to create a direct job in fuel sales.

Indirect economic impacts result from re-spending by Alaska households of income earned as direct payroll, as well as re-spending of angler expenditures by firms for business services. Indirect economic impacts reflect significant leakage of expenditures from the Alaska economy. For most types of expenditures, indirect economic impacts on payroll and employment are about half the level of direct economic impacts.

Table VII-5a shows, for Scenario A (200,000 additional sockeye) the projected economic impacts of the total increase in Kenai River expenditures, while Table VII-5b shows the projected economic impacts of the smaller net change in resident expenditures. As expected, the economic impacts of the total change in Kenai River expenditures are much larger than the economic impacts of the net change in angler expenditures. By itself, the $558,000 increase in resident angler expenditures for Kenai River trips would generate an increase of $435,000 in Alaska value added, $138,000 in payroll, and 6.5 annual average jobs. However, the smaller net increase of $108,000 in resident angler expenditures (Table VII-5b) would generate an increase of $40,000 in Alaska value added, $17,000 in payroll, and 0.8 annual average jobs.

Why would the net change in economic impacts be so small? Part of the reason is that the net change in expenditures is only about 20 percent of the total increase in Kenai River expenditures, as we noted above. However, another factor is that a greater share of Kenai River expenditures are for types of goods or services (in particular, vehicle investment and maintenance and food) that have a relatively smaller economic impact on Alaska. A greater share of expenditures for trips to other sites are for types of goods or services (in particular air charters, boat charters, and guide services) that have a relatively larger economic impact on Alaska—because less of the expenditure leaks out of the economy.

Tables VII-6a and VII-6b correspond to Tables VII-5a and VII-5b, but provide summary economic impacts for all our sport fishery scenarios. Economic impacts are slightly higher for Scenario B (higher sport bag limit) than for Scenario A, because more anglers would be attracted to the Kenai River by the combination of a higher bag limit and more fish. Economic impacts would be only about half as great for Scenario D (increasing sockeye by just 100,000), because changes in expenditures would only be about half as large. Economic impacts would be somewhat smaller for Scenario A3 (low sockeye run) because the extra fish attract relatively fewer additional anglers when the overall quality of the fishing is not as good.

Measuring Changes in Economic Impacts of Non-Resident Expenditures

In Chapter VI, we did not analyze changes in non-residents' willingness to pay for Kenai River sport fishing, because our focus is on net economic value to Alaskans. In considering changes in economic impacts, however, we are interested not only in changes in resident expenditures, but also in changes in non-resident expenditures—because both affect economic impacts in Alaska. Non-resident households accounted for more than 40 percent of households that fished for Kenai River sockeye and kings in 1993.

How might changes in the number of sockeye entering the Kenai River affect non-resident fishing expenditures? As with resident expenditures, it is likely that much of any increase in non-resident expenditures for fishing the Kenai River would be offset by reduced expenditures for fishing elsewhere in Alaska—or by reduced expenditures for other kinds of activities in Alaska. However, if a change in management of Kenai River salmon caused non-residents to spend more time (and money) in Alaska, this would represent a net gain in total Alaska expenditures. Also, this increased spending for Kenai River fishing would likely be further multiplied by other kinds of expenditures these visitors might make. Thus to examine how non-resident expenditures might change, we focused on how improving the quality of Kenai River sport fishing opportunities might affect the total number of days non-residents spend in Alaska.

Table VII-5a. Cook Inlet Salmon Economic Impact Model: Economic Impacts of Changes in Kenai River Expenditures Only: Scenario A: +200K at Sonar

		Estimated Economic Impacts								
	Change in	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	expenditures	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Food	$158,978	$86,886	$52,971	$139,858	$30,384	$14,127	$44,511	1.7	0.5	2.2
Lodging	$24,869	$24,869	$16,310	$41,179	$7,561	$4,323	$11,883	0.5	0.2	0.6
All other trip-related expenditures	$91,834	$54,000	$36,195	$90,195	$23,009	$9,587	$32,596	1.2	0.4	1.6
Commercial transport	$3,008	$3,008	$2,082	$5,090	$773	$502	$1,275	0.0	0.0	0.0
Fuel	$73,180	$44,378	$36,963	$81,341	$9,936	$7,043	$16,979	0.5	0.2	0.7
Air charter	$0	$0	$0	$0	$0	$0	$0	0.0	0.0	0.0
Boat charter	$3,636	$3,636	$1,895	$5,531	$934	$466	$1,400	0.1	0.0	0.1
Guide services	$0	$0	$0	$0	$0	$0	$0	0.0	0.0	0.0
Personal transportation, repair	$2,057	$2,057	$1,445	$3,508	$1,067	$431	$1,498	0.0	0.0	0.1
Personal transportation, parts	$2,057	$1,040	$769	$1,809	$433	$203	$636	0.0	0.0	0.0
Boats, new investment	$23,697	$5,324	$3,078	$8,402	$1,987	$820	$2,807	0.1	0.0	0.1
Boat maintenance	$24,579	$17,640	$12,353	$29,993	$9,125	$3,683	$12,808	0.4	0.2	0.5
Plane maintenance	$5,685	$1,973	$1,382	$3,356	$1,021	$412	$1,433	0.0	0.0	0.1
Vehicles, new investment	$84,453	$2,138	$1,593	$3,730	$941	$421	$1,362	0.0	0.0	0.1
Vehicle maintenance	$59,307	$12,670	$8,872	$21,542	$6,554	$2,645	$9,199	0.3	0.1	0.4
TOTAL	557,341	$259,620	$175,909	$435,535	$93,725	$44,662	$138,387	4.8	1.7	6.5

ISER file: Sport Analysis.

Table VII-5b. Cook Inlet Salmon Economic Impact Model: Economic Impacts of Net Changes in Resident Angler Expenditures: Scenario A: +200K at Sonar

		Estimated Economic Impacts								
	Change in	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	expenditures	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Food	$41,782	$22,835	$13,922	$36,757	$7,985	$3,713	$11,698	0.4	0.1	0.6
Lodging	$9,600	$9,600	$6,296	$15,897	$2,919	$1,669	$4,587	0.2	0.1	0.3
All other trip-related expenditures	$28,876	$16,979	$11,381	$28,360	$7,235	$3,014	$10,249	0.4	0.1	0.5
Commercial transport	$2,851	$2,851	$1,973	$4,824	$733	$476	$1,209	0.0	0.0	0.0
Fuel	-$15,296	-$9,276	-$7,726	-$17,002	-$2,077	-$1,472	-$3,549	-0.1	0.0	-0.1
Air charter	-$4,247	-$4,247	-$2,213	-$6,460	-$1,091	-$544	-$1,635	-0.1	0.0	-0.1
Boat charter	-$15,924	-$15,924	-$8,298	-$24,222	-$4,092	-$2,039	-$6,131	-0.3	-0.1	-0.3
Guide services	-$3,607	-$3,607	-$2,525	-$6,132	-$1,866	-$753	-$2,619	-0.1	0.0	-0.1
Personal transport., repair	-$1,754	-$1,754	-$1,232	-$2,990	-$910	-$367	-$1,277	0.0	0.0	-0.1
Personal transport., parts	-$1,754	-$887	-$655	-$1,542	-$369	-$173	-$542	0.0	0.0	0.0
Boats, new investment	-$443	-$99	-$57	-$157	-$37	-$15	-$52	0.0	0.0	0.0
Boat maintenance	-$459	-$329	-$231	-$560	-$170	-$69	-$239	0.0	0.0	0.0
Plane maintenance	$3,558	$1,235	$865	$2,100	$639	$258	$897	0.0	0.0	0.0
Vehicles, new investment	$38,485	$974	$726	$1,700	$429	$192	$621	0.0	0.0	0.0
Vehicle maintenance	$27,000	$5,768	$4,039	$9,807	$2,984	$1,204	$4,188	0.1	0.0	0.2
TOTAL	$108,669	$24,120	$16,265	$40,380	$12,310	$5,093	$17,404	0.6	0.2	0.8

ISER file: Sport Analysis.

Table VII-6a. Changes in Economic Impacts of the Sport Fishery: Effects of Changes in Kenai River Expenditures Only

	Scenario Name and Code					
	+200K at sonar	Higher sport bag limit	Higher sport and dipnet bag limits	+100K at sonar	-100K at sonar	Low run
Type of Economic Impact	A	B	C	D	E	A3
Change in Alaska Output/Sales						
Change in direct impact	$259,620	$272,172	$216,910	$118,602	-$98,235	$223,518
Change in indirect impact	$175,909	$184,402	$147,101	$80,380	-$66,604	$151,516
Change in total impact	$435,535	$456,580	$364,016	$198,985	-$164,842	$375,039
Change in Alaska Payroll						
Change in direct impact	$93,725	$98,263	$78,339	$42,821	-$35,475	$80,688
Change in indirect impact	$44,662	$46,821	$37,331	$20,405	-$16,904	$38,455
Change in total impact	$138,387	$145,084	$115,670	$63,226	-$52,379	$119,144
Change in Alaska Employment						
Change in direct impact	4.8	5.0	4.0	2.2	-1.8	4.1
Change in indirect impact	1.7	1.8	1.4	0.8	-0.6	1.5
Change in total impact	6.5	6.8	5.4	3.0	-2.5	5.6
Expressed as a percentage of Scenario A:						
Change in Alaska Output/Sales						
Change in direct impact	100%	105%	84%	46%	-38%	86%
Change in indirect impact	100%	105%	84%	46%	-38%	86%
Change in total impact	100%	105%	84%	46%	-38%	86%
Change in Alaska Payroll						
Change in direct impact	100%	105%	84%	46%	-38%	86%
Change in indirect impact	100%	105%	84%	46%	-38%	86%
Change in total impact	100%	105%	84%	46%	-38%	86%
Change in Alaska Employment						
Change in direct impact	100%	105%	84%	46%	-38%	86%
Change in indirect impact	100%	105%	84%	46%	-38%	86%
Change in total impact	100%	105%	84%	46%	-38%	86%

ISER file: Sport Analysis.

Table VII-6b. Changes in Economic Impacts of the Sport Fishery: Effects of Net Changes in Resident Angler Expenditures

	Scenario Name and Code					
	+200K at sonar	Higher sport bag limit	Higher sport and dipnet bag limits	+100K at sonar	-100K at sonar	Low run
Type of Economic Impact	A	B	C	D	E	A3
Change in Alaska Output/Sales						
Change in direct impact	$24,120	$26,322	$21,834	$10,117	-$7,155	$17,087
Change in indirect impact	$16,265	$17,734	$14,842	$6,837	-$4,857	$11,581
Change in total impact	$40,380	$44,051	$36,671	$16,951	-$12,011	$28,663
Change in Alaska Payroll						
Change in direct impact	$12,310	$13,266	$10,893	$5,316	-$3,986	$9,324
Change in indirect impact	$5,093	$5,512	$4,550	$2,177	-$1,599	$3,771
Change in total impact	$17,404	$18,778	$15,443	$7,493	-$5,586	$13,096
Change in Alaska Employment						
Change in direct impact	0.6	0.7	0.5	0.3	-0.2	0.5
Change in indirect impact	0.2	0.2	0.2	0.1	-0.1	0.2
Change in total impact	0.8	0.9	0.7	0.4	-0.3	0.6
Expressed as a percentage of Scenario A:						
Change in Alaska Output/Sales						
Change in direct impact	100%	109%	91%	42%	-30%	71%
Change in indirect impact	100%	109%	91%	42%	-30%	71%
Change in total impact	100%	109%	91%	42%	-30%	71%
Change in Alaska Payroll						
Change in direct impact	100%	108%	88%	43%	-32%	76%
Change in indirect impact	100%	108%	89%	43%	-31%	74%
Change in total impact	100%	108%	89%	43%	-32%	75%
Change in Alaska Employment						
Change in direct impact	100%	108%	88%	43%	-32%	75%
Change in indirect impact	100%	108%	89%	43%	-32%	75%
Change in total impact	100%	108%	88%	43%	-32%	75%

ISER file: Sport Analysis.

Estimating Changes in Non-Resident Expenditures

To examine potential changes in expenditures by non-resident anglers, we used results from two ISER surveys of non-resident households that had bought sport fishing licenses in Alaska. As we describe below, those survey results have shortcomings that limit their application. In general, we found that many non-residents households might fish more on the Kenai River, and might stay longer in Alaska, if there were better sockeye fishing.

But we found no statistical relationship between the survey responses and specific management changes we asked about. And in some cases we believe respondents made unrealistically high estimates of how much they would extend their trips to take advantage of two weeks of better sockeye fishing in July. Still, because so many non-residents fish for Kenai River sockeye and kings, it is crucial to look at how their expenditures for fishing could change if there were improved sockeye fishing. So, we used the survey results in a limited way (as described below) to come up with very rough, order-of-magnitude estimates of potential changes in economic impacts as a result of increases in non-resident spending.

Potential Changes in the Number of Days Non-Residents Spend in Alaska

In late 1993, we sent a mail-back questionnaire to a sample of households that had bought 1993 non-resident Alaska sport fishing licenses. We asked where and when they had fished, for what species, and what their expenditures were. Based on responses to that survey, in January 1995 we sent a short follow-up survey to all the households that reported fishing in Southcentral Alaska in 1993. We sent slightly different versions of the survey to those households that had fished the Kenai and those that had fished elsewhere in Southcentral Alaska. Copies of the two versions of our non-resident sport fish survey questionnaire are included in Appendix F.

In both versions of the questionnaire, we asked non-resident households that had fished Southcentral Alaska in 1993 how their fishing behavior and the length of their trip to Alaska might have changed if the quality of fishing for red salmon in the Kenai River had been different. As examples of differences in the quality of fishing, we randomly asked different respondents how their fishing behavior and length of trip would have been affected by higher or lower bag limits, and shorter or longer average times necessary to catch a fish.

Table VII-7 summarizes the responses to our non-resident household survey. Among those households that had fished for Kenai River red (sockeye) or king salmon during their 1993 visits, 56 percent said that fishing for Kenai late-run reds was either very important or somewhat important in their decision to visit Alaska in 1993.

Almost half the non-resident households that had fished for Kenai River reds or kings said their fishing would have changed in some way—from spending more time on the fishing trips they took to changing the duration of their Alaska visits—in response to better or worse conditions for Kenai red salmon fishing. About 16 percent said they would have lengthened their Alaska visits in response to better red salmon fishing, or shortened them in response to poorer fishing.

However, a variety of statistical tests, including simple cross-tabulations and binomial probit models, failed to show any significant relationships between the magnitude of the change in the fishing quality—as measured by the change in the bag limit or time to catch a fish—and how respondents said they would change their behavior.

Table VII-7. Summary of Responses to Non-Resident Angler Survey

	Households which fished for Kenai reds or kings in 1993	Households which fished elsewhere in Southcentral Alaska in 1993	All households which fished in Southcentral Alaska in 1993
As a factor in the decision to visit Alaska in 1993, fishing for Kenai late-run reds was: (a)			
Very important	24.1%	4.7%	13.0%
Somewhat important	32.4%	20.0%	24.8%
Not important	43.5%	75.3%	62.9%
Did the household have information about Kenai late run red salmon bag limits and openings before visiting Alaska in 1993? (a)			
Yes	27.5%	18.4%	21.9%
No	72.5%	81.6%	78.1%
Would better or worse fishing on the Kenai have affected the length of the visit to Alaska? (b)			
Yes	15.7%	10.1%	13.0%
No	84.3%	89.9%	87.0%
Number of survey responses about number of days by which households would have extended their visits	37	24	
Number of days by which households would have extended their visits to Alaska (c)			
1-3 days	32%	29%	31%
4-7 days	43%	46%	44%
8-14 days	3%	8%	5%
More than 14 days	22%	17%	20%
Average number of days by which households would have extended their visit to Alaska:			
Average of trip extensions reported by all respondents	7.9	8.5	
Average adjusted for maximum of 14 days	6.5	6.5	
Average adjusted for maximum of 7 days	4.8	5.0	

(a) Responses for all households. (b) Responses for households which visited Alaska in July.
ISER file: Nonresident angler analysis.

For example, some anglers were asked to suppose that the bag limit had been three fish per day instead of two, while other anglers were asked to suppose that the bag limit had been five fish per day instead of two. But increasing the bag limit by three fish per day did not make non-residents any more likely to spend more time fishing for red salmon than increasing the bag limit by only one fish per day. And among those who said they would lengthen their visits in response to better fishing, the number of extra days they would have spent was not related to either the bag limit or the amount of time they could expect to spend catching a fish. The fact that there was no statistically significant difference in responses as to whether changing the bag limit would cause non-residents to extend their stay, or if so by how many days, suggests that their responses can not be reliably related to any particular change in the management of the Kenai.

Among those non-resident households that had fished in other parts of Southcentral Alaska (but not the Kenai River), 5 percent said that fishing for Kenai late-run reds was very important in their decision to visit Alaska in 1993, and another 20 percent said it was somewhat important—even though they didn't actually make it to the Kenai River to fish.

Of those households that visited in July, about forty percent said that better fishing on the Kenai would have led them to fish for Kenai River reds, and about 10 percent said they would have lengthened their stay in Alaska. Again, however, there was no statistically significant relationship either between the likelihood that they would fish for Kenai reds and the amount of improvement in red salmon fishing, or between the length of an extended stay and the amount of improvement in the fishing.

The survey results imply that better fishing on the Kenai River would indeed cause some increase in the number of days non-resident anglers spend fishing in Alaska, and thus some increase in non-resident angler expenditures. However, the fact that there was no statistically significant relationship between the change in the quality of fishing and how much longer respondents said they would have stayed in Alaska makes it difficult to develop a reliable estimate of the potential change in non-resident expenditures, or how the change in expenditures might vary among our study scenarios.

In order to develop an estimate of the general magnitude of the potential change in expenditures by non-residents in response to better fishing on the Kenai, we began by estimating the increase in the number of days that non-residents might spend in Alaska. As shown in Table VII-8, we estimated that there were 21,000 non-resident households whose visits to Southcentral Alaska started in July 1993. We multiplied this number of non-resident households by the percentage who said they might extend the length of their trips if the fishing for Kenai River reds were better. This results in an estimate of 2,693 non-resident households that would spend more time in Alaska. In our survey, these anglers said that they would extend their trips by an average of about 8 days (responses ranged from 1 additional day to 30 additional days). Multiplying the 2,693 households who said they would spend more time in Alaska by an average trip extension of 8.2 days results in an estimated increase of 21,969 non-resident days spent in Alaska.

Table VII-8. Potential Change in Non-Resident Days Spent in Alaska in Response to Better Kenai Sockeye Salmon Fishing

	Households which fished for Kenai reds or kings in 1993	Households which fished elsewhere in Southcentral Alaska in 1993	All households which fished in Southcentral Alaska in 1993
Estimated total number of households in group (a)	10,060	11,021	21,081
Percentage which would extend the length of their visit (b)	15.7%	10.1%	12.8%
Estimated number extending visit	1,579	1,113	2,693
Average number of days by which households would have extended their visit to Alaska (b)	7.9	8.5	8.2
Estimated total increase in days spent in Alaska	12,507	9,462	21,969

(a) Includes only households that visited Southcentral Alaska in July of 1993.
(b) See survey results reported in Table VII-7.
ISER file: Nonresident angler analysis.

How reliable is this estimate? Unfortunately, it is not very reliable, for several reasons. First, we believe that respondents' estimates about whether or not they would have spent longer in Alaska, and if so how much longer, may be biased upwards. It is probably very difficult for non-resident anglers, filling out a survey form more than a year after their visit to Alaska, to provide an accurate response as to whether they would in fact stay longer in Alaska, and by how many days, if the fishing were better on the Kenai River. Our experience with survey research suggests that some respondents unintentionally overestimate the magnitude of how they might respond to this kind of hypothetical change, because it easy to respond that you would do something you would like to do when there is no actual cost involved.

The management changes addressed by this study would improve the fishing on the Kenai River for a period of about 14 days. However, as shown in Table VII-7, 20 percent of the respondents who said they would increase their stay in response to better fishing said that they would increase their stay by more than 14 days. While it is possible that better fishing might cause some anglers to extend their stay by more than the total period of time for which the fishing was better, it is questionable whether 20 percent would do so. This provides an additional indication that respondents' answers about how much they might extend their trips might be biased upwards. As shown in the bottom of Table VII-7, if we allowed a maximum of 14 days additional stay in Alaska in response to better fishing, this would slightly reduce the average trip extension and the resulting estimated increase in non-resident days in Alaska.

The most important reason for not placing a great deal of confidence in the estimates in Table VII-8 is the fact that our survey respondents' answers are not correlated with the hypothetical improvement in Kenai River fishing quality. To actually increase non-resident days by the amount estimated in Table VII-8, we can't use our survey responses to say whether it would be necessary to increase the bag limit by one per day, two per day or five per day. This means that any estimates we develop about changes in the economic impacts of non-resident spending can't be related to any of our study scenarios. In order to increase the number of days that non-residents spend in Alaska by our Table VII-8 estimate of 21,969, we can't say whether it would be necessary to increase the Kenai River sonar count by 100,000, 200,000 or 400,000.

A different problem—and a potential source of *downward* bias to the estimates in Table VII-8—is that they do not take account of the extent to which improved fishing might attract additional non-resident anglers to Alaska, who would not otherwise have visited Alaska. Our estimates in Table VII-8 of additional non-resident angler days in Alaska are based on responses of anglers who had already made the decision to visit Alaska, some of whom said they would have stayed longer in response to improved fishing on the Kenai River. However, we did not interview anglers who had not visited Alaska. It would be very difficult to design such a survey or to obtain accurate estimates as to how the behavior of this much larger group of anglers might change in response to better fishing on a particular stream in Alaska.

What our survey responses do clearly show is that some non-residents consider the quality of Kenai River late-run sockeye fishing to be an important factor in their decision to visit Alaska, and in how long they might stay in Alaska. The fact that there are large numbers of non-resident anglers who visit Alaska—and even larger numbers who do not visit Alaska—means that if better fishing on the Kenai River caused even a relatively small percentage of both groups to increase the time they spend in Alaska, this could lead to a substantial increase in the number of days spent by non-residents in Alaska. But we cannot provide a reliable estimate of how large this increase might be, or how it is related to any specific change in the quality of sport fishing, such as that which might result from increasing the Kenai River sonar count by 200,000.

POTENTIAL CHANGES IN NON-RESIDENT EXPENDITURES

The next step in estimating potential changes in economic impacts of non-resident sport fishing is to estimate how much additional spending in Alaska might result from more days spent by non-residents in Alaska. Table VII-9 shows several different estimates of expenditures per day, all of which were derived from our 1993 survey of non-resident anglers. The top part of the table shows estimated expenditures per day on different kinds of fishing trips. Non-resident households spent an average of $108 per day on Kenai July trips for "red salmon" or "salmon."

However, non-resident total expenditures in Alaska would not necessarily increase by this amount for each additional day visitors spent in Alaska in response to better fishing on the Kenai—even if they spent all that time fishing the Kenai. The reason is that visitors would probably offset at least part of the extra expenditures associated with more days spent in Alaska—whether or not they spent the entire extra time fishing the Kenai—by reducing their expenditures during the rest of their visit.

As shown in the second part of Table VII-9, average expenditures per day during non-resident anglers' visits to Alaska were negatively correlated with the length of time spent in Alaska. The longer non-resident anglers stayed in Alaska, the lower their average spending per day. For example, non-resident anglers who took trips of 8 to 4 days spent an average of $194 per day, while non-resident anglers who took trips of 14 to 30 days spent an average of $125 per day.

Table VII-9. Selected Estimates of Non-Resident Expenditures per Day

Expenditures per day on fishing trips (a)	
All Southcentral Alaska trips	$138
All Kenai River trips	$131
All Kenai River July trips	$138
Kenai July trips for "red salmon" or "salmon"	$108
Average expenditure per day in Alaska (b)	
Trips of 1-7 days	$301
Trips of 8-14 days	$194
Trips of 14-30 days	$125
Trips of more than 30 days	$63
Estimated increase in total spending per extra day in Alaska (c)	$24

Source: ISER non-resident survey, 1993. Data are for non-resident household expenditures in Alaska.
(a) For more details about non-resident fishing trip expenditures, see Table VII-1.
(b) Based on responses to questions about total trip expenditures in Alaska (question A9A) and total number of days spent in Alaska (question A4).
(c) See discussion of regression results in text.
ISER file: Expenditures per day.

To examine further the relationship between trip length and total household expenditures, we estimated a linear regression to see how the length of visit, the number of visitors in the household, and the presence of friends or relatives in the state affected the household's total spending within Alaska. The results of our regression are:

Total Spending = 24.3*Trip Length in days + 651.6*Number HH members visiting Alaska
– 1200.7*(1 if visiting friends or relatives, 0 otherwise) + 864.5

[Number of observation=3168; R-Squared=.165; t-statistics are 12.2 for Trip Length, 17.4 for Number of HH members, and -13.4 for Visiting Friends or Relatives]

The coefficients measure how much a change in an independent variable will affect the size of the dependent variable— here, the dependent variable is total spending in Alaska. The results suggest that for the sample of non-resident anglers who visited Alaska in 1993, total spending in Alaska increased by only $24.30 per extra day spent in Alaska.

How is it possible that total spending could increase by only this amount per extra day in Alaska, given the much higher figures for average spending per day shown in the top part of Table VII-9? Table VII-10 provides an example of how the increase in total spending per extra day spent in Alaska might be less than average expenditures per day—even much less. In this example, an angler who spends ten days in Alaska spends an average of $194 per day, for a total of $1,940, while an angler who spends 20 days in Alaska spends an average of $125 per day, for a total of $2,500. The angler who spends 20 days spends $560 more in Alaska, or $56 per extra day—which is well below average spending per day for even the 20-day trip.

Table VII-10. How the Increase in Total Spending Per Extra Day in Alaska Can Be Less Than Average Expenditure per Day: An Example

Number of days in Alaska	Average expenditure per day	Total expenditure	Change in total expenditures	Increase in total spending per extra day in Alaska
10	$194	$1940		
20	$125	$2500		
			$560	$56

ISER file: Expenditures per day.

Why would average spending per day decline as the length of the stay increases? One possible reason is that some non-resident may have a limited total amount which they can afford to spend in Alaska. If they spend more time in Alaska, the limited amount they have to spend has to be spread over more days. In the extreme, if a non-resident angler with a fixed amount to spend in Alaska decided to take a longer trip to Alaska because the Kenai River fishing was better, his extra spending per extra day in Alaska would be $0.

We do not have sufficient information to know exactly how much spending might increase for each extra day that non-resident anglers spent in Alaska in response to better Kenai River fishing. We believe that it is less than the average of $108 per day that they spend per day fishing the Kenai River, because of the evidence that anglers who stay longer spend less per day on average. However, we believe that it is probably significantly greater than the $24 per extra day estimated from the total Alaska spending reported by all anglers we surveyed—which includes anglers who may have visited Alaska primarily for reasons other than fishing.

As shown in the middle part of Table VII-11, we used $108 per day as a "high estimate" of the increase in total spending per extra day, and $24 per day as a "low estimate." We chose an intermediate figure—$75 per day—as a "medium estimate. These result in low, medium, and high estimates of the potential increase in spending of $527 thousand, $1.6 million, and $2.4 million.

Table VII-11. Potential Change in Non-Resident Expenditures in Response to Better Kenai Red Salmon Fishing

	Low estimate	Medium estimate	High estimate
Total increase in days spent in Alaska (a)	21,969	21,969	21,969
Assumed increase in expenditures per extra day ($) (b)	$24	$75	$108
Total increase in expenditures, based on number of non-resident anglers in 1993	$527,252	$1,647,662	$2,372,633
Assumed growth in number of non-resident Kenai anglers above 1993 level	20%	30%	40%
Total estimated increase in non-resident expenditures in response to better Kenai red salmon fishing	$632,702	$2,141,961	$3,321,687

(a) See estimate in Table VII-8. Based on number of non-resident anglers in 1993.
(b) See discussion in text of change in expenditures per extra day in Alaska.
(c) See discussion in text of growth in non-resident fishing.
ISER file: Nonresident angler analysis.

These estimates are based on the number of non-resident angler households that visited Alaska beginning in July 1993. However, the number of non-resident anglers visiting Alaska has been growing rapidly. As was illustrated in Figure II-7 in Chapter II, between 1983 and 1993, the number of non-resident sport anglers in Alaska (as measured by sales of non-resident sport fishing licenses) increased from 86,000 to 189,000, or at an annual average growth rate of 10.6 percent per year. In 1994, the number of non-resident anglers grew by another 16 percent to 219,000. Although data entry for 1995 license sales are not yet complete, preliminary indications are that substantial growth continued in 1995.

These data are for statewide sales of non-resident licenses. We do not have data on how the number of non-residents fishing the Kenai has changed over time. However, it seems likely that this number has grown rapidly, and will continue to grow. How rapidly it will grow will depend, in part, on management decisions which affect Kenai River sport fishing opportunities for non-residents.

As the non-resident sport fishing population grows, then the potential increase in non-resident spending that would result from some of those fishermen spending more time in Alaska due to better Kenai River sport fishing also grows. We do not have sufficient information to estimate reliably how much this growth might be. In general, we might expect the change in non-resident expenditures associated with better Kenai River fishing to grow over time, but to eventually level off due to constraints related to physical facilities, crowding, and the number of fish available.

We adjusted our estimates of the change in non-resident expenditures upward to reflect this growth in the number of non-resident anglers. As shown in the bottom part of Table VII-11, we chose 20 percent as a "low estimate" of the increase in the change in expenditures above the level estimated based on the number of anglers who fished in 1993. We chose 30 percent as a "medium estimate" of the increase and 40 percent as a "high estimate" of the increase. This results in low, medium and high estimates of the potential increase in non-resident angler spending of $633,000, $2.1 million, and $3.3 million.

Estimated Economic Impacts of Changes in Non-Resident Expenditures

Table VII-12 shows the economic impacts associated with our low, medium and high estimates of changes in non-resident angler expenditures. Our estimates of the change in Alaska employment are for an increase of 13.3 jobs in our low estimate, 45.1 jobs in our medium estimate, and 69.9 jobs in our high estimate. Our estimates of the change in Alaska payroll are for an increase of $288 thousand in our low estimate, $975 thousand in our medium estimate, and $1.5 million in our high estimate.

There is a very wide range of variation between these estimates. It would clearly be desirable to have a more precise estimate. But due to the uncertainty associated with the many assumptions needed to develop our estimates of changes in expenditures, we cannot develop a more precise estimate. We think it is likely that the economic impacts would be within the range between our low estimates and our high estimates. We also think that our medium estimates are more likely than the low or high estimates. But we cannot rule out the possibility that the actual effects might be as low as the low estimate or as high as the high estimate—or even outside this range.

Table VII-12. Order-of-Magnitude Estimates of Changes in Impacts of Non-Resident Sport Fishing Expenditures

	Estimated impact per million dollars of non-resident spending (a)	Order-of-magnitude estimates of changes in impacts due to changes in non-resident expenditures (b)		
		Low estimate	Medium estimate	High estimate
Assumed change in expenditures		$632,702	$2,141,961	$3,321,687
Type of economic impact				
Alaska Output/Sales				
Direct	$808,745	$511,695	$1,732,300	$2,686,397
Indirect	$543,533	$343,895	$1,164,226	$1,805,447
Total	$1,352,431	$855,686	$2,896,855	$4,492,353
Alaska Payroll		0	0	0
Direct	$310,269	$196,308	$664,583	$1,030,615
Indirect	$144,887	$91,670	$310,342	$481,269
Total	$455,156	$287,978	$974,925	$1,511,884
Alaska Employment		0	0	0
Direct	15.4	9.7	32.9	51.1
Indirect	5.7	3.6	12.2	18.9
Total	21.0	13.3	45.1	69.9

(a) Estimated using Cook Inlet Salmon Economic Impact Model Coefficients. For documentation of assumed allocation of expenditures among different expenditure categories in the Cook Inlet Salmon Economic Impact Model, see Appendix C, Tables C-2 and C-3.
(b) Based on estimates of changes in expenditures derived in Table VII-11.
ISER file: Nonresident angler analysis.

Summary of Changes in Economic Impacts

Table VII-13 summarizes the results of our analysis for changes in economic impacts due to changes in resident and non-resident expenditures. The changes in economic impacts are overwhelmingly attributable to changes in non-resident expenditures. In this table we have used our "medium estimates" of the changes in economic impacts due to changes in non-resident economic impacts. We consider these medium estimates more likely than our low or high estimates, but we cannot rule out the possibility that the actual effects might be significantly lower or higher.

As we discussed earlier, we cannot relate our estimates of changes in economic impacts of non-resident expenditures to specific study scenarios, because our survey responses provided no statistical basis for relating changes in non-resident visits to specific changes in the quality of Kenai River sport fishing.

Table VII-13. Changes in Economic Impacts of the Sport Fishery: Summary

	Scenario Name and Code					
Type of Economic Impact	+200K at sonar A	Higher sport bag limit B	Higher sport and dipnet bag limits C	+100K at sonar D	-100K at sonar E	Low run A3
Effects of changes in resident fishing expenditures (a)						
Change in Alaska output/sales	$40,380	$44,051	$36,671	$16,951	-$12,011	$28,663
Change in Alaska payroll	$17,404	$18,778	$15,443	$7,493	-$5,586	$13,096
Change in Alaska employment	0.8	0.9	0.7	0.4	-0.3	0.6
Effects of changes in non-resident expenditures (medium estimate) (b)						
Change in Alaska output/sales	$2,896,855					
Change in Alaska payroll	$974,925					
Change in Alaska employment	45.1					
Total (medium estimate) (c)						
Change in Alaska output/sales	$2,937,234					
Change in Alaska payroll	$992,329					
Change in Alaska employment	45.9					

(a) From Table VII-6b.
(b) From Table VII-12.
ISER file: Sport Analysis.

There are important differences between our analysis and findings with respect to changes in net economic value of sport fishing in Chapter VI and our analysis and findings with respect to changes in economic impacts of sport fishing in this chapter.

Our analyses in Chapter VI showed that better sport fishing on the Kenai—or at other Alaska sites—can significantly increase the net economic value that Alaska residents derive from sport fishing. But better fishing on the Kenai would result in relatively small increases in economic impacts attributable to resident spending. Put differently, better fishing on the Kenai would allow Alaska sport anglers to enjoy significantly more non-market value—but it would not greatly increase the total impact they have on the Alaska economy.

In Chapter VI, we did not measure changes in net economic value to non-residents. (Similarly, in Chapter IX, we did not measure changes in the net economic value of commercial fishing for non-resident fishermen). But as shown in this chapter, by bringing additional dollars into the Alaska economy, better fishing on the Kenai could substantially increase the total economic impact that spending by non-resident fishermen has on the Alaska economy.

Regional Distribution of Changes in Economic Impacts

What is the regional distribution within Alaska of the projected change in economic impacts of commercial fishing? As we discuss in Appendix I, the Alaska Input-Output Model is configured into four regions of Alaska: Southcentral, Southeast, Southwest, and Arctic-Yukon-Kuskokwim. Because the economic impacts of the Upper Cook Inlet commercial fishery and the Kenai River sport fishery are overwhelmingly concentrated in the Southcentral region, we did not report projections separately for these four regions.

The model was not designed to track in detail where economic impacts of commercial fishing expenditures occur within Southcentral Alaska. To trace the distribution of economic impacts between the Kenai Peninsula Borough and other parts of Southcentral Alaska would require development of very detailed assumptions about where expenditures by each industry occur. Even if we tried to collect data to develop these assumptions, the information would likely be out of date soon due to changes in the structure of interregional purchases, such as have likely occurred as a result of the construction of major new retail outlets on the Kenai Peninsula in recent years.

We also did not collect information in our surveys about where sport fishing expenditures occur in Southcentral Alaska. To develop rough estimates of the share of impacts that might occur within the Kenai Peninsula Borough, we made assumptions about the shares of each type of angler expenditure (and thus the share of direct economic impacts) that would occur within the Kenai Peninsula Borough. Note that expenditures for Kenai River fishing do not necessarily occur in the Kenai Peninsula Borough. or example, a sport angler fishing the Kenai River may buy gas and tackle in Anchorage. Similarly, some expenditures for fishing at other sites occur within the Kenai Peninsula Borough.

For each industry, we also assumed that the share of indirect economic impacts occurring within Kenai Peninsula Borough would be the same as for direct economic impacts. Although we believe that this probably overstates the share of indirect effects occurring within the borough, we did not have the detailed data needed to develop more reliable assumptions. We then used these assumptions to estimate the share of direct and indirect economic impacts that would occur within the Kenai Peninsula Borough. Our assumptions and calculations for Scenario A (+200K) are shown in Appendix C, Tables C-4 and C-5.

Our rough estimates suggest that most—about 80 percent—of the changes in sport fishing economic impacts would occur within the Kenai Peninsula Borough. This is because most of the projected impacts result from increased non-resident expenditures, and we assume that most of these additional non-resident expenditures would occur within the Kenai Peninsula Borough.

Chapter VIII. Profile of the Upper Cook Inlet Fishery and Assumptions for Economic Analysis

This chapter first profiles the Upper Cook Inlet commercial salmon fishery, and then estimates changes in what economists call "accounting income." Accounting income includes profits permit holders earn and payments crew members earn. It's called accounting income to distinguish it from net economic value, discussed in the next chapter. It's an important part of net economic value—but it doesn't measure all value because it doesn't include the value of fishermen's time. The estimates of changes in accounting income presented in this chapter are important for the net value analysis in Chapter IX and the economic impact analysis in Chapter X.

We estimate changes in accounting income by estimating changes in the harvest value (which represents revenues of permit holders), harvest expenditures, and crew payments.

Tables VIII-1 through VIII-4 show harvest levels, ex-vessel value, employment, and other information about the Cook Inlet salmon fishery in the 1990s. That information provides the basis for our estimates of potential changes in harvest value and expenditures and allows us to estimate changes in accounting income.

Harvest Size, Value, and Fishing Time, 1990-1994

The commercial sockeye harvest in Upper Cook Inlet includes sockeye from several river systems, but the largest run is the Kenai River late sockeye run. Table VIII-1 shows that between 1990 and 1994 the total sockeye harvest varied from as little as 2.5 million sockeye to as much as 9.3 million. The harvest of Kenai River late sockeye alone varied from about 1 million to 7 million fish.

Smaller numbers of four other salmon species are also commercially harvested in Upper Cook Inlet. The combined harvests of coho, pink, and chum salmon varied from about 1 million in 1990 to 350,000 in 1993. The reported annual catch of chinook (kings) varied from about 5,000 to 15,000 annually in the early 1990s.

Most of the Upper Cook Inlet harvest is taken with gillnets—either drift or set. As discussed in more detail in Chapter II, the drift fleet is restricted to the Central District (the area of the Upper Inlet between Anchor Point and Boulder Point). Setnetters operate on the east, west, and north shores of the Central and Northern Districts—but most of the commercial setnet harvest of sockeye goes to the east side setnetters (see Map II-1, Chapter II). The drift fleet took as little as half the commercial catch of sockeye in 1991 and as much as two thirds in 1992. The east side setnetters took between 30 and 40 percent of the annual sockeye catch in the early 1990s.

Table VIII-1. Selected Cook Inlet Salmon Harvest Data, 1990-1994

	1990	1991	1992	1993	1994
Sockeye run and harvest (number of fish)					
Total return of Cook Inlet sockeye salmon (a)	5,000,000	3,600,000	10,800,000	6,500,000	5,100,000
Total return of sockeye of Kenai Origin (a)	2,772,564	1,812,003	8,120,080	3,590,207	3,119,387
Kenai run size (e)	medium	low	high	medium	medium
Commercial harvest of sockeye of Kenai origin (a)	2,076,357	1,083,880	6,997,282	2,736,678	2,091,776
Total Cook Inlet sockeye harvest (b)					
Gillnet	3,620,573	2,206,855	9,132,042	4,770,699	
Seine	188,032	281,250	143,537	195,896	
Total	3,808,605	2,488,105	9,275,579	4,966,595	3,710,000
Upper Cook Inlet drift gillnet harvest (f)					
Sockeye	2,305,742	1,117,514	6,069,495	2,558,492	1,878,463
Chinook	621	241	615	746	460
Coho	247,453	175,504	267,300	121,828	306,217
Pink	323,955	5,791	423,738	46,457	251,602
Chum	289,521	215,469	232,955	88,823	245,854
Upper Cook Inlet East Side setnet harvest (f)					
Sockeye	1,126,975	844,156	2,838,076	1,941,706	1,482,957
Chinook	4,319	4,891	10,718	13,977	15,885
Coho	40,351	30,435	57,078	43,075	69,281
Pink	225,429	2,670	244,068	41,674	236,582
Chum	4,611	2,387	2,867	2,977	2,944
Average sockeye weight (lbs)	6.41	5.62	6.59	5.88	5.64
Harvest volume (lbs)					
Total volume of Cook Inlet harvests (b)					
Gillnet	23,192,145	12,399,425	60,147,333	28,055,791	
Seine	742,576	1,164,393	630,607	829,009	
Total	23,934,721	13,563,818	60,777,940	28,884,800	20,890,000
Total volume, all species (c)					
Driftnet fishery	19,874,014	9,215,538	45,304,704	16,813,960	
Setnet fishery	11,550,650	7,986,161	22,876,698	14,668,213	
Total	31,424,664	17,201,699	68,181,402	31,482,173	
Estimated total hours fished (d)					
Driftnet fishery	162,010	91,223	232,752	231,208	
Setnet fishery (east side only)	142,567	101,600	288,526	216,563	
Estimated harvest/hour					
Driftnet fishery	123	101	195	73	
Setnet fishery	81	79	79	68	
Harvest Ex-Vessel Value, Upper Cook Inlet Sockeye (g)	35,804,485	12,259,753	96,038,337	27,969,409	29,432,768

(a) Doug McBride and Steve Hammarstrom, Assessment of Sockeye Salmon Returns to the Kenai River, Table 1 (See Appendix G, Table G-1 for more information for 1981-1994).
(b) 1990-93 data are from Commercial Fisheries Entry Commission, unpublished data (See Appendix G, Table G-3 for more detailed data by species for 1980-93). 1994 data are from Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 1994 Salmon Season, Preliminary Data, updated 4/27/95. Note that 1994 data are for all gear types, and include small volumes of sockeye harvested by seiners.
(c) CFEC Basic Information Table #1a (See Appendix G, Tables G-5 and G-6).
(d) Estimated by ISER based on open fishing hours and number of permits reporting landings, by week. See Appendix G, Table G-15 for details of calculation.
(e) Based on run size categories described in Chapter III ("low" is less than 2 million; "medium" is 2-5 million; "high" is more than 5 million).
(f) Paul Ruesch and Jeff Fox, Upper Cook Inlet Annual Management Report, 1994, ADF&G Regional Information Report No. 2A95-26 (May 1995), Appendix Tables A1-A5.
(g) Same as (f)
ISER file: Commercial fishery overview.

Fishing Time

Estimating how long it takes the commercial fleet to take the inlet harvest is also important for calculating potential changes in fishing expenditures. The last second and third rows from the bottom of Table VIII-1 show estimates of total hours the drift fleet and the east side setnetters fished and their harvests per hour in the years 1990-1993, based on ADF&G fish ticket data. (Comparable data for 1994 were not available in time to be analyzed.)

The drift fleet fished as many as 232,000 hours and as few as 91,000 in the early 1990s. Hours the east side setnetters fished each year varied from 101,000 to 288,000. The drift fleet can harvest more fish per hour than the setnetters—more than twice as many per hour in a high-run year like 1992, but only about a third more in a low-run year like 1991.

Residents' Share of Permits and Harvests

For this study, we are estimating changes in net economic value for Alaska residents only—so an important consideration is how much of the harvest is taken by residents. As shown in Table VIII-2, Alaska residents own approximately 66 percent of Cook Inlet driftnet permits and 86 percent of setnet permits. However, the share of the total harvest Alaska residents take is slightly higher. If we define Alaska residents as those with Alaska addresses, then Alaska residents caught 72.7 percent of the driftnet harvest and 88.8 percent of the setnet harvest between 1990 and 1993. We defined residence that way when calculating the Alaska resident shares of net economic value for both permit holders and crew.[1] That residents take higher percentages of the harvest than they own of permits indicates that they are fishing more often or fishing harder—or both—than non-residents.

Table VIII-2. Residency of Cook Inlet Permit Holders

	Percent	
	Resident	Non-resident
Driftnet Permit Holders		
Total number of permanent permit holders, 1993 (a)	65.9%	34.1%
Total number of permit holders, 1994 (c)	67.2%	32.8%
Percentage of landings, 1990-93 (residency based on permit fee paid) (b)	71.4%	28.6%
Percentage of landings, 1990-93 (residency based on permit address) (b)	72.7%	27.3%
Setnet Permit Holders		
Total number of permanent permit holders, 1993 (a)	85.6%	14.4%
Total number of permit holders, 1994 (c)	84.4%	15.6%
Percentage of landings, 1990-93 (residency based on permit fee paid) (b)	86.3%	13.7%
Percentage of landings, 1990-93 (residency based on permit address) (b)	88.8%	11.2%

(a) Source: CFEC Basic Information Table #1a.
(b) Based on ISER analysis of ADFG fish ticket data.
(c) Source: CFEC Report No. 95-12N, June 1995.
ISER file: Residency

[1]A stricter definition of residency would consider as residents only those permit holders who paid resident fees for their limited entry permits. Such a definition would reduce the resident share by about one percent. However, defining residency based on the permit holder's address corresponds to the way we defined residency for sport and dipnet anglers. We obtained sport and dipnet results from surveys of households based on random digit dialing of telephone numbers in various Alaska communities. We did not ask sport anglers if they held resident fishing licenses.

Employment and Earnings, 1994

How many people work in the Cook Inlet fishery, and how are they paid? Table VIII-3 provides estimates of Cook Inlet commercial fishing employment, permit holders' revenues, and crew payments, based on our surveys of permit holders and crew members. (Details of how we developed these estimates are provided in Appendix H, Tables H-8, H-9, and H-10.)

We estimate that 2,893 persons worked in the Cook Inlet commercial fishery in 1994, half of them in the driftnet fishery and the other half in the setnet fishery. Of this total, 825 were heads of operations. In multi-permit operations (which occur mainly in the setnet fishery), many of the permits are owned by persons who are not heads of operations. An estimated 210 such permit holders were paid "as permit holders or owners"—from the profits of the operation. So we estimate there were 1,035 permit holders who were either heads of operations or who were paid out of the profits of the operations. The remaining 1,858 persons who worked in the fishery were paid in other ways. In our subsequent discussion in this report, we use the term "crew" for these 1,858 persons—which includes some permit holders who were neither heads of operations nor paid as permit holders or owners.

The most common method of payment of crew was on a share basis. We estimate that 73 percent of driftnet crew members and 63 percent of setnet crew members were paid by shares.

In the driftnet fishery, 75 percent of the operations we surveyed paid at least one crew member on a share basis. In the setnet fishery, 68 percent of one-permit operations paid at least one crew member on a share basis. This percentage declined somewhat for larger operations (to 60 percent for two-permit operations and 51 percent for three-permit operations). The most common other methods of payment were "as family members" (4.8 percent), by the day (4.7 percent), and by the season (3.3 percent).

For drift crew members paid by share, 44.5 percent were paid a share of gross revenues (revenues before expenditures are deducted). For the remaining 55.5 percent, one or more costs (most commonly fuel, food, and aquaculture taxes) were deducted from gross revenues before the crew share was calculated. For setnet crew paid by share, 53.6 percent were paid a share of gross revenues, while 46.4 percent had costs deducted before the crew share was calculated.

The average individual crew share was 13.5 percent in the driftnet fishery (for one-permit operations). The average individual crew share ranged between 9 percent and 11 percent for setnet operations with one to five permits. For operations with more permits, the crew shares were smaller.

For this study, we assumed that changes in crew income due to a reduction in commercial harvests would be a fixed share of the change in the harvest value. We based that assumption on the fact that a large percentage of crew are paid on a crew share basis. It is likely that crew paid by other methods are paid comparable amounts.

To calculate an average crew share of total harvest value, we first estimated total 1994 crew earnings by multiplying average crew earnings times the average number of crew per operation. We then divided total crew earnings by the total harvest value for 1994, as estimated from our survey responses.

Harvest value (revenues) for setnet permit holders in 1994 was an estimated $13.5 million and for driftnet permit holders $19.5 million. Total crew earnings for the driftnet fishery were 13.9 percent of total harvest value, or $2.7 million, and for the setnet fishery 29.2 percent of total harvest value, or $3.9 million. We used these shares to develop our estimates of changes in crew income.

Table VIII-3. Estimated Employment and Earnings Driftnetters and Eastside Setnetters, Central District, Upper Cook Inlet, 1994

	Driftnet	Setnet	Total
Estimated number of permits fished in 1994	580	514	1,094
Estimated total operations	567	258	825
Average number of fishermen per operation			
Heads of operations	1.0	1.0	1.0
Other workers paid as owners	0.1	0.6	0.3
Crew	1.5	4.0	2.3
TOTAL	**2.6**	**5.6**	**3.5**
Estimated total fishermen			
Heads of operations	567	258	825
Other workers paid as owners	54	155	210
Crew	830	1,028	1,858
TOTAL	**1,451**	**1,442**	**2,893**
Method of payment (for persons other than heads of operations			
Owner	6.1%	13.1%	10.1%
Share	73.3%	62.5%	67.1%
By Pick	0.4%	1.7%	1.1%
Hourly	0.3%	0.6%	0.5%
Per day	2.4%	6.4%	4.7%
Per season	2.3%	4.0%	3.3%
Family member	6.6%	3.5%	4.8%
Other	5.3%	4.0%	4.5%
Not available	3.3%	4.2%	3.8%
TOTAL	**100%**	**100%**	**100%**
Deductions for crew paid by share			
Percent with no deductions	44.5%	53.6%	49.3%
Percent with one or more deductions	55.5%	46.4%	50.7%
Estimated total crew earnings ($000)	$2,709	$3,941	$6,649
Estimated total revenues ($000)	$19,548	$13,508	$33,057
Total crew earnings as % of total revenues	13.9%	29.2%	20.1%

Source: Estimates based on ISER permit holder and crew surveys. See estimates in Appendix H, Tables H-8, H-9, and H-10.
ISER file: Crew Summary Info.

Fishing Expenditures, 1994

To harvest fish, permit holders have to spend money not only for crew members but also for various variable and fixed costs. Table VII-4 shows 1994 expenditures permit holders' reported when we surveyed them. *Variable* costs change with the harvest or the amount of time fished; they include costs of food, fuel, repairs, and supplies. *Fixed* costs are sunk costs that don't change, no matter if an operator harvests more or fewer fish or spends more or less time fishing. Those include costs of mooring and storage, insurance, licenses, and taxes.

Permit holders reported variable costs of $4.3 million and fixed costs of $9.5 million in the 1994 driftnet fishery. In the setnet fishery, variable costs totaled $2.0 million and fixed costs $4.1 million. Looked at on a per pound harvested basis, variable costs averaged 32 cents per pound in the driftnet fishery and 20 cents per pound in the setnet fishery. The higher variable costs in the driftnet fishery reflect higher costs of fuel and equipment repair. Fixed costs per pound in 1994 averaged 39 cents per pound in the drift fishery and 21 cents per pound in the set fishery. Drift fishermen pay much higher costs for mooring and storage, insurance, and property taxes.

Table VIII-4. Overview of 1994 Cook Inlet Commercial Salmon Harvesting Costs

	Total Cost or Value		Percent of Total Costs		Cost per Pound		Cost or Value per Permit	
	Drift Net	Set Net	Drift Net	Set Net	Drift Net	Set Net	Drift Net	Set Net
Total number of permits fished (a)	580	514						
Total pounds reported harvested (lbs) (b)	13,424,000	10,124,000						
Costs other than crew, boats, equipment and permits:								
Variable costs (c)								
Food	$690,806	$596,840	7.3%	14.5%	$0.051	$0.059	$1,191	$1,161
Fuel	$969,708	$379,882	10.2%	9.2%	$0.072	$0.038	$1,672	$739
Boat or camp supplies	$583,631	$392,114	6.2%	9.5%	$0.043	$0.039	$1,006	$763
Equipment repair	$1,636,749	$503,174	17.3%	12.2%	$0.122	$0.050	$2,822	$979
Other supplies	$402,315	$154,068	4.2%	3.7%	$0.030	$0.015	$694	$300
SUBTOTAL: VARIABLE COSTS	$4,283,208	$2,026,080	45.2%	49.2%	$0.319	$0.200	$7,385	$3,942
Fixed Costs (d)								
Mooring and storage	$475,161	$75,148	5.0%	1.8%	$0.035	$0.007	$819	$146
Insurance	$1,934,073	$521,230	20.4%	12.7%	$0.144	$0.051	$3,335	$1,014
Services like accountants or lawyers	$444,846	$344,595	4.7%	8.4%	$0.033	$0.034	$767	$670
Licenses, fees & association dues	$405,061	$320,658	4.3%	7.8%	$0.030	$0.032	$698	$624
Property taxes	$494,103	$304,788	5.2%	7.4%	$0.037	$0.030	$852	$593
Interest expenses (e)	$1,346,847	$466,116	14.2%	11.3%	$0.100	$0.046	$2,322	$907
Other	$101,579	$55,817	1.1%	1.4%	$0.008	$0.006	$175	$109
SUBTOTAL: FIXED COSTS	$5,201,671	$2,088,352	54.8%	50.8%	$0.387	$0.206	$8,968	$4,063
Total variable and fixed costs	$9,484,879	$4,114,432	100.0%	100.0%	$0.707	$0.406	$16,353	$8,005
Payments to crew (f)	$2,708,781	$3,940,571			$0.202	$0.389	$4,670	$7,666
Value of equipment and property (g)	$76,208,514	$56,263,756					$131,394	$109,463
Cook Inlet permit value (h)	$37,700,000	$14,597,600					$65,000	$28,400

(a) For estimates of number of permits fished, see Appendix H, Table H-1.
(b) Based on weighted responses to permit holder survey question A20. For additional detail, see Appendix H, Table H-4. Note that this estimate exceeds total harvest reported for Cook Inlet by ADF&G; thus permit holders reported harvests are biased upwards.
(c) Based on responses to permit holder survey question A13. For additional detail, see Appendix H, Table H-5.
(d) Based on responses to permit holder survey question A9. For additional detail, see Appendix H, Table H-5.
(e) It was not possible to distinguish between interest expenses for equipment or property and interest expenses for permits.
(f) Estimated from permit holder survey and crew survey responses. For details of calculations, see Appendix H, Table H-9.
(g) Based on responses to permit holder survey question A5. For additional detail, see Appendix H, Table H-7.
(h) Estimated average value for all 1994 permit sales reported by Commercial Fisheries Entry Commission in the CFEC1994 Estimated Monthly. Permit Value Report, based on sales prices reported to CFEC. The standard deviation of the reported price was $4350 for drift net permits and $9750 for set net permits. Total value estimated by multiplying by number of permits.
ISER file: Cost Overview

Permit holders also valued their boats, nets, and other fishing equipment and property at $132 million in 1994—$76 million in the drift fishery and $56 million in the set fishery. The value of Cook Inlet limited entry permits in 1994, based on sales figures from the Commercial Fisheries Entry Commission, was $37.7 million for drift permits and $14.5 million for set permits.

Estimating Changes in Harvest Value

We now turn from background information to estimates of how the ex-vessel value of the Cook Inlet salmon harvest—the revenues for permit holders—would change under our 10 study scenarios (Table VIII-5).

Assumptions About Change in Harvest Size

To estimate how the harvest value might change, we first have to consider how harvest size might change under different conditions. Eight of our scenarios assume that the commercial salmon harvest in Upper Cook Inlet would have to be reduced to allow more sockeye into the Kenai River. One scenario—Scenario A4—assumes that in a year with a high run of sockeye the commercial harvest wouldn't have to be reduced at all. The remaining scenario—Scenario E—examines the effects of reducing the number of sockeye entering the Kenai River, thereby increasing the commercial harvest. All the estimates of the change in harvests were provided by ADF&G.

The assumed reduction in commercial sockeye harvests varies from zero to 459,000 fish, depending on what we assume about run size and proposed increased in the inriver return to the Kenai. ADF&G biologists told us that in years of medium runs, they would most likely eliminate one or two emergency openings, which are only for portions of the Central District. In a low-run year, they would also eliminate a regular opening—which would be districtwide and therefore would cost the commercial fishermen many more fish.

Assumptions about Average Weight, Price, and Run Size

To assess potential changes in the value of the commercial harvest, we also have to make some assumptions about average salmon weights, ex-vessel prices, and run sizes.

For the average weight per fish, we used the average harvest weights for the period 1990-95. We assumed an average weight of 6.0 pounds for sockeye harvested in Cook Inlet. Appendix B provides documentation for our average weight calculations.

One of the most important factors affecting change in harvest value is also one of the most difficult to predict: the average ex-vessel price per pound of sockeye. For our scenarios, we used the ex-vessel price assumptions discussed in detail in Chapter III and shown in Table VIII-3. Our assumed medium price per pound is $1.43, low price $1.00 per pound, and high price $1.75 per pound.

Run size will also have a major effect on the change in harvest value—because, as we noted above, ADF&G managers would eliminate more commercial fishing time in a low-run year, thereby costing commercial harvesters many more fish.

Table VIII-5. Estimated Changes in Ex-Vessel Value of Commercial Harvest Based on ADF&G Harvest Assumptions

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price (e)
	A	D	E	A1	A2	A3	A4	A5
Change in drift-net harvest (a)								
Sockeye	-60,000	-30,000	30,000	-60,000	-60,000	-349,000	0	-349,000
Chinook	-100	-50	50	-100	-100	-300	0	-300
Coho	-1,000	-500	500	-1,000	-1,000	-33,500	0	-33,500
Chum	-6,000	-3,000	3,000	-6,000	-6,000	-47,000	0	-47,000
Pink	0	0	0	0	0	-14,000	0	-14,000
Change in setnet harvest (a)								
Sockeye	-185,000	-92,500	92,500	-185,000	-185,000	-110,000	0	-110,000
Chinook	-1,500	-750	750	-1,500	-1,500	-1,500	0	-1,500
Coho	-3,000	-1,500	1,500	-3,000	-3,000	-3,000	0	-3,000
Chum	0	0	0	0	0	0	0	0
Pink	0	0	0	0	0	0	0	0
Change in total commercial harvest (a)								
Sockeye	-245,000	-122,500	122,500	-245,000	-245,000	-459,000	0	-459,000
Chinook	-1,600	-800	800	-1,600	-1,600	-1,800	0	-1,800
Coho	-4,000	-2,000	2,000	-4,000	-4,000	-36,500	0	-36,500
Chum	-6,000	-3,000	3,000	-6,000	-6,000	-47,000	0	-47,000
Pink	0	0	0	0	0	-14,000	0	-14,000
Ex-vessel price ($/lb) (b)								
Sockeye	$1.43	$1.43	$1.43	$1.00	$1.75	$1.43	$1.43	$1.00
Chinook	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
Coho	$0.68	$0.68	$0.68	$0.68	$0.68	$0.68	$0.68	$0.68
Chum	$0.39	$0.39	$0.39	$0.39	$0.39	$0.39	$0.39	$0.39
Pink	$0.18	$0.18	$0.18	$0.18	$0.18	$0.18	$0.18	$0.18
Average fish weight (c)								
Sockeye	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Chinook	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8
Coho	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Chum	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Pink	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Change in value of drift-net harvest (d)								
Sockeye	-$514,800	-$257,400	$257,400	-$360,000	-$630,000	-$2,994,420	$0	-$2,094,000
Chinook	-$3,096	-$1,548	$1,548	-$3,096	-$3,096	-$9,288	$0	-$9,288
Coho	-$4,352	-$2,176	$2,176	-$4,352	-$4,352	-$145,792	$0	-$145,792
Chum	-$15,678	-$7,839	$7,839	-$15,678	-$15,678	-$122,811	$0	-$122,811
Pink	$0	$0	$0	$0	$0	-$8,316	$0	-$8,316
TOTAL	-$537,926	-$268,963	$268,963	-$383,126	-$653,126	-$3,280,627	$0	-$2,380,207
Change in value of setnet harvest (d)								
Sockeye	-$1,587,300	-$793,650	$793,650	-$1,110,000	-$1,942,500	-$943,800	$0	-$660,000
Chinook	-$46,440	-$23,220	$23,220	-$46,440	-$46,440	-$46,440	$0	-$46,440
Coho	-$13,056	-$6,528	$6,528	-$13,056	-$13,056	-$13,056	$0	-$13,056
Chum	$0	$0	$0	$0	$0	$0	$0	$0
Pink	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	-$1,646,796	-$823,398	$823,398	-$1,169,496	-$2,001,996	-$1,003,296	$0	-$719,496
Change in value of total commercial harvest (d)								
Sockeye	-$2,102,100	-$1,051,050	$1,051,050	-$1,470,000	-$2,572,500	-$3,938,220	$0	-$2,754,000
Chinook	-$49,536	-$24,768	$24,768	-$49,536	-$49,536	-$55,728	$0	-$55,728
Coho	-$17,408	-$8,704	$8,704	-$17,408	-$17,408	-$158,848	$0	-$158,848
Chum	-$15,678	-$7,839	$7,839	-$15,678	-$15,678	-$122,811	$0	-$122,811
Pink	$0	$0	$0	$0	$0	-$8,316	$0	-$8,316
TOTAL	-$2,184,722	-$1,092,361	$1,092,361	-$1,552,622	-$2,655,122	-$4,283,923	$0	-$3,099,703

* Assumptions and analysis for Scenarios B and C same as for Scenario A. Notes: (a) Assumptions about changes in harvest provided by ADF&G (see Chapter IV). (b) Ex-vessel price assumptions developed by ISER (see Chapter III). (c) Average harvest weight assumptions developed by ISER (see discussion in Chapter VI). (d) Calculated by multiplying change in harvest by average price by average fish weight. (e) ADF&G did not provide specific harvest assumptions for this scenario. For this table, we used the ADFG assumptions for Scenario A3 ("Low Run").

Changes in Harvest Value

We estimate the potential change in harvest value by multiplying the ADF&G assumptions about the change in the number of fish harvested by an assumed average weight per fish and an assumed ex-vessel price per pound. Table VIII-5 shows that the ex-vessel value of the Cook Inlet sockeye harvest could decline anywhere from zero to $3.9 million under the various scenarios. Values of other species of salmon the commercial harvesters would also give up would vary from zero to about $350,000.

Scenario A, which assumes a loss of 245,000 sockeye from the commercial harvest, a medium run, and a medium price, harvest value for sockeye would decline an estimated $2.1 million.

Under other scenarios, the ex-vessel value would not decline at all (in a high-run year) or it could decline by as much as $3.9 million in a year of low runs and low prices. And under Scenario E, which assumes an increase of 100,000 in the commercial harvest of sockeye, harvest value would actually increase by about $1 million.

Estimating Changes in Harvest Expenditures

After estimating changes in harvest value (revenues), we now turn to estimates of changes in harvest expenditures. We estimate changes in harvest expenditures based on permit holders' survey responses about how their costs were affected by the loss of an emergency opening on July 30, 1994, as well as on other survey responses about expenditures during the 1994 fishing season.

How might expenditures change in response to reduced fishing opportunities? In addressing this question, an important factor to consider is how total capacity in the harvesting industry might change in response to a permanently smaller average harvest. We assumed for this study that there would be no significant change in total harvesting capacity: that the number of fishing operations would remain unchanged, but that average harvest value, costs, crew earnings, and profits per operation would decline.

We assumed harvesting capacity would remain essentially the same because Cook Inlet limited entry permits command substantial prices—which suggests that both the drift and setnet fisheries are profitable at the margin. This in turn suggests that the number of harvesting operations—and total capacity—is primarily limited by the number of permits, rather than by profitability. Put differently, the main effect of reducing Cook Inlet commercial harvests would be to reduce the profitability of the fishery—which in turn would reduce the value of limited entry permits, rather than reducing the number of operations in the fishery.

If the number of operations remained the same, then a reduction in long-term average harvests would likely have relatively little effect on fixed costs. However, with fewer openings and less fishing time, variable non-labor costs would change. How might those costs change in response to fewer openings and less fishing time?

Table VIII-6 shows, for Scenario A (200,000 additional sockeye in the river) three possible methods of estimating changes in variable non-labor costs. None of these methods is entirely satisfactory.

The "cost per pound" method assumes that variable costs are a constant function of pounds harvested, with the marginal cost per pound equal to the average variable cost per pound in 1994 of 31.9 cents for the driftnet fishery and 20.0 cents for the setnet fishery. The problem with this method is that variable costs per pound are likely lower when the fishing is best, so that average variable costs per pound for the entire 1994 season may overstate average variable costs for openings at the peak of the season.

The "cost per hour" method assumes that variable costs would change in proportion to permit hours fished. As we discuss in the next section of this chapter (in the observed choices method), we estimated how open fishing hours would change for the drift and setnet fisheries for each of our study scenarios. We could use these estimates of changes in the number of hours the fishery is open to estimate the change in total permit hours fished. Unfortunately, we do not have a reliable estimate of hours fished in 1994 to use as a basis for estimating variable cost per hour. Table VIII-1 shows estimates of total hours fished in the years 1990-1993, based on ADF&G fish ticket data, but comparable data for 1994 were not available in time to be analyzed for this study. So for our "cost per hour" method in Table VIII-6, we assumed that 200,000 permit hours were fished in both the drift and setnet fisheries in 1994, approximately half-way between the number of hours fished in the medium-run years of 1990 and 1993.

Table VIII-6. Estimates of Changes in Non-Labor Expenditures for Scenario A (+200K): Comparison of Three Potential Methods

	Driftnet	Setnet	Total
Cost per pound based on average variable expenditures			
Estimated variable cost per pound, 1994 (a)	$0.319	$0.200	
Assumed change in sockeye pounds harvested, Scenario A (b)	-360,000	-1,110,000	-1,470,000
Estimated total change in costs, Scenario A	-$114,866	-$222,140	-$337,006
Cost per hour based on average variable expenditures			
Total variable costs, 1994 (based on survey responses) (a)	$4,283,208	$2,026,080	
Estimated total fishing hours (c)	200,000	200,000	
Estimated cost per hour fished	$21.42	$10.13	
Change in open hours (d)	-16	-32	
Number of vessels (e)	580	514	
Estimated lost hours	-9280	-16448	
Estimated total change in costs, Scenario A	-$198,741	-$166,625	-$365,366
July 30, 1994 Closure (based on avoided expenditures)			
Estimated change in costs for lost opening, July 30, 1994	-$130,656	-$67,286	-$197,942
Assumed ratio of change in costs for Scenario A to estimated change in costs due to lost opening July 30, 1994	2.0	2.0	
Estimated total change in costs, Scenario A	-$261,312	-$134,572	-$395,884

(a) See estimates in Table IV-4.
(b) See Table VIII-5. Calculated as change in number of fish times average weight.
(c) Assumed based on ISER estimates of number of hours fished in other "medium" harvest years, presented in Table VIII-1.
(d) ISER estimates. See discussion in Chapter VI section on observed choices method for estimating change in net economic value.
(e) See Appendix H, Table H-1, for estimates of number of permits fished.
(f) Based on responses to permit holder survey question B2a. See Appendix H, Table H-5 for more details of calculations.
ISER file: Cost Assumptions, Scenario A.

The third method, the "July 30, 1994 cost" method, is based on permit holders' survey responses about how the loss of an opening on July 30, 1994 affected their costs. According to the survey, fishing that day would have cost driftnet permit holders $130,656 and setnet permit holders $67,286. However, it is difficult to relate permit holders' estimates of costs for this specific lost opening to the potential reduction in costs associated with our study scenarios. For Scenario A, we assumed that the reduction in fishing costs would be twice as large as it was during the lost opening on July 30, 1994.

All three methods produce total estimates of reduced expenditures of comparable magnitude—between $337,000 and $396,000. However, the cost per pound method estimates larger changes in expenditures for the setnet fleet than for the driftnet fleet, while the other two methods estimate larger changes in costs for the driftnet fleet than for the setnet fleet.

We decided to use the "cost per hour" method to estimate changes in variable costs, because we believe this method is based on better data, is more straightforward, and is more directly comparable between scenarios than the other two methods. However, we recognize that the actual reduction in cost per pound not harvested would not necessarily be the same as the average cost per pound in 1994. Nor would it necessarily be the same across scenarios. In general, we believe that this method may somewhat overstate the reduction in expenditures for our medium run scenarios, because costs per pound are likely to be lower in periods of good fishing than the average for the entire season. For the same reason, this method may understate the reduction in expenditures for our low run scenarios (Scenarios A3 and A5).

Another major expenditure for permit holders—but an obvious benefit to crew members—are crew payments. How might crew payments change if fishing opportunities were reduced?

To the extent that crew shares reflect average seasonal earnings (over a period of years) necessary to attract crew to the Cook Inlet commercial fishery, crew shares might adjust up or down in the future if average harvest value decreased or increased significantly. Thus, payments to crew as a percentage of total harvest value might be somewhat higher in a low run or low price year—or somewhat lower in a high run or high price year. For this reason, our estimates of changes in crew earnings may be too low in our low run and low price scenarios (A1, A3 and A5).

Estimated Changes in Accounting Income

We can now compare our estimates of potential changes in harvest revenues and expenditures to estimate the change in accounting income. Table VIII-7 presents those estimates. The most significant assumptions are shown at the top of the table. The rest of the table shows the estimated change in harvest value and the estimated changes in harvest expenditures of permit holders, and changes in crew payments. Finally, because we are interested in how the potential change in management of Kenai River sockeye could affect Alaska residents, we estimate changes in incomes of resident permit holders and crew members.

Scenario A (200,000 additional sockeye in the river) would result in a $1.1 million loss in income to resident permit holders (50 percent of the decline in total harvest value) and a loss of $1.6 million to resident permit holders and crew combined (72 percent of the decline in total harvest value). Resident setnet permit holders and crews would bear more than 80 percent of the total loss for resident fishermen—because they are assumed to bear most of the harvest loss.

The loss in combined permit holder and crew income would only be half as great under Scenario D (100,000 additional sockeye in the river). In the low-price scenario (A1), the loss in income would be smaller because the sockeye that fishermen gave up wouldn't have been worth as much. Similarly, in the high-price scenario (A2), the loss in income would be greater because the sockeye that fishermen gave up would have been worth more. The loss in income would be highest for the low-run scenario (A3), because the decline in total harvests would be the largest. Under the high-run scenario, commercial fishermen wouldn't lose any income—because managers wouldn't have to reduce commercial harvests to allow more sockeye into the Kenai River in a year when there were so many fish.

Table VIII-7. Estimates of Changes in Permit Holders' Income and Crew Payments

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	D	E	A1	A2	A3	A4	A5
Assumptions								
Change in sockeye pounds harvested (a)								
Driftnet	-360,000	-180,000	180,000	-360,000	-360,000	-2,094,000	0	-2,094,000
Setnet	-1,110,000	-555,000	555,000	-1,110,000	-1,110,000	-660,000	0	-660,000
Variable harvest cost per pound (b)								
Driftnet	$0.32	$0.32	$0.32	$0.32	$0.32	$0.32	$0.32	$0.32
Setnet	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20
Crew income as share of total harvest value (c)								
Driftnet	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%
Setnet	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%
Alaska resident share (h)								
Driftnet	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%
Setnet	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%
Change in harvest revenues (a)								
Driftnet	-$537,926	-$268,963	$268,963	-$383,126	-$653,126	-$3,280,627	$0	-$2,380,207
Setnet	-$1,646,796	-$823,398	$823,398	-$1,169,496	-$2,001,996	-$1,003,296	$0	-$719,496
Total	-$2,184,722	-$1,092,361	$1,092,361	-$1,552,622	-$2,655,122	-$4,283,923	$0	-$3,099,703
Change in harvest expenditures (except crew) (d)								
Driftnet	-$114,840	-$57,420	$57,420	-$114,840	-$114,840	-$667,986	$0	-$667,986
Setnet	-$222,000	-$111,000	$111,000	-$222,000	-$222,000	-$132,000	$0	-$132,000
Total	-$336,840	-$168,420	$168,420	-$336,840	-$336,840	-$799,986	$0	-$799,986
Change in crew payments (e)								
Driftnet	-$74,772	-$37,386	$37,386	-$53,255	-$90,785	-$456,007	$0	-$330,849
Setnet	-$480,864	-$240,432	$240,432	-$341,493	-$584,583	-$292,962	$0	-$210,093
Total	-$555,636	-$277,818	$277,818	-$394,747	-$675,367	-$748,970	$0	-$540,942
Change in permit holder's accounting income (f)								
Driftnet	-$348,314	-$174,157	$174,157	-$215,031	-$447,501	-$2,156,634	$0	-$1,381,372
Setnet	-$943,932	-$471,966	$471,966	-$606,003	-$1,195,413	-$578,334	$0	-$377,403
Total	-$1,292,246	-$646,123	$646,123	-$821,035	-$1,642,915	-$2,734,967	$0	-$1,758,775
Change in crew payments & permit holder accounting income (g)								
Driftnet	-$423,086	-$211,543	$211,543	-$268,286	-$538,286	-$2,612,641	$0	-$1,712,221
Setnet	-$1,424,796	-$712,398	$712,398	-$947,496	-$1,779,996	-$871,296	$0	-$587,496
Total	-$1,847,882	-$923,941	$923,941	-$1,215,782	-$2,318,282	-$3,483,937	$0	-$2,299,717
Changes in income of Alaska resident crew								
Driftnet	-$54,359	-$27,180	$27,180	-$38,716	-$66,000	-$331,517	$0	-$240,527
Setnet	-$427,008	-$213,504	$213,504	-$303,246	-$519,110	-$260,151	$0	-$186,562
Total	-$481,367	-$240,683	$240,683	-$341,962	-$585,110	-$591,668	$0	-$427,089
Changes in income of Alaska resident permit holders								
Driftnet	-$253,224	-$126,612	$126,612	-$156,328	-$325,334	-$1,567,873	$0	-$1,004,258
Setnet	-$838,211	-$419,106	$419,106	-$538,131	-$1,061,527	-$513,560	$0	-$335,134
Total	-$1,091,436	-$545,718	$545,718	-$694,459	-$1,386,860	-$2,081,433	$0	-$1,339,392
Changes in income of Alaska resident permit holders and crew								
Driftnet	-$307,584	-$153,792	$153,792	-$195,044	-$391,334	-$1,899,390	$0	-$1,244,785
Setnet	-$1,265,219	-$632,609	$632,609	-$841,376	-$1,580,636	-$773,711	$0	-$521,696
Total	-$1,572,802	-$786,401	$786,401	-$1,036,420	-$1,971,970	-$2,673,101	$0	-$1,766,481

* Assumptions and analysis for Scenarios B, C and A6 are the same as for Scenario A.
(a) Change in harvest assumptions provided by ADFG multiplied by average harvest weight; see Table IV-4.
(b) See Table VIII-4 for derivation of assumptions.
(c) See Appendix H, Table H-10 for derivation of assumptions.
(d) Calculated as change in pounds harvested times variable harvest cost per pound.
(e) Calculated as change in value of harvest times crew income as share of total harvest value.
(f) Calculated as change in harvest value minus change in harvest costs and crew income.
(g) Calculated as change in crew income plus change in permit holder income.
(h) See Table VIII-2 for derivation of residency assumptions. Same shares are assumed for permit holders and for crew.
ISER file: Net Value Changes

Chapter IX. Change in Net Economic Value of the Commercial Fishery

This chapter examines how the net economic value of the Upper Cook Inlet commercial salmon fishery could change, if fishery managers decided to reduce the commercial harvest in order to let more sockeye into the Kenai River. Several groups—including limited entry permit holders, crew members, processors, and consumers—have a stake in the commercial fishery. This chapter mainly discusses potential changes in net economic value for permit holders and crew, but it also looks at potential changes for processors and consumers.

Defining Net Economic Value in the Commercial Fishery

As we did for the sport fishery, we can think of net economic value for the commercial fishery as benefits minus costs. Net value differs from the accounting income we calculated in the previous chapter because accounting income does not include the value of people's time—including the possibility that an individual who lost income from one kind of job might replace part or all of that income with income from another job. Net economic value attempts to measure all the potential changes in both monetary and non-monetary costs and benefits.

For example, suppose a crew member could have earned $5,000 from a season working for a setnet operator. But say he lost that job because of reductions in the commercial harvest and took a job as a sales clerk that paid him only $4,000. Accounting income would say the change in income was $5,000. But net economic value would say the loss was $1,000 (if the non-monetary benefits of the two jobs were the same).

Table IX-1 lists benefits and costs of the commercial fishery for five groups: permit holders (heads of fishing operations), crew members, owners of processing facilities, processing workers, and consumers. The monetary costs and benefits are much easier to understand, because they're more concrete—like wages crew members and processing workers collect and job costs they pay (like expenditures for work clothes). But non-monetary benefits and costs are also important, though less tangible. How much fishermen enjoy their jobs, for instance, influences what wages they'll accept and whether they quit fishing to take other jobs.

Table IX-1. Benefits and Costs in the Commercial Fishery

	Benefits	Costs
Permit holders	Gross (ex-vessel) revenues	Expenditures on wages, operations, and other costs
	Job satisfaction: enjoyment of the work itself, the working conditions	Opportunity costs: Lost income and satisfaction from other work opportunities and activities foregone
Crew members	Wages, fringe benefits	Work-related expenses: travel to the job, clothing, crew license
	Job satisfaction: enjoyment of the work itself, the working conditions, and lifestyle	Opportunity costs: lost income and satisfaction from other work, activities and leisure foregone
Processor owners	Gross value of products sold	Expenditures on raw fish, wages, and other costs
Processing workers	Wages, fringe benefits	Work-related expenses: travel to job, clothing
	Job satisfaction: enjoyment of the work itself, the working conditions, and lifestyle	Opportunity costs: lost income and satisfaction from other work, activities and leisure foregone
Consumers	Enjoyment of eating fish	Price of fish

Changes in Net Economic Value for Producers and Consumers

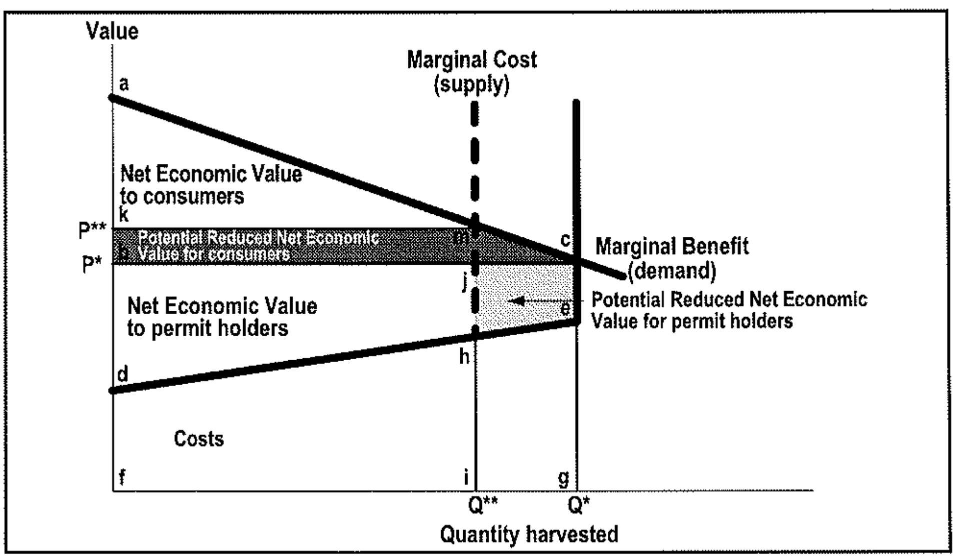
If we define net economic value as benefits minus costs, how do we measure those benefits and costs? *Net economic value to consumers* is the difference between what consumers are willing to pay for a good or service and what they actually have to pay. *Net economic value to permit holders* (heads of commercial fishing operations) is the revenue they receive, minus the costs of production, as well as job satisfaction.

Figure IX-1 illustrates the concepts of net economic value in the commercial fishery for consumers and producers, and potential changes in those values under the proposed reduction in commercial harvests. Producers include permit holders, crew members, and owners and workers in processing facilities.[1] The value of job satisfaction is difficult to quantify, and isn't explicitly shown in the figure—but it is nevertheless an important potential benefit of the commercial fishery. In net value analysis, the value of job satisfaction is often measured implicitly—for example, through people's job choices.

The marginal benefits of the commercial fishery are determined by consumers' marginal willingness to pay, which defines a downward-sloping ex-vessel demand curve for commercially harvested fish.[2] The marginal costs of the commercial fishery define a supply curve, shown in bold. The supply curve slopes upward before becoming vertical at quantity Q*—the maximum harvest, defined by the run size minus the spawning escapement. Together the supply and demand curve determine a market price—P*—at which demand is equal to supply.

In Figure IX-1, this net value to consumers *before any reduction in harvests* is represented by the triangle a-b-c. Consumers' total benefits are represented by the trapezoid a-c-g-f, while what they actually pay is represented by the rectangle b-c-g-f.

Figure IX-1. Potential Effects of Reduced Commercial Harvests on Net Economic Value to Consumers and Permit Holders



[1]Wholesalers and retailers of fish products to residents might also be included in this analysis. We ignore them here, for two reasons. First, we believe that these activities are highly competitive, so that they make relatively little money on any particular product such as Cook Inlet sockeye. Second, very little Cook Inlet sockeye is sold to Alaska residents.
[2]Technically, the demand curve for fish is a "derived demand" curve, reflecting not only the willingness to pay of final consumers, but also the (market-driven) margins paid to processors, wholesalers, retailers, and others in the distribution chain.

Producers' revenues *before any reduction in harvests* are the price times the quantity, or the rectangle b-c-g-f. The costs of production are represented by the trapezoid d-e-g-f[3]. Net economic value to producers is represented by the trapezoid b-c-e-d. Most of the producers' net benefits will be received by permit holders as the difference between their revenues and costs. This is due to the fact that Cook Inlet permits are limited, while firms may (and do) compete for Cook Inlet salmon processing until there are few if any profits left (as we discuss below). The potential profits from fishing are reflected in the value of limited entry permits.[4]

If the commercial harvest were reduced, net economic value to permit holders and consumers might change in several ways, as Figure IX-1 shows. A reduction in harvests from Q* to Q** would shift the supply curve left to the dashed vertical curve. As a result, the market price could in theory rise from P* to P**. The amount of the change in net value depends on how much the price rises, which is determined by the shape of the demand curves. (Whether the market price would actually rise at all is examined at the end of this chapter.)

If reduced harvests did cause sockeye prices to rise, *the net economic value to consumers* would decline from the area represented by the triangle a-c-b to the area represented by the triangle a-m-k. The change in area shown in Figure IX-1 includes the effects of both a change in price and a change in quantity. But if the price remained unchanged, or changed very little, the only decline in net value to consumers would be the result of reduced quantity. That decline is represented by the small triangle m-c-j. (Keep in mind that most Cook Inlet salmon are sold outside Alaska—so any decline in net economic value would mostly be for consumers outside the state.)

If the price rose when the harvest was reduced, changes in net economic value for permit holders would depend on how much the price rose—whether the price increase would be large enough to offset the loss in harvest. But if the price remained unchanged, or changed very little, the economic value would decline by the area represented by the trapezoid j-c-e-h, which is the difference between the value of the lost harvest amount and the cost of catching that amount.

It's important to realize that if a change in management led to a permanent reduction in commercial harvests, all the effects would fall on current permits owners. As long as these permit holders continued to fish, they would be the ones to experience smaller profits. If they decided to sell their permits, the market value of the permits would have declined to reflect the lower value of expected future profits. As a result, new entrants to the fishery would be able to offset the decline in harvest value by paying less for their permits, while the sellers would experience a capital loss.

In the remainder of this chapter we first discuss estimates of changes in net economic value from the harvesting sector—permit holders and crew members—where we think most of the changes are likely to occur. Then we discuss changes in net economic value for the processing sector and for consumers.

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[3] The costs of production include only the costs of the resources (labor and capital) used to harvest the fish. They do not include other monetary costs fishermen pay, like taxes or payments for limited entry permits. In practice we are assuming that these costs are fixed, so they don't change profits either. They are considered transfers of economic value between fishermen and other individuals or the government rather than costs of production. Of course taxes and other payments are costs to the fishermen, but they are benefits to the government, banks, or former permit holders—so in economic analysis they cancel out.

[4] Some permit holders may be creating economic value, even if they are losing money. For instance, if a current permit holder is making payments on a limited entry permit that he bought when permit prices were much higher than they are today, he may be paying too high a cost, relative to revenues he makes from fishing. But he is still creating economic value—because the former permit holder is getting some of the benefits. Again, the change in profits and economic value can be positive, even if permit holders start out losing money. (Their losses could be reduced.)

Methods of Estimating Change in Harvester Net Value

Net economic value for permit holders (heads of fishing operations) and crew might change in a number of ways if commercial harvests were reduced, and there are a number of ways to estimate these changes. The important criterion that a method must satisfy is that it must provide a way to estimate the value permit holders and crew members place on their time. (See Table IX-1.) We in fact used three methods to assess change—two methods to assess changes in value for permit holders, and one to assess changes for crew members.

- **Observed choices method:** An indirect method that uses observations about permit holders' historical landings and past participation to assess potential changes in the profitability of fishing, if commercial fishing opportunities were reduced. It looks only at changes in net economic value for permit holders (heads of fishing operations). This method is analogous to the travel cost method we used for assessing potential change in the sport fishery.
- **Contingent valuation method:** A survey-based method to directly estimate the value permit holders would place on changes in their harvests. It is analogous to the contingent value method used to assess change in the sport fishery. Again, this method estimates just change in net economic value for permit holders.
- **Job ranking method:** An indirect method that uses crew survey responses to value potential changes in monetary and non-monetary benefits for crew members. This is the only method that explicitly estimates changes in net value for crew members.

Table IX-2 show how accounting income differs from net economic value, and compares the three methods of estimating changes in net value for permit holders and crew members. If commercial harvests of Kenai River sockeye were reduced, revenues, costs, job satisfaction, and other factors could be affected in a number of ways.

The table shows that accounting income measures just changes in revenues and expenditures—which are a major part but not all the potential changes.

For permit holders, the most obvious effect, and the easiest to measure, is the drop in revenues from fish sales. They might be able to partially offset those revenue losses by reducing their payments to crew members or their non-labor costs such as fuel; by working at other jobs; or simply by enjoying increased leisure. Job satisfaction among permit holders might also decline. The observed choices and contingent value methods both measure all these potential components of change for permit holders.

For crew members, the most obvious change would be loss of income, if reduced commercial harvests meant less work for them. Crew members might also experience reduced job satisfaction. These losses might be partially—or even fully—offset by increased earnings from other jobs or by increased opportunities for leisure. Only the job ranking method explicitly estimates these changes.

We estimate total changes in net economic value for commercial fishermen by adding together the changes for permit holders and crew members.

Table IX-2. Comparison of Measures of Change

Group affected	Components of change if commercial harvest opportunity declined	Accounting income	Observed behavior method	Contingent valuation method	Job ranking method
Permit holders	Decrease in revenues from fish sales	X	X	X	
	Decrease in costs other than payments to crew	X	X	X	
	Decrease in payments to crew	X	X	X	
	Increase in permit holder income from other work		X	X	
	Increase in permit holder leisure		X	X	
	Decrease in permit holder job satisfaction		X	X	
Crew	Decrease in payments to crew	X			X
	Increase in crew income from other work				X
	Increase in crew leisure				X
	Decrease in crew job satisfaction				X

Observed Choices Method

Description of Method

The observed choices method is analogous to our travel cost analysis of changes in net economic value of the sport fishery in Chapter VI. This method estimates changes in economic value for Central District set and driftnet permit holders, based on a statistical analysis of historical economic and management data from the Cook Inlet commercial fishery. Appendix B provides a technical discussion of our methods, including detailed statistical estimation results.

We analyzed information on how the fisheries have actually been prosecuted in the past to estimate how profits vary under different stock abundance and market conditions. We used Alaska Department of Fish and Game (ADF&G) landings records, along with information on fishery openings in each district each week, to estimate how net earnings of permit holders vary with run size, salmon prices, open fishing hours, and the availability of other fishing opportunities.

Profits and fishing costs are not observed directly in fish harvest data. Instead, we observe participation in a variety of fisheries at different times and under different conditions. Rather than estimating profits or costs directly, we estimate cost and profit relationships indirectly, by assuming that participation is an indicator of expected profitability.

The observed choices method builds on the assumption that permit holders participate in the Cook Inlet salmon fisheries during weeks (and years) when the fishery is most profitable for them, relative to other opportunities. When conditions change slightly between weeks so that a permit holder who did not fish the week before now chooses to fish, we infer that the fishing operation crosses the break-even point to profitability, compared with alternative activities. This inference allows us to further infer how fishing conditions affect profitability. If past behavior is a guide to the future, we can then predict how variations in open fishing hours under different run size and price assumptions will affect net profits.

Because the observed choices method generates net value estimates from choices among a set of opportunities, it measures *relative* rather than absolute earnings among the choices. That means that when the method measures changes in earnings for one of the opportunity to fish for Cook Inlet salmon, it measures just differences in operating earnings, ignoring fixed costs. In the short run (one year) permit holders can't avoid fixed costs simply by not fishing during certain periods. This means that the method properly counts changes in earnings only for people who are actually fishing that season, or who would be fishing if it were not for the regulatory changes.

The change in relative net earnings we estimate captures much of the net value we want to measure. As long as Cook Inlet salmon management does not affect the value of alternative opportunities—either fishing or other activities—then the change in relative net value equals the change in total net value. Permit holders make participation decisions based not only on net money earnings but also on job satisfaction, so changes in permit holders' job satisfaction are implicitly included in the estimates of change in net value under this method. While the method includes an estimate the change in total net benefits resulting from the change in management, it cannot easily distinguish monetary components from non-monetary components (i.e., job satisfaction) of value. And this method does not estimate changes in net value for crew members, since permit holders rather than crew members generally make the decisions about when to go fishing.

Variation in Fisheries Participation by Week

Our analysis is based on historical variations in participation in the Cook Inlet drift and setnet fisheries by week. To achieve spawning escapement goals, managers have in the past relied almost exclusively on varying commercial openings (times during which fishing is permitted) in various parts in the inlet. Commercial fishing operators plan their activities around regularly scheduled openings and "emergency openings" that managers typically add during the peak fishing weeks of the season. Regular 12-hour openings occur on Mondays and Fridays of each week from the third week of June through August for both drift and setnet fisheries.

Although the fisheries open in June every year, many permit holders do not start fishing until the emergency openings begin at the peak of the sockeye season. Emergency openings may occur at any time, but usually begin early in July and continue into August. While the pattern is similar for both fisheries, the set fisheries usually close earlier in the season than the drift fisheries. Biologists generally open both fisheries nearly every day for several weeks after the management target for Kenai River sockeye has been met—usually by the third week of July.

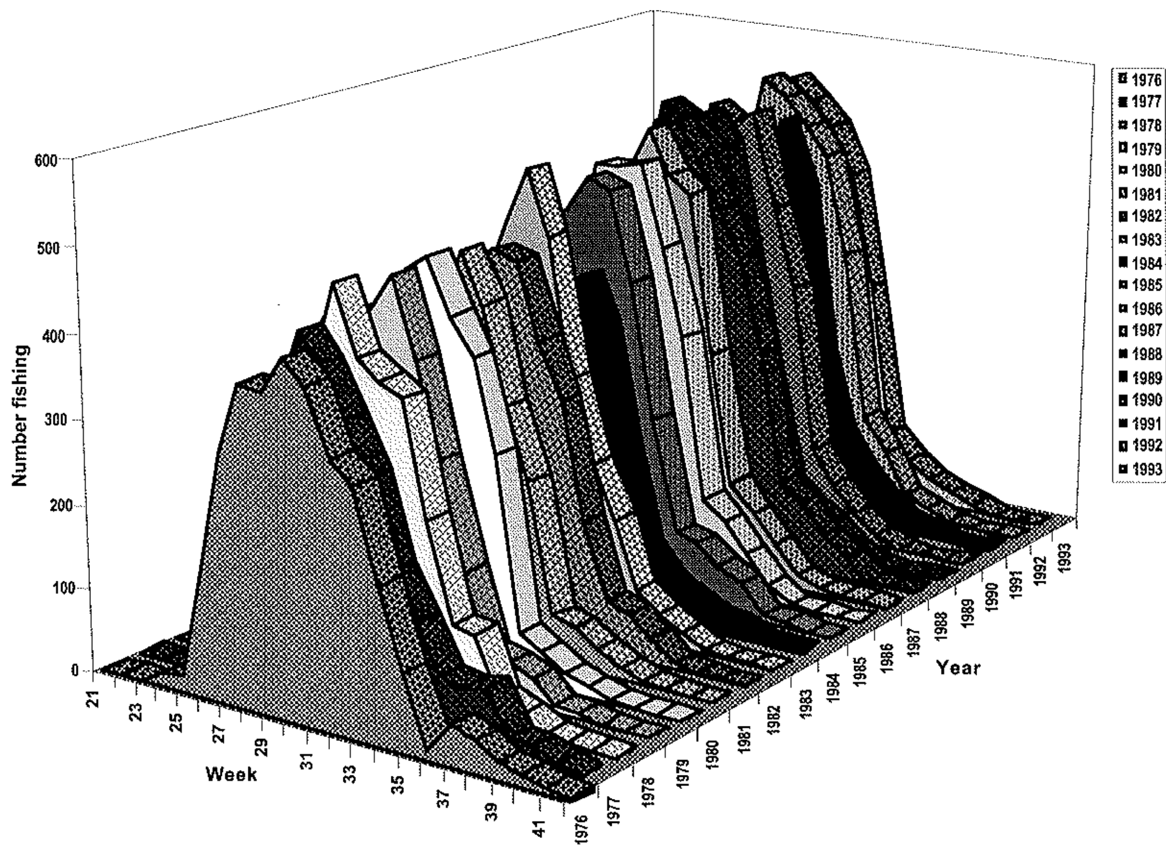
The observed choices method estimates net values by assuming that the number of permit holders fishing actually does vary with fishing and market conditions. If the number fishing were always the same, or varied randomly from week to week and year to year, it would not be possible to link changes in participation with changes in factors that affect profitability.

Landings data for the Cook Inlet set and drift fisheries show that participation does in fact vary across the season and across years. Figure IX-2 shows the number of setnet permit holders recording landings by week and year from 1976 through 1993, the latest year for which complete data are available.

The figure shows clearly that participation varies greatly over the season, with the pattern varying somewhat from year to year. Very few operators began fishing before the third week in June — when regular openings now usually begin—even when the season was open during that period. Hardly anyone ever fishes after week 36 (around September 1). Participation increases strongly every year as the run builds and then falls rapidly as returns tail off, but the pattern differs somewhat each year. Participation figures for the drift fishery show a similar pattern, except that the drift fisheries were closed due to oil spills in 1987 and 1989.

If managers did increase the Kenai River sockeye management target, that change could change the pattern of participation. Permit holders would be able to decide when it was best for them to plan to go fishing and when to do other things.

Figure IX-2. Number of People Fishing Cook Inlet Setnet Salmon (S04H Permits) by Year and Week



Managers would most likely allow more fish into the river by varying the emergency openings during the middle of July. Exact timing of the changes, of course, would vary depending on the timing of the runs each year. These weeks correspond to weeks 29 and 30 of the calendar year. Our analysis of changes in commercial fishing net values therefore focuses on estimating effects of regulatory changes on fishing hours during weeks 29 and 30.

An anticipated change in hours of commercial openings during a given fishing week may cause some permit holders to decide to change fishing operations for the entire week. For example, if emergency openings are unlikely to occur during the second week of July, some permit holders may skip that week of fishing entirely (i.e., forego the regular openings as well). Others may choose not to begin fishing for the year until the third week in July, or to skip the year entirely if the price is low or the expected run size is small. Estimation of changes in net values from allocation changes requires estimating how changes in fishing hours will affect these decisions.

Figure IX-2 suggests a seasonal variation in participation that is relatively similar from year to year over a long period of time. To explore whether this long-term pattern is associated with changes in profitability of fishing, we estimated a statistical relationship economists call a *supply response*. This relationship assumes that the amount of fishing effort supplied by each gear group each week depends on the average harvest per week, the average ex-vessel price, and the earnings from alternative work. Both the price and the harvest rate—a simple measure of catch per unit of effort—should increase profits and draw more people into the fishery.

Higher earnings in alternative work would be likely to decrease fishing. To estimate fishermen's potential earnings in past years from alternative work, we used the Alaska average construction wage to represent an index of alternative earnings. While prices and harvest rates vary each week, we considered only year-to-year changes in real wages. We adjusted prices and wages for inflation to 1993 dollars using the Anchorage Consumer Price Index.

We estimated the following statistical relationship for the number of setnet permits not fished in any given week, using historical data for 1976 through 1993:

(IX-1) log(number of permits-number fished) =
6.22 - 0.18*log(price) - 0.20*log(pounds) + 0.42*log(wage)

[Number of observations = 305; R-squared = .74; t-statistics are -3.2 for log(price), - 12.2 for log(pounds) and 2.0 for log(wage). See Appendix B, Table B-1 for full details of equation.]

where "log" refers to the natural logarithm. The equation says that historically a 10 percent increase in salmon prices *decreased* the number of permit holders *not fishing* in a given week by 1.8 percent. Our choice to explain variation in people *not fishing* rather than fishing simply reflects the choice of a functional form for the supply response that provides a better fit to the data. A 10 percent increase in catch rates reduced the number of idle permit holders 2.0 percent. If higher prices and harvest rates decrease the number of unfished permits, then they increase the number of people fishing, as we expected.

We estimated a similar statistical relationship for drift permit holders:

(IX-2) log(number of permits-number fished)=
-2.16 - 1.32*log(price) - 0.71*log(pounds)+3.64*log(wage)

[Number of observations = 210; R-squared = .77; t-statistics are -5.5 for log(price), - 11.3 for log(pounds) and 3.5 for log(wage). See Appendix B, Table B-2 for full details of equation.]

The results shown in equations (IX-1) and (IX-2) suggest that the effects of price and harvest rate have a much larger effect on the number of idle drift permit holders than setnet operations. Economists call this a more *elastic supply response*. It means that the costs incurred by drift fishermen to fish an additional week of the season are likely to be larger—and incremental profits smaller—than those of setnet operations.[5]

These simple supply response equations suggest that participation in the Cook Inlet drift and setnet salmon permit holders respond consistently over a long period of time (17 years) to profit incentives in a way that makes economic sense. However, we are only able to estimate a crude supply relationship, with the aggregate data, that could only provide an imprecise measure of changes in costs and profits. The observed choices method looks more closely at details of fishing activities. Although practical limitations of the method—basically, that it uses a large amount of data—limit us to analyzing the fisheries over a four-year period, the intensive look at the fisheries over several years with widely varying run size and price can provide a much better estimate of the change in net value.

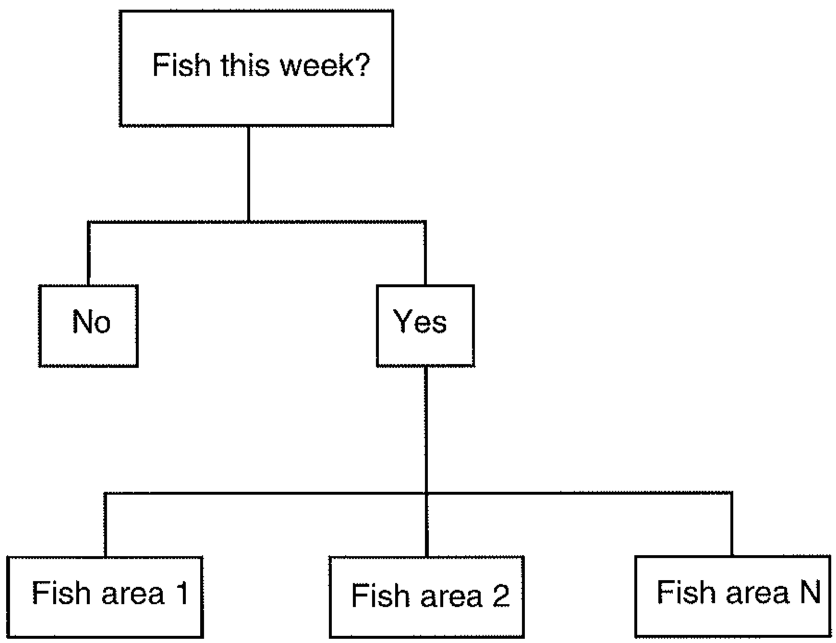
[5]As explained in Appendix B, equations (IX-1) and (IX-2) were estimated assuming that harvest rates are not affected by the number of people participating. This might not be true, imparting a potential bias in the coefficients estimated for the equations. The extent of this bias is unknown, and we did not try to analyze it or correct for it, since we use these equations only to illustrate that a positive supply response exists.

Weekly Choice Model for Drift Fishermen

Our weekly choice models identify profitable fishing opportunities by examining individual choices from among a set of discrete alternatives over a weekly time horizon. In estimating profit and cost functions for the fishing business from observed choices of permit holders, we presume that fishing operators consider crew payments, including crew shares of gross revenues, as costs when they decide when and where they will fish. If changes in harvest levels reduce crew shares below the crew members' opportunity costs, captains will have to raise the crew share percentages to retain their crews. This change would reduce profits for permit owners by still more, but leave incomes of crew members unaffected.

Cook Inlet drift and set fisheries involve completely different operations with different fishing choices. Drift fishermen use relatively small, fast boats to pursue schooling salmon as they migrate toward the mouths of spawning streams. This mobility gives them a wide set of choices for where to look for fish at any given time. We model the drift fisheries, therefore, in a two-stage choice structure summarized in Figure IX-3. Drift captains choose whether or not to participate in the fishery during a given week, assuming that if they do fish, they will do the bulk of their fishing in the most profitable area available. We first, therefore, discuss the selection of the fishing area if that the drift permit holder chooses to participate that week.

Figure IX-3. Choice Structure for Drift Permit Holders



We assume that the permit holder selects the fishing area that he or she expects will yield the largest expected profit. Because a number of factors cannot be forecast perfectly in advance—such as the weather, location of fish, other demands on their time, etc.—we can only say that the probability of selection of a given fishing area is higher if the expected profit is higher. That is, if p_{it} is the probability that the individual will choose area i in period t, then we assume p_{it} depends on profits, π_{it}, then the equation we estimate assumes that the natural logarithm of the relative probability of selecting two areas i and j is proportional to the ratio of the profits:

(IX-3) $$\log \frac{p_{it}}{p_{jt}} = \frac{\pi_{it}}{\pi_{jt}}$$

where

π_{it} = *Gross Revenue*$_{it}$ - *Operating Cost*$_{it}$

and *log* represents the natural logarithm. If the equation corresponding to the probability of selecting area *i* out of *N* area choices, given that the permit holder goes fishing that week, is

(IX-4)
$$p_{it} = \frac{e^{\alpha\pi_{it}}}{\sum_{j=1}^{N} e^{\alpha\pi_{jt}}}$$

We do not have weekly data on components of operating costs such as fuel, food, gear replacement, or labor. Instead, we assume that operating costs from fishing in an area depend on pounds landed, distance from residence and home port to the area, and the relative time available to fish in each area. Some fishing areas are open longer or more often than others during specific weeks of the season. Fishing time might either raise or lower operating costs. On the one hand, more fishing time needed to catch a given amount of fish might increase costs such as fuel, food, and labor. On the other hand, longer fishing hours per week, *for any given expected total catch,* provides more flexibility to schedule fishing around tide changes, weather, and other time commitments.

We estimate the equation (IX-4) for Cook Inlet drift permit holders using weekly landings data for weeks 26 through 36 for the years 1990 through 1993. The selected fishing area is defined as the statistical area in which the permit holder landed more than 50 percent of total salmon pounds during a given week (we combined adjacent statistical areas 24510 and 24570 because relatively few boats fished primarily in these areas). This gives us a total of six area choices in which Cook Inlet drift fishermen regularly harvest salmon. Gross revenue and pounds landed are derived from state landings records, and weekly fishing hours by area are derived from the annual management reports.

To estimate the choice equation, we first need to predict what catch and gross value would be in the areas that were available for fishing but which the individual permit holder did not select that week. We estimated separate regression equations for pounds and value landed for each of the six areas as a function of hours of fishing openings in each area each week, explicitly distinguishing corridor from non-corridor open hours for eastside areas. Other variables added to these equations were vessel length and horsepower and separate constant terms for each week and year.

We estimated the multinomial logit model to predict to drift permit holders' choice of fishing area. The choice of fishing area is a function of estimated relative profitability (equation IX-4), which depends on the regression predictions of what the harvest quantity and value would be in each open fishing area. Permit holders' choices of areas under varying prices and catch rates imply the following equation for expected profits:

(IX-5)
$$\pi_{it} = \text{Gross Revenue} - 0.85{*}\text{Quantity} - 0.0000014{*}\text{Quantity}^2 + 3327{*}\log(\text{hours}) - 25{*}\text{miles}$$

[Number of observations = 12753; t-statistics for multinomial logit estimation are 27.3 for revenues, -19.9 for quantity, -16.4 for quantity squared, 56.9 for log(hours), and -23.7 for miles. See Appendix B, Table B-3 for full details of multinomial logit estimation.]

The coefficients on the implied profit equation measure how different factors affect costs. The equation suggests that incremental costs for the drift fleet are approximately constant at 85 cents per pound for differing harvest rates, but rise when catch rates are large. Longer openings significantly increase profits, and costs rise with distance (miles) from Homer.

The participation choice depends on the expected maximum profit that could be obtained from any of the area choices. Using the specific formulation chosen for equation (IX-4), one can construct an index from the fitted values of the equation that is equal to this expected weekly profit (except for a constant scale factor). This index is traditionally called the "inclusive value" by economists, because it includes the contribution to net value of all the available choices. It is given by the formula

$$\text{(IX-6)} \qquad Incl_t = \log\left(\sum_{i=1}^{N} e^{\alpha\pi_{it}}\right)$$

where $\alpha\pi_{it}$ represents the predicted profits in each area and week from equation (IX-4). Since the constant scale factor does not vary, a change in calculated inclusive value from a change in fishing conditions represents an estimate of the change in net value for a week of fishing. The inclusive value is based only on weekly relative profits, so it does not include items that might vary across permit holders or over time but not across fishing areas.

The participation equation we estimate is:

$$\text{(IX-7)} \qquad p_t = \frac{e^{v_t}}{1+e^{v_t}}$$

where $v_t = -7.54 + 0.57 * Inclusive + 0.008 * hours + 0.099 * length - 0.00027 * hp$

and P_t is the probability of participating in week t.

[Number of observations = 29347; t-statistics for logit estimation are 33.8 for inclusive value, 11.6 for hours, 51.4 for length, and -3.1 for horsepower. See Appendix B, Table B-4 for full details of logit estimation.]

Hours represents the maximum fishing time available that week. *Length* and *horsepower* refer to length and horsepower of the vessel usually used by the permit holder for drift salmon fishing. We derived values for these variables from state landings and vessel license records.[6] Permit holders with larger vessels were more likely to go fishing for any expected maximum operating profit, possibly indicating the ability to fish profitably in less desirable weather conditions. Higher horsepower for the vessel diminished participation, possibly indicating higher overall operating costs.

Weekly Choice Model for Setnet Fishermen

Setnet operators face different choices from drift boat captains because they are restricted to a single fishing location. Instead of modeling fishing choices as a choice of areas, we focus on a subset of approximately ten percent of setnet permit holders who engaged in other fishing activities during the Cook Inlet salmon season as well as setnet fishing. It is not possible to determine from the data how many operations these permit holders represent. However, an analysis of landings for these permit holders when they were fishing their setnet permits shows that their catch rates and season length are representative of those of the typical permit holder for the fishery. Consequently, we feel that it is appropriate to use estimates of changes in profits per permit holder for this group to estimate changes in profits for the typical setnet permit holder.

For the setnet permit holders who have alternative fishing opportunities, we group their choices into five options. These include fishing the setnet permit, participating in other fisheries, and not fishing that week. Alternative fisheries modeled include halibut, other salmon fisheries, and all other fisheries. Figure IX-4 summarizes the choice structure for setnet fishermen.

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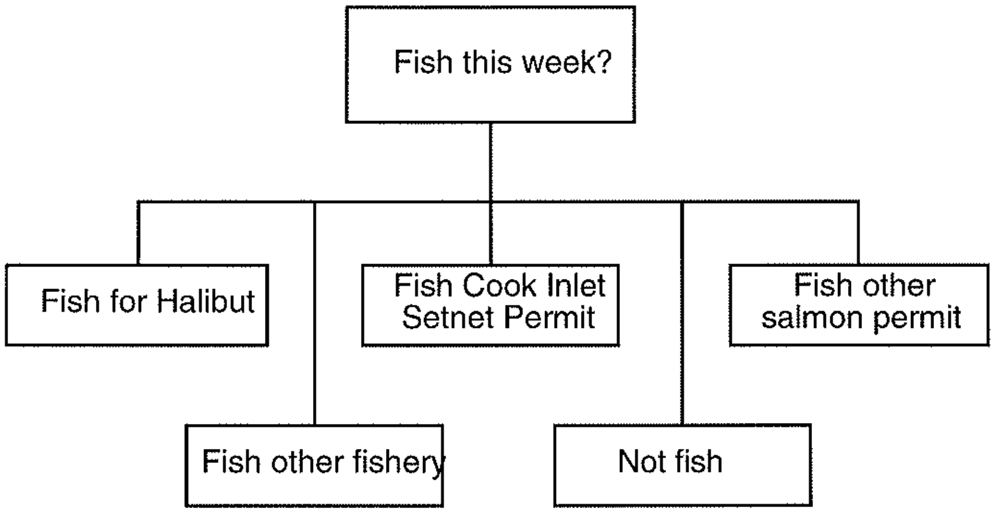
[6] Another variable that might explain the participation choice would be the income available in alternative work. We included the construction wage to represent an index of alternative income in the simple supply equations (IX-1) and (IX-2) estimated above. We explored adding the construction wage to equation (IX-7), but over the four year period of data used for the observed choice models, this variable did not vary enough to test whether it might explain participation choices.

Figure IX-4. Choice Structure for Setnet Permit Holders



We assume as before that the choice of activity depends on the expected net earnings from the activity. We use the same equation as before, except that the subscript i in equation (IX-4) now corresponds to the alternative activity instead of to the alternative area. The *not fishing* alternative represents all productive non-fishing uses of people's time. While other salmon, and other fisheries are available for fishing in every week—at least one setnet permit holder made landings in these fisheries every week in every year—the halibut fisheries are assumed to be available only in weeks when Alaska halibut landings took place. Setnet fisheries are also assumed to be unavailable during weeks when the Central District setnet fishery was closed.

We assume profit functions for each alternative fishery that are similar to the ones estimated for the drift fishery, based on the same data sources. However, we do not include the hours variable because no comparable data are available on fishing hours for any of the alternative fisheries to setnet salmon fishing. We again estimate equations to predict the catch and gross revenue from each fishing alternative from landings data for setnetters during weeks 26 through 36 from 1990 through 1993. For setnet landings, these equations model weekly catch and value as a function of open fishing hours north and south of the Blanchard Line, constant terms for each week and year, and the average weekly harvest for the individual computed over the weeks that the permit holder actually recorded landings. For other fisheries, we predict catch and value as a function of the length, gross and net tons, and horsepower of the boat that the permit holder usually used for this fishery, as well as separate constant terms for the weeks and years.

The implied setnet profit equation is approximately linear, with an incremental cost of 8 cents per pound[7], compared with 85 cents per pound for the driftnet fishery. This is consistent with the results of our supply response equations (IX-1 and IX-2) which suggested a much more elastic supply response for the driftnet fishery. The higher estimated incremental cost for driftnet permit holders does not necessarily mean that profits for drift permit holders as a whole are smaller, because these figures do not take fixed costs into account. However, they suggest strongly that most of the effects of a potential reduction in harvests for setnet operations would be to reduce profits, while harvest reductions for the drift fleet would mainly reduce participation.

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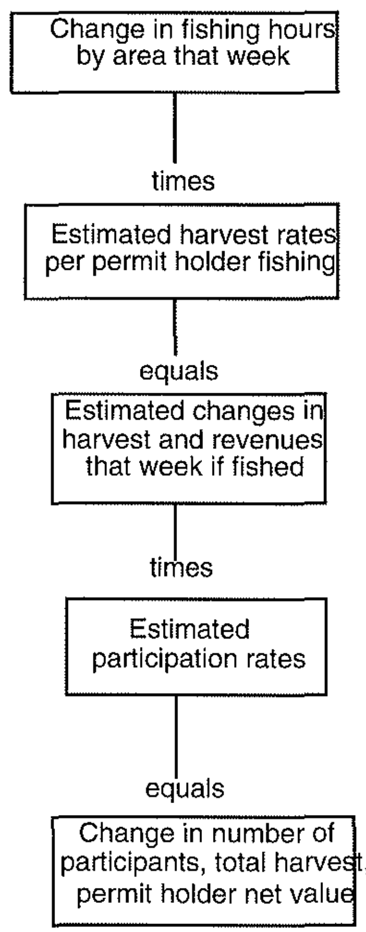
[7] These incremental costs per pound are quite different from the average variable costs per pound reported in Table IX-6 for two reasons. The landings model uses a different definition of costs, and the costs implied by the model are incremental rather than average variable.

Projected Changes in Fishing Hours and Harvests

The starting point for estimating the change in net economic value is estimating how fishing opportunities change for drift and setnet harvesters. In Chapter IV, we discussed the assumptions ADF&G provided about how openings would change for each scenario and the resulting changes in commercial harvests. The observed choices method requires more detailed assumptions about changes in the timing and location of openings. Therefore, we developed assumptions about the reduction in hours of regular and emergency openings, by statistical area, needed to increase the sockeye return to the Kenai River by the target amount for each scenario.

We assumed that the changes in fishing openings would all occur during the third and fourth weeks of July. We started with a hypothetical reduction in fishing hours (all in the corridor north of the Blanchard Line for the medium run scenarios). Then we adjusted the changes in fishing hours by simulating participation and harvests using the choice models until the projected fishing effort and harvests yielded the assumed management target (200,000 more Kenai River sockeye, for example, in scenario A). The actual procedure for simulating the choice model for the fishery is quite complex, and is illustrated in Figure IX-5.

Figure IX-5. Procedure for Simulating Observed Choices Model for Evaluating Effects of Management Changes



Change in fishing hours adjusted until the total harvest equals the assumed scenario change in salmon harvest for that gear group.

The top half of Table IX-3 shows the assumptions about the change in hours fished under each scenario and the resulting change in total harvest derived from this simulation procedure. We estimated the landings model using data from the 1990-93 fishing seasons. The model's predictions generally confirm that ADF&G assumptions for each scenario (shown in Table IV-3) are reasonable. However, the landings model projects that the loss of a regular opening would cause a larger reduction in driftnet catch than ADF&G assumes when prices are in the medium and high range, but a smaller reduction when prices are low. Our model projects that when sockeye prices and returns are both low, fewer drift boats will be fishing, and it will be easier to manage the harvest.

The model projects that longer setnet closures than driftnet closures would be needed to achieve management targets, but in practice set openings typically last longer than drift openings. Under the low run scenario (A3), the reduction in fishing time is greater for the drift fleet but less for setnetters than under the medium run scenario (A). Under the low run/low price scenario (A5), the reduction in fishing hours is greater than for the low run scenario because the model projects fishing effort would be lower. The low run scenario requires that the commercial fleet forego one regular opening districtwide as well as one or two emergency openings in the corridor to allow 200,000 more sockeye into the Kenai River. The loss of a regular opening would have a much greater impact on the fleet, because it would affect the entire Central District, not just the corridor north of mid-Kalifonsky Beach.

Measuring the Change in Net Value for Permit Holders

Our landings model predicts that the fleet would respond to the changes in openings in several ways. The exact formulation for the drift fleet differs from that for the setnet operations.

For a drift operator, changing time open for fishing in an area first changes the predicted catch that week, if the operator chooses to fish there. The change in potential expected catch and revenues affects the best area in which to fish, if the operator were to go fishing that week. Finally, the change in expected profit from fishing opportunities—measured as the change in inclusive value calculated in equation (IX-6) from the choice equation—affects the decision whether to fish at all that week, represented in the drift participation equation (IX-7).

The inclusive value—defined according to the formula in equation (IX-6)—corresponds to the expected maximum profit available to the drift permit holder from the choice sets available that week. Commercial permit holders have other uses of their time besides fishing. Some of these alternate activities may earn money. The participation equation for drift permit holders measures the relative value of fishing compared to other uses of time. The formula for estimating the effect on net value for a permit holder for a week of a change in fishing hours, landings, and gross value, as follows:

$$\text{(IX-8)} \qquad \textit{Change in drift value} = \frac{\log\left(1+e^{v_{1t}}\right)-\log\left(1+e^{v_{2t}}\right)}{\alpha\gamma}$$

where v_{kt} is the exponent in the participation equation given by equation (IX-7) evaluated for scenario k, α is the coefficient on revenue in equation (IX-4)—estimated as 0.000514 in Table B-3—and γ is the coefficient on inclusive value in the participation equation (0.57). The total change in net value for the fishery as a whole is simply the change in net value calculated above times the number of permit holders.

For setnet operators, the landings model predicts a simpler response to changes in openings, since setnetters do not have the opportunity to change their fishing area during the season. Changing

Table IX-3. Observed Choices Method Estimates of Changes in Net Value

	Scenario Name and Code*								
					+200K at sonar				
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price	Low run, high price
	A	D	E	A1	A2	A3	A4	A5	(none)
Ex-vessel price ($/lb)	$1.43	$1.43	$1.43	$1.00	$1.75	$1.43	$1.43	$1.00	$1.75
Number of permits									
Drift net	583	583	583	583	583	583	583	583	583
Setnet	745	745	745	745	745	745	745	745	745
Change in average hours fished									
Drift net	-16	-8	7	-16	-16	-24	0	-28	-24
Setnet	-32	-16	17	-32	-32	-25	0	-28	-24
Change in pounds harvested									
Drift net	-430,865	-223,239	226,194	-430,865	-430,865	-3,043,029	0	-1,746,159	-3,531,862
Setnet	-1,072,144	-514,737	512,277	-1,072,144	-1,072,144	-708,447	0	-724,298	-709,817
Total	-1,503,009	-737,976	738,471	-1,503,009	-1,503,009	-3,751,476	0	-2,470,457	-4,241,679
Estimated change in net value per permit									
Drift net	-$451	-$212	$182	-$91	-$576	-$2,648	$0	-$758	-$4,648
Setnet	-$1,409	-$656	$623	-$791	-$1,870	-$1,106	$0	-$752	-$1,384
Estimated total change in net value									
Drift net	-$262,981	-$123,655	$105,983	-$53,138	-$335,701	-$1,543,740	$0	-$442,136	-$2,709,871
Setnet	-1,049,823	-488,990	464,307	-$588,964	-$1,393,018	-823,795	0	-560,042	-1,030,871
Total	-1,312,804	-612,645	570,290	-642,102	-1,728,719	-2,367,535	0	-1,002,178	-3,740,742
Alaska resident share									
Drift net	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%
Setnet	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%
Estimated total change in net value to Alaska residents									
Drift net	-$191,187	-$89,897	$77,050	-$38,631	-$244,055	-$1,122,299	$0	-$321,433	-$1,970,076
Setnet	-$932,243	-$434,223	$412,305	-$523,000	-$1,237,000	-$731,530	$0	-$497,317	-$915,413
Total	-$1,123,430	-$524,120	$489,354	-$561,631	-$1,481,055	-$1,853,829	$0	-$818,750	-$2,885,490

*Assumptions and analysis for Scenarios B, C and A6 are the same as for Scenario A.

time open for fishing in a setnet area changes the predicted catch and revenues for the week if the operator decides to fish that week. The change in potential expected catch and revenues affects the decision to fish at all that week. The change in expected setnet value is defined as the change in setnet inclusive value derived from applying equation (IX-6) to the participation equation in each scenario. That is, the change in value realized from moving from scenario one to scenario two is:

$$\text{Change in setnet value} = (\text{Incl}_1 - \text{Incl}_2)/\alpha$$

where α is the coefficient on revenue in the setnet choice equation. The change in net value may be less than the change in setnet profits, because some setnetters have other income earning opportunities. These opportunities are reflected in the inclusive value, which includes a contribution of income from other fisheries and non-fishing activities, as estimated in the participation equation, when those opportunities exist.

Results: Observed Choices Method

The bottom half of Table IX-3 shows our estimates of change in net economic value for each scenario under the observed choices method. The estimated change in net value for the typical permit owner is calculated from the inclusive value, as described in the preceding section. The estimated total change in net value is calculated by multiplying the total number of permits (shown at the top of the table) by the estimated change in unit net value. The estimated change in net value to Alaska residents is calculated by multiplying the total change in net value by the resident shares shown in Table IX-3.

Under Scenario A (200,000 additional sockeye in the Kenai River) the observed choices method projects that allowing 200,000 more sockeye into the Kenai River would result in a net loss to driftnet operations (resident and non-resident) of about $260,000, or $0.61 per pound. It projects a net loss to setnet operations of around $ 1 million, or $0.98 per pound.[8] Looking just at losses to residents, resident driftnet operations would see a net loss of about $190,000, and resident setnet operations a net loss about $930,000—for a combined net loss of about $1.1 million.

In the low run scenarios (A3 and A5), the losses in net value with a re-allocation of 200,000 sockeye to the Kenai River are somewhat lower for setnetters than in the medium run case for comparable price assumptions. This is because our projection of the reduction in open fishing hours and harvests is lower.

However, the losses for the drift fleet are much larger in the low run scenarios. These losses occur because ADF&G managers assume that in a low run year they would have to eliminate one regular, districtwide opening to meet the Kenai River management target while protecting other salmon stocks. The loss of a regular 12-hour opening would be very costly for the drift fleet, especially if salmon prices were better than average. We estimate that increasing the sockeye escapement to the Kenai River by 200,000 would cost the drift fleet $1.9 million when the sockeye price is $1.43 per pound. If sockeye prices reached $1.75/lb in a low run year (shown in the right hand column of Table IX-3), we project that the change in net value to driftnet operators would approach $3 million dollars.

In medium run years, low sockeye prices (Scenario A1) would reduce the losses experienced by the drift fleet to about one third of the net loss under the medium price scenario (Scenario A). For the setnet fishermen, however, the net losses would be only about 40 percent lower. That

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[8] We estimate that a sockeye price of $1.43 per pound would be associated with an average salmon price (including all species) of about $1.28 per pound. These figures imply an incremental total cost of 67 cents per pound for drift permit holders and 30 cents per pound for set permit holders, taking into account all the other options they have for the use of their time.

difference in losses is due to the higher incremental costs of drift fishermen, providing them with much lower net earnings in low price years.

In the high price scenario with medium sockeye returns (Scenario A2), the effects of reduced harvests would be about one-third larger for both gear groups.

Contingent Valuation Method

Description of Method

The contingent valuation method is based on permit holders' responses to ISER surveys about whether they would be willing to pay for increased openings or willing to pay to avoid specific fishery closures. This method is analogous to our contingent valuation analysis of changes in net economic value of the sport fishery in Chapter VI.

While the contingent valuation method relies on entirely different data and assumptions from the observed choices method, the estimates of the two method represent similar concepts, or definitions of value. As in the observed choices method, permit holders are unlikely to include changes in crew members' net earnings in their valuation of management changes. While not explicitly asked to value non-monetary aspects of their work in the valuation questions, respondents typically include these values implicitly. Contingent value estimates therefore implicitly include changes in job satisfaction for permit holders but not for crew members.

Contingent Valuation Questions

In our survey of set and driftnet permit holders, we asked respondents three sets of contingent value questions to understand how they subjectively value small changes in harvest levels (see Appendix F, Permit Holder Survey, questions B7-B9).

In the first set of questions, interviewers told survey respondents that "more intensive management" could hypothetically yield higher harvest levels. Respondents were randomly assigned harvest level increments ranging from 100 to 400 sockeye. They were then asked whether they would be willing to pay a specific amount if the funds were used to pay for more intensive management that would yield them a given annual increase in catch. We used a two-stage dichotomous-choice valuation framework to elicit willingness to pay. We first asked respondents whether they would be willing to pay or accept a randomly chosen amount—the bid value—for the harvest change. If respondents said yes, interviewers asked if respondents would agree to a random higher bid. If permit holders said no, interviewers asked if respondents would agree to a random lower bid. The random bids ranged from $100 to $1,800. For example, some respondents were asked:

"Suppose that intensive management could result in an increase in your commercial harvest of Cook Inlet reds by 200 in most years. Would you be willing to pay $600 annually if the funds were used to pay for such intensive management?"

Respondents who answered "yes" to this first question were then asked:
"Would you be willing to pay more than $900 annually?"

Respondents who answered "no" to the first question were instead asked:
"Would you be willing to pay more than $400 annually?"

The second and third sets of questions asked about incremental values in slightly different ways. In the second set of questions, we asked permit holders about willingness to pay to avoid a reduction in seasonal harvest of the same number of fish. Finally, in the third set of questions, we asked respondents to value the amount they would need to be compensated for the loss of that number of sockeye.

Results: Contingent Valuation Method

Based on our survey responses, we estimated average net willingness to pay (net value) from a bid function using the same methods as described in Chapter V for sport anglers. Technical documentation of the estimation methods are documented in Appendix A. We assumed that willingness to pay varied with the incremental number of fish in a simple log-linear relationship. Table IX-4 (top portion) shows the statistical results for the bid functions for WTP for drift and setnetters.

The bottom part of Table IX-4 shows the economic interpretation of our statistical results, in terms of willingness to pay per additional fish or per additional pound. Technically, the values are the values per fish or per pound at which 50 percent of fishermen would answer "yes" if asked if they were willing to pay or accept this amount.

Table IX-4. Contingent Value Results

	Type of contingent valuation question asked		
	Willingness to pay to increase sockeye harvest by X fish	Willingness to pay to prevent harvest declines of X fish	Willingness to accept harvest declines of X fish
STATISTICAL RESULTS			
Dependent variable in estimated equation	Nat. log. of WTP	Nat. log. of WTP	WTP
Driftnet operators			
Estimated coefficient for number of fish (X)	1.087	1.194	6.276
(t statistic)	(8.13)	(8.32)	(3.88)
Estimated sigma	422.9	462.5	2497
(t statistic)	(12.12)	(10.50)	(6.34)
Estimated coefficient for change in escapement			7.623
(t statistic)			(2.53)
Setnet operators			
Estimated coefficient for number of fish (X)	1.591	1.415	5.079
(t statistic)	(6.28)	(5.53)	(3.19)
Estimated sigma	622.5	646.9	1581
(t statistic)	(7.70)	(7.67)	(6.35)
Estimated coefficient for change in escapement			9.218
(t statistic)			(2.84)
ECONOMIC INTERPRETATION*			
Willingness to pay or accept per additional fish			
Driftnet operators	$1.09	$1.19	$6.28
Setnet operators	$1.59	$1.42	$5.08
Willingness to pay or accept per additional lb.			
Driftnet operators	$0.18	$0.20	$1.05
Setnet operators	$0.27	$0.24	$0.85
Willingness to pay or accept per 100,000 increase in escapement			
Driftnet operators			$762.30
Setnet operators			$921.80

*Willingness to pay or accept per pound is equal to the estimated coefficient for the number of fish (X). Technically speaking, the figure shows the estimated value per fish or per pound at which 50 percent of fishermen would answer "yes" if asked if they were willing to pay or accept this amount.
ISER file: CV Results.

Drift operators were willing to pay $1.09 per fish (about $.18 per pound) to increase their harvest slightly. They were willing to pay $1.19 per fish to prevent harvest declines—about $.10 more per fish to prevent harvest declines. However, driftnetters would want to be compensated $6.28 per fish ($1.05 per pound) to agree to accept a harvest decline.

Setnet operators would be willing to pay somewhat more for a harvest increase or to prevent declines, but would be willing to accept slightly less per fish for harvest declines.

Although interviewers did not mention allocation of harvests between sport and commercial users in the contingent value section of the questionnaire, respondents were aware that this issue motivated the survey. Earlier in the survey, interviewers had mentioned a randomly assigned allocation from commercial to sport as a potential factor affecting expenditures. We checked if this previous information might have affected survey respondents' answers by testing whether respondents were more likely to agree to a higher bid if the change in allocation proposed earlier in the survey was larger. A positive effect would indicate that respondents placed a higher value on potential losses from a larger proposed reallocation from the fleet as a whole.

The effect of the proposed reallocation turned out to be positive but not statistically significant for the two willingness to pay questions. This finding suggests that this type of response effect is unlikely to be present in these contingent value results. However, the effect was significantly positive in the willingness to accept question. The estimated coefficients—shown in Table IX-4 as 7.623 for drift and 9.218 for setnet operators—measure the increase in the willingness to accept per thousand fish reallocated to the sport fishery. Drift operators would need to be compensated about $1,500 (plus $6.28 per fish) in order to accept a harvest decline due to an increase in the escapement target of 200,000 sockeye. Setnet operators would need about $1,800 (plus $5.08 per fish).

Apparently, both drift and setnet permit operators feel that their loss of value from a reallocation to the sport fishery would be substantially greater if the reallocation from the commercial fishery as a whole were greater, regardless of the change in their individual harvests. This does not necessarily imply a bias in the willingness to accept numbers; respondents may really suffer perceived losses from the idea that commercial fishermen as a whole would be hurt more.

The willingness to pay estimates are simply proportional to the harvest decline per operation. If we ignore the component of willingness to accept that varies with the escapement target, we have a marginal willingness to accept that is also proportional to the harvest decline. The unit of analysis for the survey is an operation. If we assume that harvests change for each operation under each allocation scenario in proportion to their baseline harvest, however, then we may estimate the total portion of the change in resident net value by multiplying the values per fish in Table IX-4 by our residency assumptions in Table IX-3 and by the total change in the commercial sockeye harvest in the scenario assumptions. We use the assumptions for sockeye harvest declines provided by ADF&G, shown in the top part of Table IX-4.

Table IX-5 shows the resulting contingent valuation estimates of the total change in net value for Scenario A (200,000 additional sockeye in the river), Scenario D (100,000 additional sockeye), and Scenario E (100,000 fewer sockeye in the river). We excluded the component of willingness to accept that varies with the escapement target, so these figures represent a lower bound. Since we didn't ask respondents to value the change in harvest under different market conditions and run sizes, we don't know how the results might vary under price and run size scenarios. We assume that the results apply to the medium price scenarios, although permit holders used their own price expectations in forming their responses, which might be higher or lower than our medium price.

Table IX-5. Contingent Valuation Method Estimates of Changes in Net Value

	Scenario Name and Code		
	+200K at sonar A	+100K at sonar D	-100K at sonar E
Change in commercial harvest level on which questions were based	-200,000	-100,000	+100,000
Willingness to pay to prevent a decline in harvest or gain an increase in harvest			
Driftnet			
Lower 5%	-$41,800	-$20,900	$18,900
Best estimate	-$52,100	-$26,000	$23,700
Upper 5%	-$62,400	-$31,200	$28,500
Setnet			
Lower 5%	-$163,400	-$81,700	$96,500
Best estimate	-$232,500	-$116,300	$130,700
Upper 5%	-$301,600	-$150,800	$165,000
Total			
Lower 5%	-$205,200	-$102,600	$115,400
Best estimate	-$284,600	-$142,300	$154,400
Upper 5%	-$364,000	-$182,000	$193,500
Willingness to accept a decline in harvest (amount attributable to change in operator's own harvest)*			
Driftnet			
Lower 5%	-$157,600	-$78,800	
Best estimate	-$273,800	-$136,900	
Upper 5%	-$389,900	-$195,000	
Setnet			
Lower 5%	-$403,900	-$201,900	
Best estimate	-$834,300	-$417,200	
Upper 5%	-$1,264,800	-$632,400	
Total			
Lower 5%	-$561,500	-$280,700	
Best estimate	-$1,108,100	-$554,100	
Upper 5%	-$1,654,700	-$827,400	

* not counting the portion of WTA correlated with change in escapement for the fishery as a whole.
Note: Estimates are for changes in net value to Alaska residents. Assumptions and analysis for Scenarios B, C and A6 are the same as for Scenario A. We did not prepare contingent valuation estimates for changes in net value for Scenarios A1, A2, A3, A4 or A5. Different run size and price conditions would have required asking different specific questions of survey respondents.

ISER file: Net value changes

We estimated confidence intervals using the method described by Cameron (1991), as discussed for the sport fish contingent value estimation in Chapter V. Technically, the lower 5 percent estimates are based on the value per fish at which 95 percent of fishermen would answer "yes" if asked if they were willing to pay or accept this amount. The upper 5 percent estimates are based on the value per fish at which only 5 percent of fishermen would answer "yes" if asked if they were willing to pay or accept this amount.

Under Scenario A, commercial operators would be willing to pay between $205,000 and $364,000—with a best estimate of about $285,000—to avoid the reduction in commercial harvests needed to increase the Kenai River sonar count by 200,000 fish. They would want between $562,000 and $1.7 million—with a best estimate of $1.11 million—to agree to that large a harvest reduction.

The estimated values for the amount needed to compensate operators for a harvest reduction (willingness to accept) are nearly four times larger than those for willingness to pay to keep harvests from declining. This is not surprising; we would expect willingness to accept estimates to be higher.

Willingness to pay and *willingness to accept* measure different concepts of value (as we discussed in Chapter III). Both concepts are valid, and there is no methodological reason for accepting one figure as superior to the other. We suspect, however, that some survey respondents were likely to understate their true willingness to pay because of their feelings about potential harvest re-allocations. Since we are able to control at least in part for this type of response bias in the willingness to accept figures by subtracting out the portion of estimated value correlated with the potential reallocation suggested in our survey, we believe that the willingness to accept figures in Table IX-5 are probably better estimates of the value commercial fishing operators would place on the change in harvests.

Setnet operators account for most of the change in estimated net economic value, for two reasons. First, there is a greater change in their harvests. Second, their willingness to pay per fish is greater.

Table IX-5 also shows willingness to pay estimates for increases in harvest levels for Scenario E (which would increase the commercial harvest by reducing the management target for the Kenai River by 100,000 sockeye). We calculate that resident commercial fishermen would value this increase at between $115,400 and $193,500, with a best estimate of $154,400.

We did not ask drift and setnet operators to assume specific salmon price levels when answering our contingent value questions. Instead, we intended their responses to reflect their own expectations about future prices. These expectations may differ from any of our sockeye price assumptions, but probably lie close to the middle of the three scenarios in Table IX-5.

Net Economic Value for Crew

The types of benefits and costs accruing to fishermen are listed in Table IX-1 earlier in the chapter. These include monetary benefits and costs such as wages and work expenses, non-monetary but tangible benefits and costs such as fringe benefits[9], and intangible benefits and costs such as job satisfaction or work opportunities foregone.

Intangibles like job satisfaction enter into workers' decisions about jobs. Workers may accept lower wages for jobs they enjoy, because they get benefits from their work beyond what they are paid. Employers get an implicit wage subsidy from such workers, relative to other workers or other jobs in the labor market. Conversely, workers demand higher pay to work in jobs they find onerous. Job dissatisfaction must be compensated in cash; otherwise unhappy workers will leave for alternative jobs they like better.

Anthropologists (Pollnac and Poggie, 1988; Gatewood and McCay, 1990) as well as fishermen have argued that enjoyment of fishing—the work, the working conditions, and the lifestyle—is an important reason fishermen sometimes choose fishing over other jobs where they could earn more. If job satisfaction is higher in fishing than in the next best alternative job, this difference in job satisfaction is part of the net economic value of the commercial fishery.

Figure IX-6 illustrates the labor market for crew. It is like any other free labor market except that the demand for Cook Inlet crew labor market is quite inelastic—the demand curve is nearly vertical on the graph. This is because the number of employers (permit holders), the size and number of nets, and the hours they can fish is fixed in regulation. Furthermore, the technology limits the number of crew that can productively fish each unit of gear, particularly in the drift fishery. The supply curve for labor represents the number of crew who are willing to work at each wage: as fishing wages increase, the number of workers offering their services increases. Conversely, it represents the minimum wage required to secure the services of various numbers of crew.

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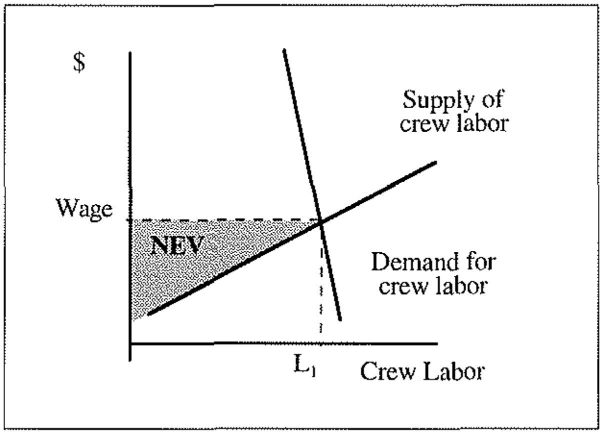
[9] Major fringe benefits such as health insurance or retirement funds are left out because they are rare in commercial fishing.

Figure IX-6. Crew Labor Market

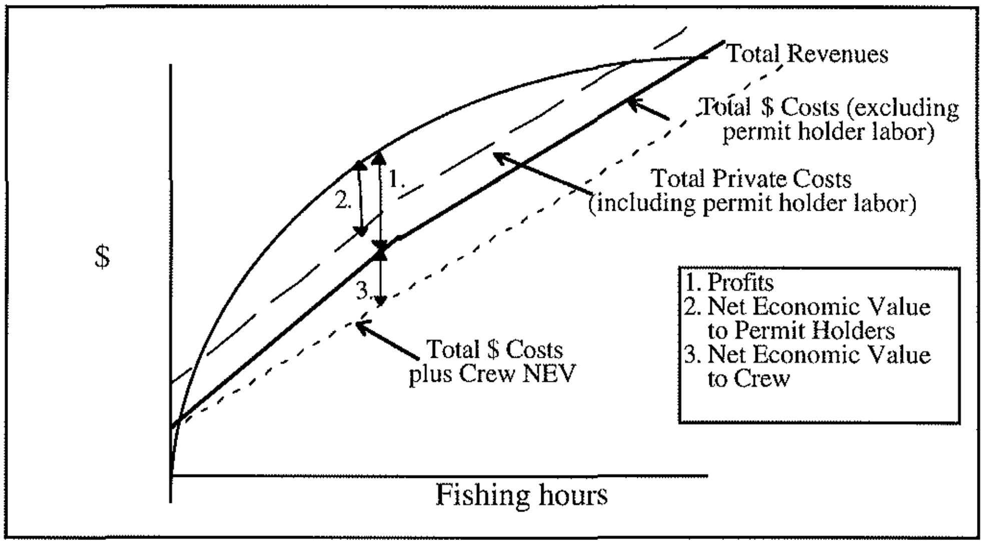


In the conventional model, all workers earn the same wage. Competition among crew for a limited number of jobs ensures that the market wage will be bid down to the minimum required to fill the available jobs. The wage for all is effectively set by the last worker hired—the marginal worker. There are likely to be other workers already hired who would have been willing to work for less, but don't have to. The extra compensation these workers enjoy, above the minimum they would have been willing work for, is the net economic value (NEV) for the workers. A portion of this NEV is job satisfaction.

In a free labor market, workers will seek the jobs they like best. If pay plus satisfaction in crew jobs is lower than in some other available job, the marginal worker would take that other job. But if the crew pay and satisfaction is higher than for other available jobs, the next job seeker in line for crew jobs would offer to work for a little bit less. The last worker hired is indifferent between the commercial fishing crew job taken and the next best alternative job. The labor supply curve therefore represents the dollar value of the wages and job satisfaction workers could get in their next best alternative job. It is called the "opportunity cost" of their labor. The net economic value for crew members is crew earnings minus crew opportunity cost.

Figure IX-7 shows how net economic value for the commercial fishing operations we studied differs from a simple cash accounting of net profits. Total revenues minus total costs equals accounting net profits, which are part of net economic value to permit holders (1). But this does not include the opportunity cost of the permit holder's labor—what that permit holder could have earned in the next best alternative (e.g., another fishery or another job). Relative to a cash flow measure of costs, accounting for the opportunity costs of permit holder labor increases estimated costs, and reduces net economic value to permit holders below their accounting net profits (2). Net profits also don't include the net economic value to crew members—benefits they receive in addition to their wages (3). Accounting for the net economic benefits to crew decreases estimated costs and increases net economic value relative to net profits. From a social accounting perspective, net economic value for commercial fish harvesting equals net accounting profits adjusted downward for the opportunity costs of permit holders and upward for the net economic benefits to crews. Since the two offset each other, we cannot know without measuring them whether the net economic value of the fishery will be higher or lower than the simple cash accounting of net profits.

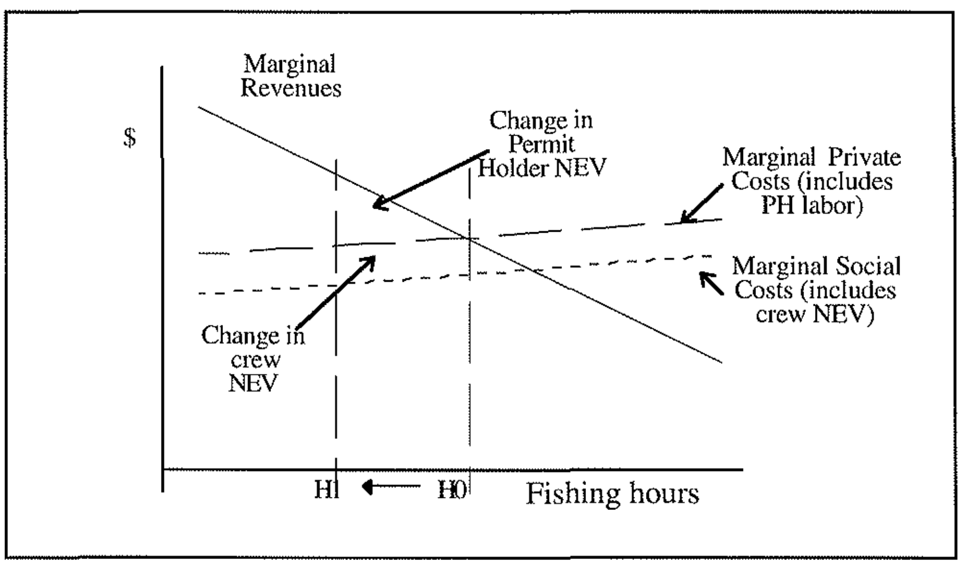
Figure IX-7. Profits and Net Economic Value to Permit Holders and Crew



Changes in Net Economic Value for Permit Holders and Crew

Changes in net economic value for commercial fishermen that could result from changes in management of Kenai River sockeye are illustrated in Figure IX-8. The marginal revenue curve represents the change in total revenues (the slope in Figure IX-7) for each additional hour of fishing time. The marginal private cost curve represents the change in costs to the permit holder—wages, operating expenses, and the value of the permit holder's time—for each additional hour of fishing. The marginal social cost curve has adjusted the private costs to account for the net benefits to crew. In this figure, the open hours for the fishery have been reduced from H0 to H1 to allow more sockeye into the Kenai River. The resulting change in net economic value of salmon harvesting is the sum of the changes in net economic value to permit holders and crew members.

Figure IX-8. Change in Net Economic Value to Permit Holders and Crew



The potential changes in management we're studying concern the number, hours, and locations of commercial openings during the week of July 22 through July 29. Hypothetical reductions in fishing time that week could have indirect as well as direct effects on harvesting workers. The direct effects are the lost net income to permit holders and crew from the fish not caught, and the decreased time spent fishing. The indirect effects are that marginal operators may decide to pursue other work and not fish at all that week, or possibly even that season. This is a voluntary choice for the permit holder, reflecting high opportunity costs (good alternatives) to fishing; it implies a relatively small loss in net economic value. For the crew member, however, it is involuntary. For a crew member with poor alternatives, the loss in net economic value may be high.

There can be both fixed and variable components to job satisfaction. Some satisfaction may derive from being a fishermen—the lifestyle, job location, and autonomy, for instance. Working fewer hours or fewer weeks doesn't decrease these components of job satisfaction. Other components may be proportional to the hours worked: working outdoors, challenging the elements, excitement, and the like. Under all of the scenarios, most commercial fishermen we studied would still fish—but for fewer hours (the management change assumptions) or perhaps fewer weeks (for the operation only marginally fishing in the week of closures). These permit holders and crew would lose only part of their job satisfaction.

The only permit holders and crew for whom a "whole job" measure of net economic value is required, including fixed as well as variable components, are those who would leave the fishery for a whole season as a result of the management changes. This does not include those who would sell their permits, because those who sell will be replaced by others who fish. It does include those marginal operators who would forego fishing in years of low runs or low prices—the ones who were barely making it under those conditions before the management change, and for whom a loss of fishing time would change their decision to fish.

Job Ranking Method

As we've said, we accounted for the change in NEV to permit holders in the observed choices method. But that method doesn't account for the lost economic value to the crew members. We developed the job ranking method to try to value that net economic value to crew members.

To estimate the NEV for workers, we must subtract the opportunity cost of work from the wages received. We can observe the wages paid to workers. The methodological challenge is to estimate the opportunity cost of work. One analytic solution is to draw the labor supply curve in Figure IX-6 horizontally ("perfectly elastic"). This would indicate that that there are plenty of alternative jobs that are just as good as the job in question. No workers have any reason to accept lower pay for that job relative to others. If the opportunity cost of working that job is just equal to the wages received, there is no net economic value to the workers.

Another solution is to assume that wage rates in other jobs measure the opportunity cost of the work in question—in this case fishing work. This approach has been criticized for ignoring the non-monetary benefits of fishing—the worker satisfaction bonus. If fishermen would be willing to work for less pay in fishing than in other kinds of work just because they enjoy it, using the wage rates in other jobs overstates the opportunity cost of fishing work and understates the net economic value.

The approach we use in this study is to ask fishermen directly about their tradeoffs between fishing and other kinds of work. Analyzing their responses comparing alternative jobs allows us to estimate the minimum earnings from Cook Inlet fishing they would accept and still choose to fish. This measures the value of the work opportunities foregone,[10] as valued by the fishermen

[10] A more complete analysis would have included leisure as an alternative.

themselves; it is the opportunity cost of fishing. Because we use individual measures of compensation and the opportunity cost of fishing, for our estimate of NEV we do not need to make any assumptions about the workings of the labor market for Cook Inlet fishermen.

The methodology we developed is analogous to that used for the travel cost model for sport fishermen (described in Chapter VI) and the observed choices model for permit holders. It statistically analyzes choices over a defined set of alternatives to infer the rate at which fishermen are willing to trade off monetary costs or benefits for non-monetary costs or benefits. In this case, the choices we analyzed are a set of job alternatives with different mixes of earnings and working conditions.

The data on alternative jobs come primarily from our survey of crew members. (The crew survey questionnaire and survey description appear in Appendixes E and F.) We asked a series of questions about alternative jobs that might be available to respondents during the fishing season. We asked about expected earnings, benefits, risks, job security, and various kinds of working conditions. We asked respondents to rank the jobs, including commercial fishing, from most preferred to least preferred. We then asked them to rank the jobs again, given a 20 percent pay increase in the top-ranked alternative job or a 10 percent decrease in income from the Cook Inlet fishery. We also asked a series of questions about what job characteristics generally are most the important and least important to them in choosing jobs. Statistical analysis of these responses allowed us to estimate an equation predicting job rankings as a function of earnings, benefits, working conditions, and individual characteristics. The estimated coefficients from the equation are then used to calculate the change in net economic value.

Estimation of Job Ranking Equation

To estimate the net economic value of crew labor in the Cook Inlet fishery, we built a data set with 479 observations representing data on Cook Inlet fishing jobs and the alternative jobs crew members described and ranked in our crew survey. A rank-order logit regression was used to estimate an equation predicting crew members' job preferences. Many variables and combinations of variables were tried. With one exception, variables were kept in the equation only if they were significant. The *DRIFTCI* dummy variable—a variable of policy interest—was kept just to show its insignificance. Table IX-6 lists the variables that appear in the job ranking equation and their signs. Table B-10 in Appendix B gives the full regression results.

Table IX-6. Definition of Variables and Their Signs

	Coefficient Sign	
EARN	(+)	Earnings for the season or duration of the job; if the job is year-round, this is earnings for a period comparable to Cook Inlet fishing.
SETCI	(+)	1 indicating a Cook Inlet setnet job; 0 otherwise.
WEEKSET	(-)	The number of weeks from the start of the setnet fishing job to the end.
HPWSET	(+)	The number of hours per week worked setnetting during the season
DRIFTCI	(+)	1 indicating a Cook Inlet driftnet job; 0 otherwise.
HPWDRFT	(+)	The number of hours per week worked drift fishing during the season
CERTAIN	(+)	1 if the ex-ante expected earnings for the job were known with some certainty; 0 if the expected earnings were uncertain.
OFFICE_S	(+)	1 indicating an office job, for those who expressed a strong preference for working outdoors.

The earnings coefficient plays a role similar to that of the coefficient on trip cost in the travel cost model for the sport fishery (described in Chapter VI); it estimates how important money is relative to non-monetary factors in explaining choices people make. The coefficient here is positive and statistically significant. Yet earnings play a relatively minor role in explaining job preferences. (For further discussion, see Appendix B.) The top explanatory variable is the Cook Inlet setnet dummy (*SETCI*), with the hours per week of setnet fishing (*HPWSET*) and the number of weeks fished (*WEEKSET*) ranking second and third. The set dummy and hours worked per week have positive coefficients, while weeks worked has a negative coefficient. These results indicate that there is a large fixed value to setnet fishing, as well as significant benefit to the hours per week spent working and significant cost to the total weeks worked.

The drift fishery shows a different pattern: the hours worked per week (*HPWDRFT*) is the only significant drift variable, and it has relatively weak explanatory power. (In the weighted data set, setnetters outnumber drifters two to one—so relatively fewer drift observations contribute to the equation estimate.) Other significant variables were the certainty of earnings and the work environment. The positive coefficient on *OFFICE_S*—indicating both a strong preference for working outdoors and preference for an office job—might be interpreted as a desire for complementarity. Perhaps those who work both office jobs and fishing jobs value their office jobs but fish too because they greatly appreciate the opportunity to work outdoors in the summer.

The model is estimated on 1994 data. Most crew are paid on a share system, so their earnings track closely with gross harvest value. To simulate high and low price years we adjusted earnings according to the ratio of ex-vessel price assumptions. To simulate low run years we adjusted earnings by the estimated ratio of gross harvest value between 1991 and 1994, calculated by species and weight at 1994 prices.

Results: Job Ranking Method

Table IX-7 summarizes our estimates of potential changes in net economic value to resident crew, if the commercial harvest were reduced to allow more sockeye into the Kenai River.

Scenario A (which assumes an increase of 200,000 sockeye in the Kenai River in a medium-run year) would cost crew members nearly $600 thousand in net economic value. Losses would be about $310 thousand under Scenario D (which assumes an increase of 100,000 sockeye in the Kenai River), and crew members would gain about $330 thousand in net economic value under Scenario E (which examines the effects of decreasing rather than increasing the number of sockeye in the Kenai River by 100,000).

Losses would be lower in a low price scenario ($520 thousand) but higher under other conditions, peaking at $811 thousand for the low run, low price scenario. In the low-run scenario, managers would eliminate a regular, districtwide opening, which would cost commercial fishermen many more fish. If it was also a low price year, fewer permit holders would be fishing, so managers would have to close the fishery more hours in order to reach the same target reduction in harvest.

On a per capita basis, drift crews incur greater losses than set crews. For Scenario A, the average change in net economic value is about $705 per capita for drift crew members and $679 for set crews. The disparity increases as the level of losses increases. The loss in earnings accounts for only half of the loss in net economic value, with declines in job satisfaction making up the other half.

Table IX-7. Changes in Net Economic Value for Crew

	Scenario Name and Code						
	+200K at sonar A-C	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	Low run, low price A5
Total change	$ (598,493)	$(309,627)	$ 329,805	$(520,353)	$(658,185)	$(803,765)	$(811,179)
Average change per crew member							
Driftnet	$(705)	$(356)	$321	$(593)	$(791)	$(959)	$(910)
Setnet	$(679)	$(359)	$432	$(607)	$(733)	$(779)	$(802)

Summary of Net Value Results

Table IX-8 summarizes the results of our three methods of estimating changes in net economic value for resident permit holders and crew. The two methods of estimating change in net economic value to permit holders produce similar results for the two scenarios for which we have comparable estimates. For Scenario A (adding 200,000 sockeye at the river sonar counter), the contingent value method estimates a $1.11 million loss in net economic value (using the adjusted willingness-to-accept responses) and the observed choices method estimates a loss of $1.12 million. Scenario D estimates are about half that.

Table IX-8. Estimates of Changes in Net Value of the Commercial Fishery to Alaska Residents

	Scenario Name and Code								
	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5	Low run, high price No code
Estimated change in net economic value to permit holders (in thousands of dollars)									
Observed choices method	-$1,123	-$524	$489	-$562	-$1,481	-$1,854	$0	-$819	-$2,885
Contingent value method (willingness to accept)	-$1,108	-$554							
Estimated changes in net economic value to crew									
Job ranking method	-$598	-$310	$ 330	-$520	-$658	-$804	$0	-$811	-$941
Estimated change in net economic value to permit holders and crew	-$1,721	-$834	$819	-$1,082	-$2,139	-$2,658	$0	-$1,630	-$3,826

Note: Observed choices result for Scenario A5 is based on a smaller reduction in harvest than ADF&G assumes. Given the poor returns to fishing under this scenario, fishermen would be fishing less even without a harvest reduction.

To get an estimate of total change in net economic value for permit holders and crew members, we need to add the crew estimate to one of the two permit holder estimates. Adding the observed choices results (which are available for all the scenarios) to the crew results, we get an estimated total loss in net economic value of $1.7 million for Scenario A.

Under other scenarios, the potential losses in net value for permit holders and crew combined range from 0 to $3.8 million. In a high run year, there would be no reduction in the commercial harvest and therefore no loss in value. If the harvest were reduced only enough to increase the return to the Kenai River by 100,000, the loss would be only about half as large as in Scenario A. High price and low run scenarios show higher losses that Scenario A. The worst case for commercial fishermen would occur in a year with a low run and high prices, which is not a study scenario but which we analyzed for the observed choices method. This combination could cost permit holders and crew $3.8 million in net economic value.

Changes in Net Economic Value to Processors

Another aspect of net economic value in the Cook Inlet salmon fishery that we haven't yet considered is value to processors. Salmon harvested commercially in Cook Inlet are processed into frozen, fresh, canned, and roe products. Salmon processing is a major industry in the Cook Inlet area, adding significantly to the value of Cook Inlet salmon and employing as many as 3,000 workers at the peak of the season.

As shown in Table IX-9, well over half the salmon processed in the Cook Inlet region is processed in Kenai. Significant volumes are also processed in Homer and Anchorage. Not all of this salmon is from Cook Inlet. In some years, significant volumes are brought in by plane or boat from other areas of the state where harvests exceed processing capacity.

Table IX-9. Cook Inlet Salmon Processors, 1985 and 1992

Year	City	Number of Salmon Processors	Pounds of Salmon Processed*	Value of Salmon Production*	Percentage of Total Pounds Processed*
1985	Anchorage	10	4,455,079	2,874,502	11%
	Homer	6	8,279,725	5,251,829	20%
	Kasilof	4	**	**	
	Kenai	10	28,545,291	26,512,912	69%
	Ninilchik	1	**	**	
	Seward	1	**	**	
	Total	32	41,280,095	34,639,243	100%
1992	Anchorage	15	6,477,267	5,693,326	11%
	Homer	5	9,589,864	12,999,723	16%
	Kasilof	2	**	**	
	Kenai	23	42,608,076	62,952,234	73%
	Seward	4	**	**	
	Soldotna	3	**	**	
	Total	52	58,675,207	81,645,283	100%

*Total includes only production reported for Anchorage, Homer and Kenai
**Not reported in order to preserve confidentially
Source: Data provided by the North Pacific Fisheries Management Council
ISER File: NPFMC Proc Data, CI Salmon

The processing industry consists of a few large processors with large established facilities and a number of smaller processors. For this study, ISER interviewed administrative personnel of nine Cook Inlet processors to obtain information about processor operations, employment, costs, ownership, and potential effects of a reduction of Cook Inlet sockeye harvests. We estimate that these nine processors handled most of the Cook Inlet sockeye salmon harvested in 1994. Appendix J provides background information about Cook Inlet salmon production and details about our interview questions and responses.

Processing Margins and Costs

The first step in assessing potential changes in net economic value for processors is estimating the increase in value—or margin—associated with processing Cook Inlet sockeye. We used the data on volume and value of Cook Inlet sockeye in Table IX-10 and Figures IX-9 through IX-12 to estimate that margin.

From 1991 through 1994, production volume was between 76 percent and 97 percent of harvest volume. Recall that Cook Inlet processors also process salmon from other areas of Alaska. Because yields in processing frozen salmon are typically in the 72 to 75 percent range (they are somewhat lower for processing canned salmon), we would ordinarily expect the total processed volume to be approximately 74 percent of the harvest volume. The extent to which this share exceeds 74 percent serves as a rough indicator of the extent to which sockeye production from the Cook Inlet area included production from other areas.

Table IX-10. Volume, Value and Average Prices of Cook Inlet Sockeye Salmon Harvests and Production, 1991-1994

	1991	1992	1993	1994
Volume (pounds)				
Total volume of Cook Inlet harvests (seine & gillnet)	13,563,818	60,777,940	28,884,800	20,890,000
Total volume of Cook Inlet production (incl. roe)	13,129,087	46,414,747	27,200,885	17,666,339
Production as a share of harvests	97%	76%	94%	85%
Value ($)				
Total value of Cook Inlet harvests (seine & gillnet)	14,181,245	96,858,835	29,633,233	30,499,400
Total value of Cook Inlet production (incl. roe)	29,764,382	148,442,357	60,823,723	50,736,169
Average prices & processing margin ($/lb)				
Average wholesale value (per round pound)	$1.83	$2.52	$1.80	$2.27
Ex-vessel price (gillnet harvests only)	$1.06	$1.59	$1.03	$1.46
Average processing margin (per round pound)	$0.77	$0.93	$0.77	$0.81
Average fish weight (lbs)	5.62	6.59	5.88	5.64
Average prices & proc. margin ($/fish)				
Average wholesale value ($/fish)	$10.30	$16.61	$10.60	$12.80
Ex-vessel price ($/fish, gillnet harvests only)	$5.96	$10.47	$6.06	$8.23
Average processing margin ($/fish)	$4.34	$6.14	$4.54	$4.57

Sources: Harvest volume and average fish weight: 1991-1993: Commercial Fisheries Entry Commission. 1994: Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 1994 Salmon Season, Preliminary Data, updated 4/27/95. Note that data are for all gear types, and include small volumes of sockeye harvested by seiners. Harvest value for 1994 was calculated by multiplying the preliminary harvest volume (as reported by ADFG) by the ex-vessel price of $1.46 (the preliminary price reported by CFEC). Production data: Alaska Department of Fish and Game, data reported by processors in Commercial Operator Annual Reports. Note that Cook Inlet salmon production includes salmon harvested in other areas of Alaska and transported to the Cook Inlet region for processing. Average wholesale value per round pound calculated as [average wholesale price (total excl. roe)] x [assumed processing yield of 74%] + [average price for sockeye roe] x [assumed processing yield of 4%]. Processing yields are from Chuck Crapo, Brian Paust and Jerry Babbitt, "Recoveries & Yields from Pacific Fish and Shellfish," Alaska Sea Grant College Program Marine Advisory Bulletin No. 37, 1993, page 14.
ISER file: CI sockeye prod analysis.

To calculate the margin associated with processing Cook Inlet sockeye, we first estimated wholesale value per round pound (calculated by multiplying average wholesale prices by processing yields for roe and non-roe products) and wholesale value per fish (calculated by multiplying average wholesale value per round pound by the average fish weight).

Between 1991 and 1994 the wholesale value of Cook Inlet sockeye ranged between $1.80 per round pound and $2.52 per round pound. Of this, the value paid to fishermen ranged between $1.03 per pound and $1.59 per pound. Processing added 77 cents per round pound to the value of sockeye salmon in 1991 and 1993, 81 cents in 1994, and 93 cents in 1992. Thus in most years, processing adds about 80 cents per round pound to the value of sockeye salmon.

Expressed on a per fish basis (Figure IX-12), between 1991 and 1994 the wholesale value of Cook Inlet sockeye ranged between $10.30 and $16.61 per fish. The price paid to fishermen ranged between $5.96 and $10.47 per fish. The value added in processing ranged from $4.34 per fish to $6.14 per fish, with an average of about $4.60 per fish.

Figure IX-9. Total Value of Cook Inlet Salmon Harvests and Production

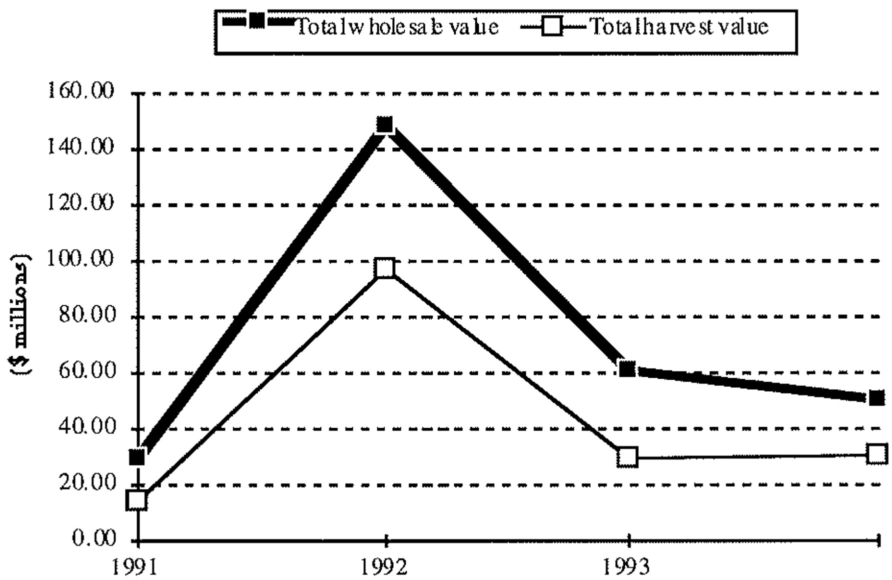


Figure IX-10. Estimated Processing Margin per Round Pound (Wholesale Value minus Ex-Vessel Value)

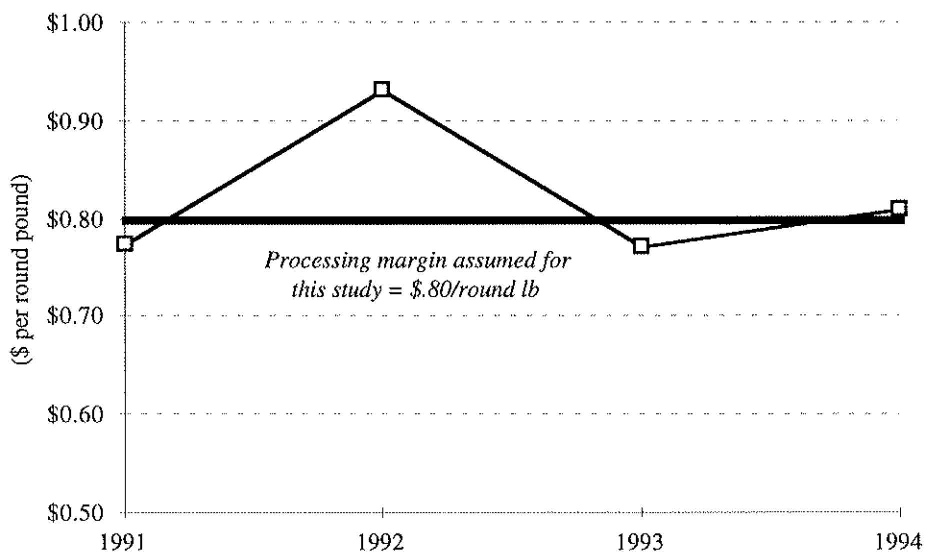


Figure IX-11. Average Value per Pound of Cook Inlet Sockeye Salmon Harvests and Production

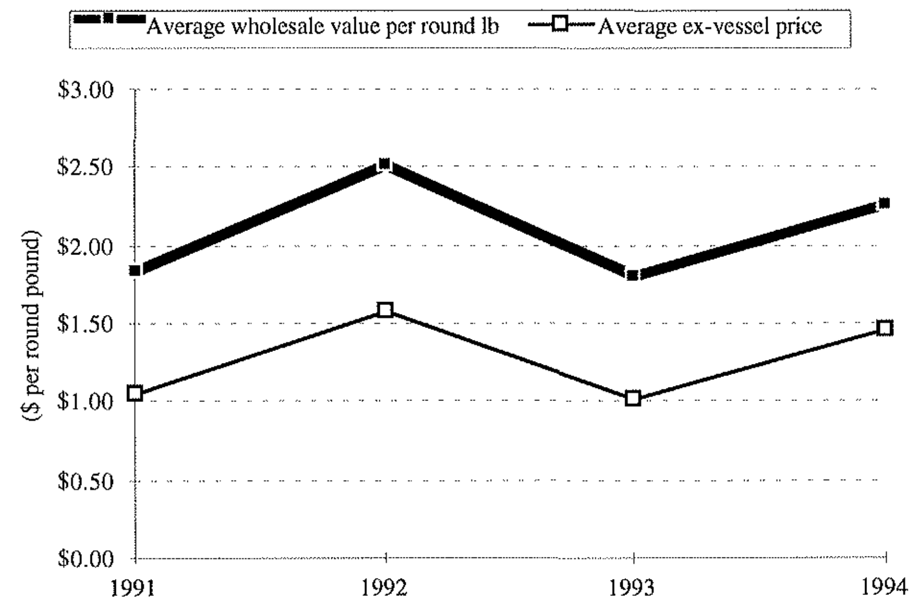
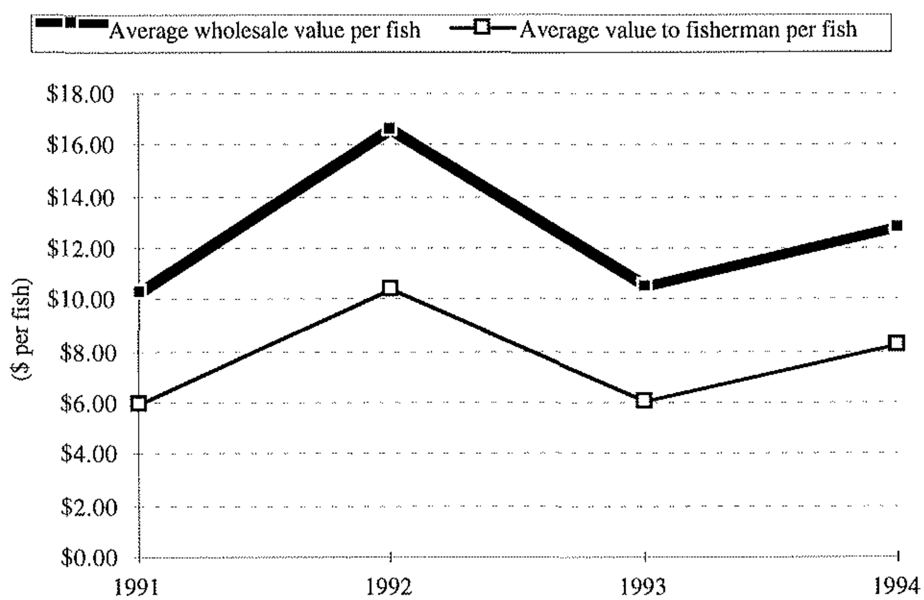


Figure IX-12. Average Value per Fish of Cook Inlet Sockeye Salmon Harvests and Production



Potential Changes in Value to Processors

What share of this 80 cents per pound is net economic value, and how might net economic value to processors change as a result of a reduction in commercial harvests? To answer these questions, we must first define what we mean by net economic value to processors. Returning to our definition of "benefits minus costs," the benefits of the processing industry are the wholesale value of production. The costs include the ex-vessel cost of purchased fish, as well as costs of labor, packaging, utilities, supplies, overhead, depreciation, and a "normal" rate of return on the capital invested in processing facilities. The concept of a normal rate of return to capital can be confusing, since this is part of what accountants would consider "profit." However, from an economic standpoint, capital invested in Cook Inlet processing facilities could have been invested elsewhere at a "normal" rate of return, which therefore represents the opportunity cost to society of using this capital to process Cook Inlet salmon.

For several reasons, it would be difficult to estimate the costs of processing Cook Inlet salmon with sufficient accuracy to develop a reliable estimate of net economic value in processing—and we did not attempt to do so for this study. First, processors are usually reluctant to share cost data. Second, because they process several different species of salmon as well as other fish, it is difficult to estimate how much of costs—in particular plant and overhead costs—should be charged to sockeye processing. Third, processing technology and costs vary widely between plants. Finally, costs per pound and profits vary widely from year to year, depending on run sizes and market conditions. In some years, processors earn significant profits; in other years they incur significant losses.

But while it is difficult to estimate net economic value in processing, theory suggests that on average (over a period of years) net economic value is low—or zero at the margin—for the processors with the highest costs. One reason for this is that competition among processors tends to drive the price they pay fishermen up to a level at which it would be difficult for higher-cost processors to earn profits above a normal rate of return on their investments. In effect, competition insures that most of the net economic value generated in the commercial fishery is captured by limited entry permit holders (some of whom in turn transfer net economic value to those from whom they acquired their permits).

In addition, there are no legal restrictions on entry into processing. If processors earned average profits above a normal rate of return, this would attract new entrants into the industry until the marginal processors no longer earned average profits above a normal rate of return.

For these reasons, therefore, we believe that over the long run the proposed reductions in Cook Inlet commercial sockeye harvests would have little or no effect on net economic value generated in the processing industry. In the short run, lower average harvests would lead to lower profits and a reduction in net economic value, in particular if sockeye production was reduced proportionally for all processors. However, over time processors would adjust their capacity and their labor force down, and some processors might leave the industry altogether. Data on year-to-year changes in buyers and processors of Upper Cook Inlet fishery products (Appendix Table J-1) indicate that such entry to and exit from the processing industry occurs frequently. Because the least profitable operations are most likely to make such adjustments, there would be little change in net economic value.

In effect, over the long-term, the reduction in benefits to the processing industry, as measured by wholesale value, would be offset by a corresponding reduction in costs. (Note that our reasoning about change in net economic value to processors is the same as our reasoning about change in net economic value to sport fishing guides in Chapter VI.)

Six of the nine companies we interviewed for this study, including the top five in reported volume of salmon processed in 1994, are owned by Alaskans. However, three are owned by non-residents. The fact that some companies are owned by non-residents would further reduce the change in net economic value to Alaskans.

As always, it is important to distinguish between net economic value and economic impacts. The fact that we are projecting little change in net economic value to processors does not mean that there would be no effects on the processing industry or its contribution to the Alaska economy. We examine the changes in economic impacts in Chapter VII.

Market Effects of Reduced Commercial Harvests

Reduced commercial salmon harvests in Cook Inlet might—at least in theory—raise the price of salmon, not only in Cook Inlet but also in other parts of Alaska. A price increase would affect net economic value to Alaska commercial fishermen, as well as net economic value to Alaska salmon consumers. Below we discuss whether the proposed reductions in commercial harvests are likely to increase sockeye prices, and how potential price changes could affect net value to Alaska salmon fishermen and consumers. Appendix B includes a detailed analysis of how we reach our conclusions about market effects.

Price Effects on the Cook Inlet Fisheries

Cook Inlet sockeye and other Alaska sockeye are close substitutes—so it is the relative change in statewide average sockeye harvests, rather than in Cook Inlet harvests, that is relevant in assessing the impacts of commercial harvest reductions on the Cook Inlet price. Between 1980 and 1995, total Alaska sockeye harvests averaged 260 million pounds, while Cook Inlet sockeye harvests averaged 28 million pounds, or 11 percent of total Alaska sockeye harvests.

A reduction of 1.47 million pounds in the Cook Inlet sockeye harvest (the assumption for Scenario A) would represent about a 5.2 percent reduction in the average Cook Inlet sockeye harvest, but only a 0.6 percent reduction in the average statewide harvest volume. We estimated a regression model the predicts the relative price of Cook Inlet to Bristol Bay sockeye as a function of the share of Cook Inlet in Alaska sockeye harvests. (Regression results are reported in Appendix B.) The equation shows a modest but statistically significant relative price effect from changes in the Cook Inlet harvest share. Evaluating the regression equation at our base-case price scenario (about equal to the average price prevailing over the past five years), a 5.2 percent reduction in Cook Inlet harvest would raise Cook Inlet sockeye prices by at most about one cent per pound.[11]

One cent per pound applied to an average harvest of 28 million pounds would yield a change in revenue for the fishery of $280,000. Multiplying average harvest shares of the drift and set fisheries by their resident shares of the harvest, we expect Alaska residents would harvest 84.9 percent of the total. This would yield an increase of $238,000 in gross revenues of resident permit holders. This gain would partially offset the projected loss of $1.785 million revenue from the reduced harvest size.

The regression estimates the effects of year-to-year fluctuations in harvest levels on prices. The changes in management studied in this report, however, would reduce harvests permanently by a small amount. Over a longer period of time, capacity constraints that might affect Cook Inlet prices during years with especially large or small runs are not likely to be a factor if processors and shippers can anticipate smaller average harvests. For this reason, the estimate of a one cent gain in the price predicted by the regression is probably an upper bound. The change that would actually occur is undoubtedly much less, and may be trivial.

[11] We use Bristol Bay as an index of all Alaska sockeye prices. The interpretation offered here assumes that Bristol Bay prices neither rise nor fall on the average when the Cook Inlet share changes.

The average reduction in the statewide harvest volume would be so small that the effect on Cook Inlet ex-vessel prices would be very small—and therefore the effects of the price change on net economic value of the Cook Inlet commercial fishery would be small relative to the effects of changes in harvest volumes. In other words, it is the reduction in harvest volume, rather than the potential change in price, that accounts for almost all the change in net economic value of the Cook Inlet fishery.

Price Effects on Other Alaska Salmon Fisheries

If we consider all Alaska fishermen, however, then even a small change in price might have an important effect on net economic value. If a reduction in Cook Inlet harvests led to a small increase in the average *statewide* price of sockeye, then net economic value to Alaska fishermen would rise by an amount equal to the statewide harvest volume times the price increase. Because the statewide harvest volume is large, even a small increase in price could result in a large increase in total value. In effect, fishermen in other parts of Alaska might benefit from a reduction in Cook Inlet harvests, if they got a slightly higher price as a result.

How significant this effect might be depends on the elasticity of demand for Alaska sockeye. The more inelastic the demand is, the greater the potential change in price. Various evidence—such as the great amount of attention paid to North American sockeye supply by Japanese importers—suggests that short-run changes in Alaska sockeye harvests do in fact affect short-run prices. However, for several reasons, we believe that long-run demand for Alaska sockeye is much more elastic than short-run demand, and the change in statewide average prices as a result of a long-run reduction in average harvests would be relatively small.

One reason is that the supply of substitutes for Alaska sockeye is growing. Canadian and Russian sockeye compete directly with Alaska sockeye on the Japanese market, and imports from Russia have grown substantially in recent years. Even more important, the last seven years have seen very rapid growth in production of farmed Chilean coho salmon, which also competes directly with Alaska sockeye on the Japanese market. Other species, including Japanese fall chum salmon and farmed Atlantic salmon, also compete less directly with Alaska sockeye. As the supply of these other species grows—and in particular the supply of farmed coho salmon—the relative effects of a given change in Alaska supply on sockeye prices will decline.

Other factors besides harvest size probably also affect the price of sockeye—including, among others, exchange rates, Japanese economic conditions, world supply of competing salmon species, and long-run trends in Japanese tastes and the Japanese distribution system.

Formal econometric measurement of the effects of these factors, and how Alaska sockeye prices might change in response to a reduction in average Cook Inlet sockeye harvests, would require the specification of a system of equations modeling supply and demand in all the Kenai River red salmon markets as well as the markets for all substitutes. The complexity of the world salmon market, as well as the absence of data for many important variables, would complicate estimation of such a model.

Herrmann (1993) and Herrmann, Mittelhammer, and Lin (1992) attempted to estimate a full econometric model of Alaska salmon demand. To obtain enough observations to estimate their model, however, they estimated equations to explain quarterly price movements. Models estimated to explain monthly or quarterly price changes are likely to give biased and misleading results when applied to long-term changes in supplies. The reason is that the change in equilibrium prices that follows from a permanent reduction in Cook Inlet harvests is likely to be much smaller than the temporary fluctuations within the year. Over a longer period of time, wholesalers and consumers have more time to locate and acquire substitutes for Alaska sockeye.

Increasingly, farmed salmon are emerging as such a substitute. In the long run, the price of farmed salmon will largely determine prices of all wild salmon species. Not enough data are yet available to estimate an econometric supply relationship for farmed salmon, but the abundance of potential sites and producing areas suggests that the long-run supply is likely to be highly elastic. Any long-term rise in salmon prices would be eliminated by an increase in farmed supply. Since the investment in farmed stock would take a few years to hit the market, the dampening effect on price fluctuations would not be visible in annual data.

This means that econometric models with high historical explanatory power probably give biased and misleading results when applied to the analysis of the effects of long-term changes in salmon supply on prices. The world salmon industry is in a time of rapid change due to the very rapid growth of world farmed salmon supply. The change in equilibrium prices due to a permanent reduction in Cook Inlet harvests is certain to be much smaller than the price effects of temporary—even year-to-year —fluctuations.

In sum, then, if average Cook Inlet sockeye harvests were reduced, Alaska residents who fish commercially for sockeye in other parts of Alaska might enjoy a small increase in price. We did not estimate this potential increase in value to other Alaska resident fishermen, and we believe that it would be extremely difficult to do so with any degree of reliability. However, we believe that the supply response would be elastic, so that the additional value due to the higher price would be small—probably much less than the loss in value to Cook Inlet fishermen. It would be further offset because a substantial share of the total Alaska sockeye harvest is caught by non-resident fishermen, in particular in Bristol Bay.

Changes in Net Economic Value to Consumers

A final issue for this chapter is the potential change in net economic value to Alaska consumers of Cook Inlet sockeye salmon, if the commercial harvest were reduced. We believe such a change would be negligible. First, as discussed in the previous section, there would be very little effect on prices, so any change in consumer surplus would result primarily from the reduction in harvests.

Second, only a small share of Cook Inlet sockeye find their way to Alaska consumers. Although we do not have specific data for Cook Inlet sockeye, Table IX-11 shows estimates of end-markets for U.S. sockeye salmon (which is almost entirely Alaska sockeye). In 1994, total U.S. sockeye harvests were 304 million pounds, with an estimated final product weight of 221 million pounds after allowing for yield loss in processing (about 27 percent).

Of this final product volume, 167 million pounds (76 percent) were exported frozen—almost entirely to Japan—and 36 million pounds (16 percent) were canned. Only an estimated 18 million pounds (8 percent) remained for all other uses, including sales of fresh and frozen salmon to the U.S. domestic market. Only a small share is sold to Alaska consumers. Consequently, we estimate that the management change analyzed in this report would result in a negligible change in Alaska resident consumers' surplus.

Table IX-11. Estimated End-Markets for U.S. Sockeye Salmon

	1990	1991	1992	1993	1994
Alaska sockeye harvest volume (000 lbs) (a)	305,969	255,519	345,810	382,280	294,160
U.S. total sockeye harvest volume (000 lbs) (b)	317,315	268,793	346,573	394,929	304,743
Total canned sockeye salmon pack (cases, 48-tall basis) (c)	1,135,417	904,770	914,543	1,077,119	813,812
Estimated canned weight (000 lbs) (d)	50,242	40,036	40,469	47,663	36,011
Assumed canned yield (percent) (k)	67%	67%	67%	67%	67%
Estimated round volume canned (000 lbs) (e)	74,988	59,755	60,401	71,138	53,748
Estimated round volume frozen (000 lbs) (f)	242,327	209,038	286,172	323,791	250,995
Assumed frozen yield (percent) (k)	74%	74%	74%	74%	74%
Estimated frozen production (000 lbs) (g)	196,767	157,004	211,767	239,605	185,736
Estimated yield loss in canned & frozen processing (000 lbs) (h)	70,306	71,753	94,337	107,661	82,996
U.S. exports of frozen red salmon, May-April (kilos) (i)	89,252,815	71,216,661	93,400,180	102,354,895	76,297,000
U.S. exports of frozen red salmon, May-April (000 lbs)	196,767	157,004	205,910	225,652	168,204
All uses other than frozen exports, canned or yield loss (000 lbs) (j)	0	0	5,857	13,954	17,532
Estimated share of final product volume					
Frozen salmon exports	80%	80%	82%	79%	76%
Canned salmon, domestic and exports	20%	20%	16%	17%	16%
All other uses	0%	0%	2%	5%	8%

GENERAL NOTES: Estimates should be viewed as approximate only. Estimates of yield loss and "other uses" depend critically upon yield assumptions. Estimates do not take account of the fact that some U.S. canned production is of Canadian harvested salmon. Estimates also do not take account of changes in frozen inventories from year to year. SPECIFIC NOTES: (a) CFEC and ADFG data. (b) 1990-93 from NMFS, Fisheries of the United States, "U.S. Domestic Landings, by Species." 1994 data are Alaska catch plus Washington catch reported in 1994 "Statpack" (Pacific Fishing Magazine, 3/95). (c) National Food Processors Association data. (d) Assumed each case is 48 14.75 oz cans. (e) Canned volume divided by yield. (f) Total harvest volume minus estimated round volume canned. (g) Estimated round volume frozen times assumed frozen yield, or frozen exports of red salmon (whichever is greater). (h) Total round volume minus estimated canned weight minus estimated frozen production. (i) Bureau of the Census data. 1994 data are for April-February only. (j) 1994 figure will likely decline as additional frozen exports are reported for September-April. (k) Average yield from Chuck Crapo, Brian Paust and Jerry Babbitt, "Recoveries and Yields from Pacific Fish & Shellfish, Alaska Sea Grant College Program Marine Advisory Bulletin No. 37, 1993. SMIS file: SOCKEYE END-MARKET ESTIMATES.

Chapter X. Change in Economic Impacts of the Commercial Fishery

This chapter examines potential changes in economic impacts of the Upper Cook Inlet commercial fishery, if managers reduced commercial harvests in order to allow more sockeye into the Kenai River. The current management target for Kenai River sockeye is 450,000 to 700,000; we are mainly examining the potential effects of increasing that target by 200,000.

Impacts are jobs, income, or other measures associated with an activity. We calculate changes in economic impacts by looking at changes in earnings, employment, and spending in commercial fishing, in processing, and in other industries. Higher earnings, employment, and spending increase economic impacts; smaller earnings, employment, and spending decrease economic impacts.

This measure of economic effects is quite different from net economic value in the commercial fishery, which we examined in Chapter IX. Below we first describe how we measured economic impacts before presenting the results in detail.

Potential Changes in Economic Impacts of the Commercial Fishery

We focused on three kinds of potential changes in economic impacts that might result from reduced commercial harvests:

- Changes in value added of businesses operating in Alaska; value added is the sales of those businesses, minus the wholesale value of goods they purchase outside Alaska.
- Changes in payroll in Alaska—including earnings of commercial fishermen and processing workers
- Changes in annual average employment in Alaska—including employment in the commercial harvesting and processing industries

We distinguish between economic impacts in three kinds of industries:

- Commercial fishing
- Fish processing
- All other industries

We estimate economic impacts in the commercial fishing industry from the changes in the total harvest value, non-labor costs, and payments to crew and permit holders that we estimated in Chapter VIII. We estimate economic impacts in the fish processing industry based on estimates of average labor costs and other costs per pound.

We estimate economic impacts in other industries by tracking the direct and indirect effects of changes in expenditures in the commercial fishing and fish processing industries. We define "direct" economic impacts in other industries as the value added, payroll, and employment in the Alaska firms that sell goods and services to the commercial fishing and fish processing industries. "Indirect" economic impacts in other industries are created as income earned from direct impacts and from payments to commercial fishermen and processing workers circulates through the economy. Total economic impacts in other industries are the sum of direct and indirect impacts. Most of the direct impacts would occur on the Kenai Peninsula, while indirect effects would be more widely spread across Alaska.

Our methodology for estimating direct and indirect economic impacts in other industries is analogous to our methodology for estimating changes in economic impacts of sport fishing expenditures (Chapter VII). The first step was estimating changes in expenditures in the commercial harvesting and processing industries. We then used ISER's Cook Inlet Salmon Economic Impact Model to transform changes in expenditures into estimates of changes in direct and indirect economic impacts. Appendix I provides a technical description of the Cook Inlet Salmon Economic Impact Model and the Alaska Input-Output Model from which it was derived.

In our Chapter VII analysis of potential changes in economic impacts of the sport fishery, a major issue was the extent to which increases in expenditures for Kenai River sport fishing might be offset by reduced expenditures for fishing in other Alaska locations. There is no parallel issue in our analysis for the commercial fishery. It is unlikely that a reduction in sales of Alaska salmon would be accompanied by any corresponding increase in sales of other Alaska industries—partly because only a small fraction of the total commercial harvest is sold in Alaska, and partly because most of the potential substitutes for Alaska salmon—other food products—are not produced in Alaska.

Changes in Economic Impacts in the Commercial Fishing Industry

In assessing potential changes in economic impacts in the commercial fishing industry, a first issue is how total capacity in the commercial fishing industry might change in response to a permanently smaller average harvest. We assumed that total capacity would remain unchanged—that the number of operations as well as the fixed costs of each operation would remain the same. The effect of reduced fishing opportunities would be reductions in average harvest value, average variable costs, average crew earnings, and average profits.

We made this assumption because entry to the Cook Inlet commercial salmon fishery is limited. At present, the constraint on total harvesting capacity is the number of limited entry permits, rather than profitability. Evidence of this is the fact that limited entry permits command substantial prices, which indicates that commercial fishing is profitable at the margin. A reduction in Cook Inlet commercial harvests, by reducing the profitability of the fishery, would primarily cause the value of limited entry permits to fall, rather than reducing the number of fishing operations.

Most, but not all, Cook Inlet commercial fishermen are Alaska residents—as estimated in Chapter VIII, 72.7 percent of driftnet fishermen and 88.8 percent of setnet fishermen are residents. When possible, in this section we identify how much of the change would be for resident permit holders and crew members.

Table X-1 shows our estimates of changes in value added in commercial fishing, calculated as the change in the harvest value minus the change in non-labor costs—which is identical to the change in payments to crew and permit holders. We discuss our estimates of changes in harvest value, non-labor costs, and payments to crew and permit holders in Chapter VIII (see Table VIII-7).

In Scenario A (which assumes an increase of 200,000 sockeye in the Kenai River in a medium-run year) the loss in value added in commercial fishing would be $1.8 million. In the low price and high price scenarios (A1 and A2), the loss in value added would be significantly lower or higher, reflecting differences in the value of the harvest. In the low run scenarios (A3 and A5), the loss in value added is higher because of the greater reduction in the commercial harvest assumed in those scenarios.

Table X-1. Estimated Changes in Value Added in Commercial Fishing

	Scenario Name and Code*							
	+200K at sonar A	+100K at sonar D	-100K at sonar E	+200K low price A1	+200K high price A2	+200K low run A3	+200K high run A4	+200K low run, low price A5
Change in ex-vessel harvest value	-$2,184,722	-$1,092,361	$1,092,361	-$1,552,622	-$2,655,122	-$4,283,923	$0	-$3,099,703
Change in non-labor costs	-$336,840	-$168,420	$168,420	-$336,840	-$336,840	-$799,986	$0	-$799,986
Change in value added (= change in payments to crew and permit holders	-$1,847,882	-$923,941	$943,941	-$1,215,782	-$2,318,282	-$3,483,937	$0	-$2,299,717

**Assumptions and analysis for Scenarios B and C are same as for Scenario A.*
Note: Based on estimates presented in Chapter VIII, Table VIII-7.
ISER file: Commercial Analysis

Table X-2 shows our estimates of changes in earnings in commercial fishing. These estimates of changes in earnings are also discussed in Chapter VIII (see Table VIII-7). To estimate a measure of earnings comparable to "payroll" in other industries, we also estimated the change in the "wage component" of permit holder earnings. This is that portion of permit holder earnings that may be considered payment for the permit holder's labor, while the remainder may be considered a return on the investment in the permit. We assumed that the average wage component of permit holder earnings is equivalent to average crew earnings, and that the average change in the wage component is equivalent to the average change in crew earnings. (Details of our calculations are shown in Appendix D, Table D-6.) Note that the change in the wage component is less that 20 percent of the total change in permit holder earnings.

The bottom row of Table X-2 shows estimates of changes in earnings for just residents (including changes for crew members and in the wage component of the change for permit holders). Under Scenario A, resident fishermen would lose an estimated $694,000 in earnings. They would lose only about half that amount under the scenario (D) that assumes only a 100,000 increase in the number of sockeye in the Kenai River, and in the scenario that examines the effects of reducing the number of sockeye in the river by 100,000 (Scenario E), resident fishermen would gain about $345,000. The low run scenario (A3) would cost commercial fishermen the most—because it assumes they would lose a districtwide opening. In a high-run year, earnings would be unchanged.

Table X-3 shows our estimates of changes in annual average employment in commercial fishing. We estimated changes in annual average employment by estimating the change in total hours worked—equal to the number of permit holders and crew members multiplied by the change in hours of fishery openings—and dividing by an assumed average work year of 2,000 hours. (Details of our calculations are shown in Appendix D, Table D-5.) In Scenario A, we estimate that 1,451 driftnet fishermen each work an average of 16 fewer hours, and 735 setnet fishermen north of the Blanchard Line work an average of 32 fewer hours. In total, fishermen work 46,700 fewer hours, which is a equal to a loss in 23.4 annual average jobs; of those, 18.9 would be resident jobs.

It is important to note that an "annual average job" is very different from a real year-round job. The loss in hours worked in the fishing industry affects a large number of people for a relatively short number of hours. An equivalent loss of work hours in full-time, year-round jobs would have a much more significant effect on a smaller number of people. Thus, although the change in annual average employment is a useful measure for assessing the scale of work-hours lost, it is important not to confuse it with the more familiar concept of the loss of full-time jobs.

Table X-2. Estimated Changes in Earnings in Commercial Fishing

	Scenario Name and Code*							
	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in payments to crew (a)								
Resident	-$481,367	-$240,683	$240,683	-$341,962	-$585,110	-$591,668	$0	-$427,089
Non-resident	-$74,269	-$37,135	$37,135	-$52,786	-$90,257	-$157,302	$0	-$113,852
Total	-$555,636	-$277,818	$277,818	-$394,747	-$675,367	-$748,970	$0	-$540,942
Change in payments to permit holders (a)								
Resident	-$1,035,833	-$517,916	$517,916	-$654,947	-$1,319,283	-$1,983,155	$0	-$1,268,312
Non-resident	-$180,932	-$90,466	$90,466	-$112,441	-$231,903	-$593,056	$0	-$375,561
Total	-$1,226,704	-$613,352	$613,352	-$774,456	-$1,563,261	-$2,606,450	$0	-$1,665,784
Estimated wage component of change in payments to permit holders (b)								
Resident	-$212,222	-$106,111	$106,111	-$150,796	-$257,934	-$352,555	$0	-$254,912
Non-resident	-$36,910	-$18,455	$18,455	-$26,243	-$44,847	-$106,325	$0	-$77,031
Total	-$249,131	-$124,566	$124,566	-$177,040	-$302,781	-$458,879	$0	-$331,944
Total change in payments to crew and estimated wage component of change in payments to permit holders								
Resident	-$693,588	-$346,794	$346,794	-$492,758	-$843,044	-$944,222	$0	-$682,002
Non-resident	-$111,179	-$55,590	$55,590	-$79,029	-$135,105	-$263,626	$0	-$190,884
Total	-$804,768	-$402,384	$402,384	-$571,787	-$978,148	-$1,207,849	$0	-$872,885

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) Derived from estimates of changes in earnings shown in Chapter VIII, Table VIII-7. Estimates are slightly lower because payments for the Salmon Marketing Tax (1% of ex-vessel value) and the aquaculture assessment (2% of ex-vessel value) are subtracted. Our estimates of changes in payments to permit holders used to estimate changes in economic impacts in other industries do not subtract the salmon marketing tax or aquaculture assessment, because we assume that spending of this money by state government or aquaculture associations has the same effect as spending by the permit holder.

(b) Change in wage component of average permit holder earnings is assumed to be equal to change in average crew earnings. For details of estimates, see Appendix D, Table D-6.

ISER file: Commercial Analysis.

Table X-3. Estimated Changes in Annual Average Employment in Commercial Fishing

	Scenario Name and Code*							
	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in annual average employment of crew (a)								
Resident	-12.3	-6.1	6.1	-12.3	-12.3	-15.7	0.0	-17.6
Non-resident	-2.8	-1.4	1.3	-2.8	-2.8	-3.8	0.0	-4.3
Total	-15.0	-7.5	7.4	-15.0	-15.0	-19.5	0.0	-22.0
Change in annual average employment of permit holders (a)								
Resident	-6.6	-3.3	3.2	-6.6	-6.6	-8.8	0.0	-10.0
Non-resident	-1.7	-0.9	0.8	-1.7	-1.7	-2.5	0.0	-2.8
Total	-8.3	-4.2	4.0	-8.3	-8.3	-11.3	0.0	-12.9
Total change in annual average employment of crew and permit holders								
Resident	-18.9	-9.4	9.2	-18.9	-18.9	-24.6	0.0	-27.7
Non-resident	-4.5	-2.2	2.1	-4.5	-4.5	-6.3	0.0	-7.2
Total	-23.4	-11.7	11.3	-23.4	-23.4	-30.8	0.0	-34.8

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.
(a) Estimated by multiplying total number of crew or permit holders in 1994 by change in hours (as estimated by ISER landings model), and dividing by an assumed work year of 2000 hours. For details, see Appendix D, Table D-5.
ISER file: Commercial Analysis.

Changes in Economic Impacts in the Processing Industry

In assessing potential changes in economic impacts in the processing industry—as in the commercial fishing industry—a first issue is how total capacity might change in response to a permanently smaller average harvest. For our analysis, we assumed that in the long run processing capacity would adjust down in proportion to the reduction in the average harvest. Total fixed and variable costs would decline in proportion to the harvest reduction, while fixed and variable costs per fish or per pound would remain unchanged.

This differs from the assumption we made when analyzing potential change in commercial fishing, where we assumed that only variable costs would change. The reason we're making a different assumption here is that there is no "limited entry system" for fish processing. Total capacity is limited by profitability. It is unlikely that a reduction in commercial harvests would change the level of long-run average profits the commercial processing industry is willing to accept. Thus for the processing industry we assume that both fixed and variable costs change in proportion to the change in the average harvest.

In Chapter IX, we estimated an average margin of 80 cents per round pound for processing Cook Inlet sockeye salmon (see Table IX-10). This means that on average the total wholesale value of processed Cook Inlet sockeye salmon exceeds the total ex-vessel value by 80 cents per round pound. Put differently, on average, all costs and profits in processing sockeye salmon—other than the cost of the fish—add up to 80 cents per round pound.

The next step in our analysis was estimating non-labor costs, labor costs, profits, and employment per round pound. Unlike for our commercial fishing analysis, we did not have detailed survey information on costs and employment in fish processing. We used information from several sources to develop our average cost and employment estimates. These included Alaska Department of Labor data on Kenai Peninsula fish processing employment, fish processing earnings, and residency of processing workers; information collected in our interviews with processors about processing employment, residency of processing workers, and residency of processor owners; data on 1992 Kenai Peninsula processing employment, payroll, and non-labor expenditures in Alaska, collected by Pacific Associates in a report prepared for the Pacific Seafood Processors Association; and other information on Alaska fish processing costs collected by ISER over a number of years. These data and our detailed estimates of average costs, profits, and employment per round pound are shown in Appendix D in Tables D-2, D-3, D-4 and D-7.

Table X-4 summarizes our estimates of fish processing value added, earnings, and employment per round pound, as well as total changes in value added, earnings and employment for each scenario. Value added in fish processing is the wholesale value minus the cost of purchased inputs other than labor. We estimated average value added per round pound of 45 cents, which is equal to the average margin of 80 cents per round pound minus average non-labor costs of 36 cents per round pound.

Table X-4. Estimated Changes in Fish Processing Value Added, Payroll and Annual Average Employment

	Scenario Name and Code*							
	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in total pounds harvested (a)	-1,577,080	-788,540	788,540	-1,577,080	-1,577,080	-3,395,140	0	-3,395,140
Assumptions								
Value added per round pound (b)	$.454	$.454	$.454	$.454	$.454	$.454	$.454	$.454
Payroll per round pound (c)	$.154	$.154	$.154	$.154	$.154	$.154	$.154	$.154
Employment months per million round pounds (c)	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0
Estimated resident share of employment (d)	40%	40%	40%	40%	40%	40%	40%	40%
Estimated change in value added	-$715,458	-$357,729	$357,729	-$715,458	-$715,458	-$1,540,239	$0	-$1,540,239
Estimated change in payroll								
Resident	-$97,148	-$48,574	$48,574	-$97,148	-$97,148	-$209,141	$0	-$209,141
Non-resident	-$145,722	-$72,861	$72,861	-$145,722	-$145,722	-$313,711	$0	-$313,711
Total	-$242,870	-$121,435	$121,435	-$242,870	-$242,870	-$522,852	$0	-$522,852
Estimated change in annual average employment								
Resident	-4.2	-2.1	2.1	-4.2	-4.2	-8.9	0.0	-8.9
Non-resident	-6.2	-3.1	3.1	-6.2	-6.2	-13.4	0.0	-13.4
Total	-10.4	-5.2	5.2	-10.4	-10.4	-22.4	0.0	-22.4

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) Estimated by multiplying change in number of fish harvested by average weight per fish. See Appendix D, Table D-1 for details of estimates.

(b) See Appendix D, Table D-7 for calculation of assumptions.

(c) See Appendix D, Table D-4 for calculation of assumptions. Payroll excludes cost of employee benefits.

(d) Residency share assumed based on interviews with Kenai Peninsula processors and Alaska Department of Labor data, as reported in Appendix D,
Table D-2. Also see discussion in text of this chapter.

ISER file: Commercial Analysis.

In Scenario A, multiplying by a reduction of 1,577,080 pounds in the total commercial harvest results in a total reduction in value added of $715,000. Note that for all scenarios, the change in total value added in fish processing is proportional to the reduction in harvest volume. Because the processing margin and average costs per round pound are fixed, the change in total value added is not affected by the ex-vessel price.

We estimated average payroll of $.154 per round pound, and average processing employment of 79 months per million round pounds processed. In Scenario A, the reduction in average harvest volume results in a reduction in total processing payroll of $243,000 and a reduction of 10.4 in annual average employment. As with value added, in other scenarios, these changes are proportional to the change in harvest volume but are not affected by the ex-vessel price.

Unlike in the commercial fishing industry, less than half of Cook Inlet processing workers are Alaska residents. The Alaska Department of Labor estimates that statewide, only about 24 percent of fish processing workers are Alaska residents.[1] Because it is less remote than many areas of Alaska, the resident share is probably somewhat higher in Cook Inlet. In our survey interviews, Cook Inlet processors reported that 55 percent of their workers were Alaska residents. However, data reported by the Alaska Department of Labor for these companies' statewide resident shares, weighted by their Cook Inlet salmon production reported in our interviews, would suggest a considerably lower resident share—only about 33 percent. Since these companies' statewide operations include facilities in many remote areas, it is likely that the Cook Inlet average residency share is somewhat higher. For our analysis, we assumed a resident share of 40 percent for Cook Inlet processing workers. (See Appendix D, Table D-2 for details of these residency estimates.)

Adjusting for a 40 percent resident share results in lower estimates of changes in resident fish processing payroll and resident annual average employment in fish processing. In Scenario A, the reduction in resident payroll is $97,000, and the estimated reduction in resident annual average employment is 4.2 annual average jobs.

Changes in Economic Impacts in Other Industries

Changes in economic impacts in other industries result from changes in expenditures in the commercial fishing and processing industries, including expenditures for goods and services as well as changes in payments to crew members, permit holders, processing workers and processor owners. Expenditures for goods and services result in direct economic impacts in the Alaska firms that sell goods and services to the commercial fishing and fish processing industries. Income earned in these firms, as well as by crew members, permit holders, processing workers and processor owners, results in indirect economic impacts as it circulates through the Alaska economy.

Table X-5 summarizes our estimates of changes in commercial fishing and fish processing expenditures, by type of expenditure. For the commercial fishing industry, we estimated changes in expenditures for goods and services based on assumptions about variable costs per pound for each expenditure category. Our assumptions are based on average variable costs per pound reported by respondents to our permit holder survey. (Appendix D, Table D-8 provides details of these estimates.)

As we discussed earlier, we estimated changes in payments to crew based on changes in harvest value and average crew shares. We estimated changes in payments to permit holders by subtracting changes in expenditures for goods and services and changes in payments to crew from changes in harvest value. (Chapter VIII, Table VIII-7 provides details of these estimates.)

For the fish processing industry, we estimated changes in expenditures by multiplying the change in round pounds processed by assumptions about average expenditures per pound (Appendix D, Table D-7 provides details of these assumptions.) Unlike the commercial fishing industry, for which we assume that all changes in variable expenditures for goods and services occur in Alaska, for the processing industry we assume that some of the changes in expenditures for goods and services occur outside Alaska (for example, expenditures for supplies, ocean shipping, and cold storage). This reduces the change in economic impacts in Alaska resulting from these changes in expenditures.

The final step in estimating changes in economic impacts in other industries is multiplying the changes in expenditures for each expenditure category shown in Table X-5 by the corresponding coefficients of the Cook Inlet Salmon Economic Impact Model, shown in Table X-6. These coefficients show the economic impacts per $1,000 of expenditures. They were derived using ISER's Alaska Input-Output Model, as described in Appendix I.

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[1]Kathryn Lizik and Jeff Hadland, "Nonresidents Working in Alaska, 1993," Alaska Department of Labor, January 1995, Table 1, page 7.

Table X-5. Estimated Changes in Commercial Fishing and Processing Expenditures

	Scenario Name and Code*							
Type of Expenditure	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
HARVESTER EXPENDITURES								
Fuel	-$83,918	-$41,959	$41,959	-$83,918	-$83,918	-$146,619	$0	-$146,619
Food	-$33,812	-$16,906	$16,906	-$33,812	-$33,812	-$87,990	$0	-$87,990
Boat or camp supplies	-$58,613	-$29,306	$29,306	-$58,613	-$58,613	-$116,566	$0	-$116,566
Equipment repair	-$99,017	-$49,509	$49,509	-$99,017	-$99,017	-$288,040	$0	-$288,040
Other supplies	-$27,668	-$13,834	$13,834	-$27,668	-$27,668	-$72,781	$0	-$72,781
Payments to resident crew	-$481,367	-$240,683	$240,683	-$341,962	-$585,110	-$591,668	$0	-$427,089
Payments to non-resident crew	-$74,269	-$37,135	$37,135	-$52,786	-$90,257	-$157,302	$0	-$113,852
Payments to resident permit holders	-$1,091,436	-$545,718	$545,718	-$694,459	-$1,386,860	-$2,081,433	$0	-$1,339,392
Payments to non-resident permit holders	-$200,810	-$100,405	$100,405	-$126,576	-$256,054	-$653,534	$0	-$419,384
PROCESSOR EXPENDITURES								
Utilities	-$26,842	-$13,421	$13,421	-$26,842	-$26,842	-$57,785	$0	-$57,785
Supplies	-$5,952	-$2,976	$2,976	-$5,952	-$5,952	-$12,813	$0	-$12,813
Services	-$35,011	-$17,506	$17,506	-$35,011	-$35,011	-$75,372	$0	-$75,372
Tendering	-$31,542	-$15,771	$15,771	-$31,542	-$31,542	-$67,903	$0	-$67,903
Instate shipping	-$16,339	-$8,169	$8,169	-$16,339	-$16,339	-$35,174	$0	-$35,174
Maintenance	-$26,842	-$13,421	$13,421	-$26,842	-$26,842	-$57,785	$0	-$57,785
Depreciation	-$87,528	-$43,764	$43,764	-$87,528	-$87,528	-$188,430	$0	-$188,430
Administration	-$17,506	-$8,753	$8,753	-$17,506	-$17,506	-$37,686	$0	-$37,686
Overhead	-$35,011	-$17,506	$17,506	-$35,011	-$35,011	-$75,372	$0	-$75,372
Payments to resident workers	-$196,378	-$98,189	$98,189	-$173,999	-$213,032	-$422,763	$0	-$374,586
Payments to non-resident workers	-$182,933	-$91,467	$91,467	-$182,933	-$182,933	-$393,819	$0	-$393,819
Payments to resident owners	-$252,110	-$126,055	$126,055	-$274,489	-$235,456	-$542,743	$0	-$590,920
Payments to non-resident owners	$0,0	$0,0	$0,0	$0,0	$0,0	$0,0	$0	$0,0

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.
Notes: See Appendix D, Tables D-8 and D-9 for details of estimation of changes in expenditures. Change in payments to permit holders include changes in ASMI taxes and assessments which are not included in payments to permit holders shown in Table X-2. Changes in payments to workers includes changes in benefits not shown in Table X-4. Changes in payments to resident workers also includes changes in fisheries business taxes and ASMI assessment, which are assumed to have the same economic impact.
ISER file: Commercial Analysis.

Some kinds of expenditures have a much higher economic impact on Alaska than others, per dollar spent—depending on how much of the expenditure leaks out of the economy. For example, $1,000 of expenditures on equipment repair or utilities has a direct impact of $1,000 on Alaska value added (in Tables X-6 through X-9, we use the term "output/sales" for value added). By contrast, $1,000 in expenditures for food generates only about one-third as much direct value added for businesses operating in Alaska, because a large share of expenditures for food items goes to food producers outside Alaska.

The direct impacts of $1,000 in expenditures on payroll in Alaska depend on the labor component of the expenditure category. For example, $1,000 in expenditures for equipment repair, which has a high labor component, has a direct payroll impact of $517. In contrast, $1,000 in expenditures for fuel has a direct payroll impact of only $135, only about one-fourth as great.

Our model calculates effects on employment in Alaska as effects on payroll, divided by average annual earnings per worker. Therefore, $1,000 in expenditures has a greater effect on employment, the greater the share that goes to payroll and the lower the average wage. Some kinds of expenditures create much more direct employment than others. Only $44,800 in expenditures for equipment repair is needed to create a direct annual average job in equipment repair. In contrast, $312,500 in expenditures is needed to create a direct job in boat or camp supplies.

Indirect economic impacts result from re-spending by Alaska households of income earned as direct payroll, as well as additional expenditures by business which experience direct impacts (for example, purchases of accounting services by an equipment repair firm). Indirect economic impacts reflect significant leakage of expenditures from the Alaska economy. For most types of expenditures, indirect economic impacts on payroll and employment are about half the level of direct economic impacts.

Payments to crew, permit holders, processing workers and processor owners represent payments to households (there are no corresponding expenditure categories in our analysis of sport fishing in Chapter VII, because anglers do not receive income from sport fishing). Payments to residents have no direct economic impacts, but they have significant indirect economic effects as households re-spend their income. Every $1,000 in payments to residents generates $809 in indirect value added, $218 in indirect Alaska payroll, and .0091 indirect annual average jobs. In contrast, payments to non-resident workers have a some direct impact—as we assume that workers spend part of this money for food and housing expenses—but relatively small indirect impacts.

Table X-6. Cook Inlet Salmon Economic Impact Model: Economic Impacts per $1,000 of Commercial Fishing and Processing Expenditures

	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
HARVESTER EXPENDITURES									
Fuel	$606	$504	$1,110	$135	$96	$231	0.0061	0.0032	0.0094
Food	$352	$245	$597	$147	$65	$211	0.0076	0.0025	0.0102
Boat or camp supplies	$269	$129	$399	$83	$35	$118	0.0032	0.0013	0.0046
Equipment repair	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Other supplies	$531	$357	$889	$203	$95	$298	0.0093	0.0037	0.0129
Payments to resident crew	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident crew	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
Payments to resident permit holders	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident permit holders	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
PROCESSOR EXPENDITURES									
Utilities	$1,000	$798	$1,798	$80	$144	$224	0.0015	0.0040	0.0055
Supplies	$269	$129	$399	$83	$35	$118	0.0032	0.0013	0.0046
Services	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Tendering	$1,000	$692	$1,692	$257	$167	$424	0.0073	0.0064	0.0136
Instate shipping	$1,000	$685	$1,685	$257	$171	$428	0.0077	0.0064	0.0141
Maintenance	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Depreciation	$1,000	$467	$1,467	$254	$135	$389	0.0055	0.0053	0.0108
Administration	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Overhead	$1,000	$606	$1,606	$428	$166	$594	0.0093	0.0066	0.0159
Payments to resident workers	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident workers	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
Payments to resident owners	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident owners	$0	$0	$0	$0	$0	$0	0.0000	0.0000	0.0000

Source: Calculated using the Alaska Input-Output Model and the Cook Inlet Commercial Fishery Commodity by Industry Matrix. Documentation on file at ISER. ISER file: Commercial Analysis.

Table X-7 shows, for Scenario A (200,000 additional sockeye) the changes in projected economic impacts in other industries. Total output or value added is reduced by $2.6 million, Alaska payroll is reduced by $737 thousand, and annual average employment is reduced by 30.2 annual average jobs. Changes in payments to resident permit holders are the biggest contributor to these economic impacts. Indirect economic impacts account for about two-thirds of the total change in economic impacts.

Table X-8 provides a summary of changes in economic impacts in other industries for all our scenarios. Changes in economic impacts are lower for our low prices scenario (A1) than for our medium price scenario (A), because the reduction in harvest value is lower. Similarly, changes in economic impacts are higher for Scenario A2 (high price), because the reduction in harvest value is greater. Changes in economic impacts are highest for the low-run scenarios (A3 and A5) because the greater reduction in harvest volume results in a greater reduction in harvest value.

Table X-7. Cook Inlet Salmon Economic Impact Model: Changes in Economic Impacts in Other Industries Due to Changes in Commercial Fishing and Processing Expenditures: Scenario A: +200K at Sonar

		Estimated Economic Impacts								
	Change	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	in expenditures	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
HARVESTER EXPENDITURES										
Fuel	-$83,918	-$50,834	-$42,335	-$93,169	-$11,363	-$8,063	-$19,426	-0.5	-0.3	-0.8
Food	-$33,812	-$11,908	-$8,278	-$20,186	-$4,956	-$2,188	-$7,144	-0.3	-0.1	-0.3
Boat or camp supplies	-$58,613	-$15,791	-$7,584	-$23,375	-$4,864	-$2,041	-$6,905	-0.2	-0.1	-0.3
Equipment repair	-$99,017	-$99,017	-$69,324	-$168,341	-$51,233	-$20,677	-$71,911	-2.2	-0.8	-3.1
Other supplies	-$27,668	-$14,700	-$9,887	-$24,586	-$5,609	-$2,628	-$8,238	-0.3	-0.1	-0.4
Payments to resident crew	-$481,367	$0	-$389,589	-$389,589	$0	-$105,170	-$105,170	0.0	-4.4	-4.4
Payments to non-resident crew	-$74,269	-$14,854	-$8,863	-$23,717	-$4,448	-$2,366	-$6,814	-0.3	-0.1	-0.4
Payments to resident permit holders	-$1,091,436	$0	-$883,342	-$883,342	$0	-$238,459	-$238,459	0.0	-9.9	-9.9
Payments to non-resident permit holders	-$200,810	-$40,162	-$23,965	-$64,127	-$12,027	-$6,397	-$18,425	-0.7	-0.2	-1.0
PROCESSOR EXPENDITURES										
Utilities	-$26,842	-$26,842	-$21,413	-$48,255	-$2,140	-$3,862	-$6,002	0.0	-0.1	-0.1
Supplies	-$5,952	-$1,604	-$770	-$2,374	-$494	-$207	-$701	0.0	0.0	0.0
Services	-$35,011	-$35,011	-$24,512	-$59,523	-$18,115	-$7,311	-$25,427	-0.8	-0.3	-1.1
Tendering	-$31,542	-$31,542	-$21,832	-$53,373	-$8,105	-$5,266	-$13,371	-0.2	-0.2	-0.4
Instate shipping	-$16,339	-$16,339	-$11,184	-$27,523	-$4,198	-$2,792	-$6,991	-0.1	-0.1	-0.2
Maintenance	-$26,842	-$26,842	-$18,792	-$45,634	-$13,888	-$5,605	-$19,493	-0.6	-0.2	-0.8
Depreciation	-$87,528	-$87,528	-$40,876	-$128,403	-$22,250	-$11,816	-$34,066	-0.5	-0.5	-0.9
Administration	-$17,506	-$17,506	-$12,256	-$29,761	-$9,057	-$3,655	-$12,713	-0.4	-0.1	-0.5
Overhead	-$35,011	-$35,011	-$21,231	-$56,242	-$14,967	-$5,819	-$20,786	-0.3	-0.2	-0.6
Payments to resident workers	-$196,378	$0	-$158,937	-$158,937	$0	-$42,905	-$42,905	0.0	-1.8	-1.8
Payments to non-resident workers	-$182,933	-$36,587	-$21,831	-$58,418	-$10,957	-$5,828	-$16,784	-0.7	-0.2	-0.9
Payments to resident owners	-$252,110	$0	-$204,043	-$204,043	$0	-$55,081	-$55,081	0.0	-2.3	-2.3
Payments to non-resident owners	$0	$0	$0	$0	$0	$0	$0	0.0	0.0	0.0
TOTAL		-$562,076	-$2,000,843	-$2,562,919	-$198,675	-$538,137	-$736,812	-8.1	-22.1	-30.2

ISER file: Commercial Analysis.

Table X-8. Cook Inlet Salmon Economic Impact Model: Changes in Economic Impacts in Other Industries Due to Changes in Commercial Fishing and Processing Expenditures

Type of Economic Impact	Scenario Name and Code* +200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in Alaska Output								
Change in direct impact	-$562,076	-$281,038	$281,038	-$542,932	-$576,322	-$1,317,807	$0	-$1,262,286
Change in indirect impact	-$2,000,843	-$1,000,421	$1,000,421	-$1,555,304	-$2,332,406	-$3,799,037	$0	-$3,032,145
Change in total impact	-$2,562,919	-$1,281,459	$1,281,459	-$2,098,237	-$2,908,728	-$5,116,844	$0	-$4,294,431
Change in Alaska Payroll								
Change in direct impact	-$198,675	-$99,337	$99,337	-$192,942	-$202,941	-$479,045	$0	-$462,418
Change in indirect impact	-$538,137	-$269,069	$269,069	-$417,898	-$627,618	-$1,023,998	$0	-$817,074
Change in total impact	-$736,812	-$368,406	$368,406	-$610,840	-$830,559	-$1,503,042	$0	-$1,279,492
Change in Alaska Employment								
Change in direct impact	-8.1	-4.0	4.0	-7.7	-8.3	-19.9	0.0	-18.8
Change in indirect impact	-22.1	-11.1	11.1	-17.1	-25.8	-42.0	0.0	-33.4
Change in total impact	-30.2	-15.1	15.1	-24.9	-34.2	-61.8	0.0	-52.3
Expressed as a Percentage of Scenario A								
Change in Alaska Output/Sales								
Change in direct impact	100%	50%	-50%	97%	103%	234%	0%	225%
Change in indirect impact	100%	50%	-50%	78%	117%	190%	0%	152%
Change in total impact	100%	50%	-50%	82%	113%	200%	0%	168%
Change in Alaska Payroll								
Change in direct impact	100%	50%	-50%	97%	102%	241%	0%	233%
Change in indirect impact	100%	50%	-50%	78%	117%	190%	0%	152%
Change in total impact	100%	50%	-50%	83%	113%	204%	0%	174%
Change in Alaska Employment								
Change in direct impact	100%	50%	-50%	96%	103%	246%	0%	233%
Change in indirect impact	100%	50%	-50%	77%	117%	190%	0%	151%
Change in total impact	100%	50%	-50%	82%	113%	205%	0%	173%

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.
ISER file: Commercial Analysis.

Total Changes in Economic Impacts

Table X-9 summarizes total changes in economic impacts in the commercial fishing, fish processing and other industries. In Scenario A (200,000 additional sockeye), total Alaska output or value added is reduced by $5.1 million, total Alaska payroll is reduced by $1.8 million, and total Alaska annual average employment is reduced by 63.9 annual average jobs. If we exclude payroll and jobs of non-resident fishermen and processing workers, Alaska payroll is reduced by $1.5 million, and Alaska employment is reduced by 53.2 annual average jobs.

The changes in Alaska output or value added are largest in other industries (-$2.6 million), followed by commercial fishing (-$1.8 million) and fish processing (-$715 thousand). Changes in Alaska payroll are similar for commercial fishing (-$805 thousand) and other industries (-$737 thousand), and smaller for fish processing (-$243 thousand). Changes in Alaska employment are largest for other industries (-30.2 annual average jobs), followed by commercial fishing (-23.4 annual average jobs) and fish processing (-10.4 annual average jobs).

Changes in economic impacts are relatively lower for the low price scenario (A1) and higher for the high price scenario (A2) and the low run scenarios (A3 and A5), due to differences in the harvest volumes, harvest values, and fish processing volumes.

Table X-9. Cook Inlet Salmon Economic Impact Model: Changes in Output, Payroll and Employment in Commercial Fishing, Processing and Other Industries

	Scenario Name and Code*							
Type of Economic Impact	+200K at sonar A	+100K at sonar D	-100K at sonar E	Low price A1	High price A2	Low run A3	High run A4	Low run, low price A5
Change in Alaska Output								
Commercial fishing (a)	-$1,847,882	-$923,941	$923,941	-$1,215,782	-$2,318,282	-$3,483,937	$0	-$2,299,717
Fish processing (b)	-$715,458	-$357,729	$357,729	-$715,458	-$715,458	-$1,540,239	$0	-$1,540,239
Other industries (c)	-$2,562,919	-$1,281,459	$1,281,459	-$2,098,237	-$2,908,728	-$5,116,844	$0	-$4,294,431
Total	-$5,126,259	-$2,563,129	$2,563,129	-$4,029,477	-$5,942,469	-$10,141,020	$0	-$8,134,388
Change in Alaska Payroll								
Commercial fishing (d)	-$804,768	-$402,384	$402,384	-$571,787	-$978,148	-$1,207,849	$0	-$872,885
Fish processing (b)	-$242,870	-$121,435	$121,435	-$242,870	-$242,870	-$522,852	$0	-$522,852
Other industries (c)	-$736,812	-$368,406	$368,406	-$610,840	-$830,559	-$1,503,042	$0	-$1,279,492
Total	-$1,784,450	-$892,225	$892,225	-$1,425,497	-$2,051,577	-$3,233,743	$0	-$2,675,229
Total excluding non-resident fishing and processing workers	-$1,527,549	-$763,774	$763,774	-$1,200,746	-$1,770,750	-$2,656,405	$0	-$2,170,635
Change in Alaska Employment								
Commercial fishing (e)	-23.4	-11.7	11.3	-23.4	-23.4	-30.8	0.0	-34.8
Fish processing (b)	-10.4	-5.2	5.2	-10.4	-10.4	-22.4	0.0	-22.4
Other industries (c)	-30.2	-15.1	15.1	-24.9	-34.2	-61.8	0.0	-52.3
Total	-63.9	-32.0	31.6	-58.6	-67.9	-115.0	0.0	-109.4
Total excluding non-resident fishing and processing workers	-53.2	-26.6	26.4	-47.9	-57.2	-95.4	0.0	-88.9

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.
(a) See estimates in Table X-1.
(b) See estimates in Table X-4.
(c) See estimates in Table X-8.
(d) See estimates in Table X-2.
(e) See estimates in Table X-3.
ISER file: Commercial Analysis.

Regional Distribution of Changes in Economic Impacts

What is the regional distribution within Alaska of the projected change in economic impacts of commercial fishing? As we discuss in Appendix I, the Alaska Input-Output Model is configured into four regions of Alaska: Southcentral, Southeast, Southwest and Arctic-Yukon-Kuskokwim. Because the economic impacts of the Upper Cook Inlet commercial fishery and the Kenai River sport fishery are overwhelmingly concentrated in the Southcentral region, we did not report projections separately for these four regions.

The model was not designed to track in detail where economic impacts of commercial fishing expenditures occur within Southcentral Alaska. To trace the distribution of economic impacts between the Kenai Peninsula Borough and other parts of Southcentral Alaska would require development of very detailed assumptions about where expenditures by each industry occur. Even if we tried to collect data to develop these assumptions, the information might soon be out of date due to changes in the structure of interregional purchases, such as have likely occurred as a result of the construction of major new retail outlets on the Kenai Peninsula in recent years.

To develop rough estimates of the share of impacts which might occur within the Kenai Peninsula Borough, we first assumed that 100 percent of fishing employment and payroll and 90 percent of processing employment and payroll would occur within the Kenai Peninsula Borough. Note that these assumptions are for employment and payroll by place of work, rather than by place of residence.

We also made assumptions, for each type of fish harvesting and processing expenditure, about the percentage that would occur within the Kenai Peninsula Borough. We used these to estimate the share of direct economic impacts in industries other than commercial fishing and fish processing that would occur within the Kenai Peninsula Borough. For each type of expenditure, we assumed that the share of indirect economic impacts occurring within the Kenai Peninsula Borough would be the same as for direct economic impacts. Although we believe that this probably overstates the share of indirect effects occurring within the Borough, we did not have the detailed data needed to develop more reliable assumptions about the regional distribution of indirect economic impacts. Our assumptions and calculations for Scenario A (adding 200,000 sockeye) are shown in Appendix D, Tables D-10 and D-11.

Our rough estimates suggest that most—about 90 percent—of the changes in commercial fishing economic impacts that occur in Alaska would occur within the Kenai Peninsula Borough. This is because most of the commercial fishing and processing activity occurs within the Kenai Peninsula Borough. It is likely that the economic impacts would be less concentrated within the Kenai Peninsula Borough than these estimates suggest. The main reason is that fishermen and processing workers who work in the Kenai Peninsula Borough probably spend a large share of their income outside the borough, in particular if they live outside the borough. But we did not have sufficiently detailed data to trace the regional distribution of indirect economic impacts more accurately.

Chapter XI. Other Potential Effects

In this study we analyzed the potential economic effects of increasing the number of sockeye in the Kenai River, using specific assumptions about changes in the sport harvest in the river and the commercial harvest in the Central District of Upper Cook Inlet. There are other potential effects that we were not asked to analyze. Our contract with the Department of Fish and Game asked us to briefly acknowledge some of the other potential effects, without attempting to quantify them.

Effects on Northern District Setnetters and Susitna Drainage Sport and Personal Use Fisheries

Description: The Northern District of the Upper Cook Inlet commercial fishery is the area north of Boulder Point (as shown in Map II-1 in Chapter II). Setnetters in that district target sockeye returning to the Susitna River system. Sport anglers also harvest sockeye and other salmon in area rivers and creeks.

Allowing 200,000 more sockeye into the Kenai River would also likely allow more sockeye and other salmon to escape into the Northern District—because fishery managers would make that change by reducing the commercial harvest in the Central District, where commercial fishermen intercept some salmon returning to the Northern District. But under most of our scenarios, the increase in the number of sockeye returning to the Northern District would not be large.

The study assumes that during years of average runs, fishery managers would allow extra fish into the Kenai River by eliminating only emergency openings. During emergency openings, the Central District drift fleet is confined to a relatively narrow corridor on the east side of the inlet—where they catch fewer sockeye bound for the Northern District. In years of large sockeye runs, managers would not have to eliminate any commercial openings to put more fish in the Kenai River.

But the study assumes that in years of small sockeye runs, managers would eliminate one regular commercial opening. In regularly scheduled openings in the Central District, drifters fish in the middle of the inlet, where they catch more sockeye headed for the Northern District. So if managers eliminated a regular opening, not only would more sockeye and other species escape into the Kenai River but more would also reach the Northern District. It's possible that under certain conditions as many as 50,000 to 100,000 additional sockeye could reach the northern region. (Biologists believe west side salmon stocks would be relatively unaffected by the changes assumed in our study scenarios.)

1. ***Scenarios giving rise to effect:*** One of our scenarios examines potential economic effects of allowing more sockeye into the Kenai River during a year with a small sockeye run. That scenario assumes managers would eliminate a regular opening for the Central District drift and setnetters.

2. ***Likelihood of event:*** In the past 15 years, relatively small Kenai River sockeye runs (runs of less than 2 million fish) occurred three times. We can't predict how often future runs are likely to be small. Also, our low-run scenario is not intended as a prediction of what managers would actually do during a year with a small salmon run—it's one of 11 scenarios designed to examine the range of potential economic effects under different conditions.

3. ***Possible costs and benefits of event:*** Commercial setnetters in the Northern District and sport anglers and dipnetters fishing in the Susitna River drainage all stand to benefit if more sockeye escaped into their region. More coho and chum salmon would also move north if a regular opening were eliminated in the Central District.

4. ***Informal assessment of whether costs or benefits prevail:*** Benefits would prevail for commercial and sport fishermen in the northern portion of Upper Cook Inlet.

5. ***Estimate of magnitude of effect:*** Estimating potential economic effects in the Northern District is outside the scope of this study, but we can make some general observations. The biggest benefits would go to Northern District setnetters, who might harvest a significant number of the additional sockeye. We believe those benefits could be substantial—depending on how many of the additional salmon setnetters harvested—but we can't estimate how large the benefits would be because we don't have either adequate biological information or information about setnetters' costs and other factors.

   Benefits to dipnetters could also be measurable, if a substantial number of additional sockeye moved into Fish Creek, where ADF&G opens a dip net fishery when escapement reaches a certain level. Finally, sport anglers would also benefit if more salmon moved into the Susitna drainage, but we don't have enough information on catch rates and other factors to say how much sport harvests might increase.

6. ***Information needed to quantify the costs and benefits:*** We would need biological information about how many of the sockeye that Central District fishermen give up would move into the Northern District, as well as estimates of how many additional fish Northern District setnetters would catch. We'd also need information about how the additional salmon might change sport and dip net harvests in the Susitna drainage. We would need to survey setnetters in the Northern District to determine their operating costs, catch rates, and behavior under changing circumstances. We would need to survey sport anglers to determine their net willingness to pay for sport fishing opportunities in the Susitna drainage. Finally, we would need to analyze sport anglers' net willingness to pay, using the travel cost model developed for this study.

Effects on Salmon Habitat

Description: In the past 10 to 15 years, increasing development along the Kenai River and growing numbers of sport anglers have brought worries about degradation of the riverbank and resulting destruction of fish habitat. Biologists report that the most critical habitat at risk is that of chinook (king) salmon. The rearing habitat for juvenile chinook is in nearshore areas along the river. Other species of salmon also have spawning and rearing areas along the river corridor and in outlets from lakes.

In a 1994 report, *Assessment of the Cumulative Effects of Human Uses on Fish Habitat in the Kenai River,* biologist Gary Leipitz of the Department of Fish and Game estimated the effects on fish habitat so far. He found that about 11 to 12 percent of the river's 166 miles of upland, island shoreline, and nearshore habitats had been affected by bank trampling, vegetation denuding, and structural development. Of that 12 percent, about one-third of the damage was caused by bank trampling and two-thirds by structural development.

Biologists are concerned that allowing more fish into the Kenai River could draw more sport anglers and therefore increase bank trampling.

1. ***Scenarios giving rise to effect:*** All the scenarios that put more sockeye in the river would increase the number of trips anglers would make to the river.

2. ***Likelihood of event:*** More fish in the river would likely increase the number of days fished (which is the number of anglers multiplied by the number of days they fish).

3. ***Possible costs and benefits of event:*** We can approximate the cost of any habitat loss from the pressure of more anglers as the value of any resulting loss in salmon. However, if there are

ways to mitigate the habitat damage that cost less than the value of the salmon loss, then the cost of increased angler pressure would be the cost of mitigating measures. Measuring the cost of habitat loss in the absence of a mitigation program would overestimate the cost. Damage could be mitigated through more intense use of the kinds of things managers have already began to use or at least to consider—re-planting and protecting affected areas, building boardwalks to keep people off the bank vegetation, and other protective measures. A task force of federal and state fish and wildlife protection agencies recently made a series of recommendations to the Board of Fisheries about possible ways of protecting the banks along the Kenai River.

4. ***Informal assessment of whether costs or benefits prevail:*** Costs prevail.

5. ***Estimate of magnitude of effect:*** Unknown.

6. ***Information needed to quantify the costs and benefits:*** Only when mitigation measures have minimized habitat loss for the current number of anglers could the costs of additional sport fishing pressure be measured.

Effects of Too Many Spawners

Description: Right now fishery managers try to keep numbers of late-run sockeye returning to the Kenai River in the range of 450,000 to 700,000, with roughly 90 percent intended for spawning. Biologists believe there is, for any given salmon run, some ideal number of spawners—a number that produces the highest return per spawner in future years.

Most people understand that to sustain future runs, some salmon have to escape commercial and sport fishermen and spawn. But less well known is the notion of overescapement: that too many spawners can tax spawning and rearing areas and also hurt future runs. At some point, when there are too many spawners, the return per spawner can go down sharply. That doesn't mean that the run disappears; it could mean, for example, that instead of getting 3 salmon per spawner you might get only 1 per spawner. So the harvestable surplus—the fish in excess of what you need for spawning—in future runs goes down.

Most biologists agree on the principle of overescapement, but how many salmon constitute overescapement for any given system is uncertain. An issue for managers is: would allowing 200,000 more sockeye to return to the Kenai River every year tax the system and reduce future harvests? Biologists say they don't have adequate data to establish an overescapement estimate for late-run sockeye. As we discussed in Chapter II, returns to the river have exceeded 700,000 in 6 of the past 10 years—and in several years returns exceeded 1 million. Some biologists believe that the 1987 return of nearly 1.6 million sockeye was approaching overescapement.

1. ***Scenarios giving rise to effect:*** Most of our scenarios look at the effects of increasing the management target for late-run sockeye by 200,000—making the range 650,000 to 900,000 sockeye. An additional 200,000 sockeye would not seem to constitute overescapement, based on limited available evidence from recent high returns.

   Managers are concerned, however, that a higher management target would reduce their margin for error. As discussed throughout this report, fishery management is not an exact science. Managers don't have good information about the actual size of the run until the fish are in the river and it's too late to catch them commercially. If they're aiming for a higher escapement target, they will let more fish through in the early part of the run, as insurance for meeting the target if the run comes in smaller than expected. But if the run turns out larger than they expected, a big surge of fish can put them over their target. A higher target would allow managers less margin for excess fish before they reach the overescapement threshold.

2. ***Likelihood of event:*** Unknown; would depend on a number of factors. Those include how many spawners biologists ultimately determine are too many; how well managers are able to stay within the target range for returns when run sizes, timing, and other elements change; and how much commercial fishing effort might decline under unfavorable conditions—like the 1989 oil spill or a collapse in salmon prices.

3. ***Possible costs and benefits of event:*** If overescapement reduced the future harvestable surplus of sockeye, both sport and commercial fishermen could lose—but commercial fishermen stand to lose the most because they harvest most of the fish. However, fishery managers could try to minimize the effects of too many salmon in the river by controlling how many actually reached the spawning grounds. They could look at ways of sharply increasing the sport and dip net harvests, or they could consider weirs or other devices to intercept the fish. If a weir cost less than the damage done to the fishery by overescapement, then the cost of allowing additional fish into the river would be the cost of a weir or some other lower cost method of intercepting fish. Furthermore, the intercepted fish might have a positive value that would help offset the cost of intercepting them.

4. ***Informal assessment of whether costs or benefits prevail:*** That assessment would depend on a more definite determination of how many fish constitute overescapement and on what action managers decided to take. For instance, what would be the cost of a weir and the accompanying equipment and personnel to catch and distribute any sockeye considered too many for the spawning grounds?

5. ***Estimate of magnitude of effect:*** Unknown.

6. ***Information to quantify the costs and benefits:*** Quantifying the potential effects of overescapement would depend on more information on the relationship between spawners and subsequent harvest; on whether it would be possible for sport anglers and dipnetters to significantly increase their catch in the event of overescapement; and on the feasibility and costs of installing and operating weirs or other means of interception.

Kenaitze Indian IRA Council Educational Permit Fishery

Description: ADF&G annually issues a permit for an educational fishery to the Kenaitze Indian IRA Council on the Kenai Peninsula. That permit allows the group to put a single net in the Kenai River to catch a specific number of salmon during specified periods. In 1994, for instance, the permit allowed the group to take up to 5,000 salmon, with restrictions on the number of chinook. Their harvests of sockeye in recent years have ranged between 1,500 and 3,500. ADF&G began issuing the permit in 1989, when the Kenaitzes made the argument to state officials that young Kenaitzes had no opportunities to learn traditional methods of fishing. If the management target for late-run sockeye were increased, how might it affect the educational fishery?

1. ***Scenarios giving rise to effect:*** There is no reason to assume that any of the scenarios we examined would affect the Kenaitzes' permit for an educational fishery.

2. ***Likelihood of event:*** Unknown.

3. ***Possible costs and benefits of event:*** Any possible benefits would depend on whether the Kenaitzes responded to the increase in the management target by asking to be allowed to take more sockeye, and if the Department of Fish and Game agreed an increase was justified. It's possible they'd catch more fish—or catch them more quickly—if more fish were in the river.

4. ***Informal assessment of whether costs or benefits prevail:*** Not possible to assess.

5. ***Estimate of magnitude of effect:*** Not possible to estimate.

6. ***Information to quantify the costs and benefits:*** Survey the officers of the Kenaitze IRA council to find out how they would react to more sockeye in the river; ascertain under what circumstances ADF&G would increase the allowable harvest for the educational fishery.

Chapter XII. Summary and Comparison: Economic Effects of Management Alternatives for Kenai River Sockeye

Purpose of the Study

The purpose of this study is to estimate the economic effects of reallocating Kenai River sockeye between commercial, sport, and personal use fisheries. Throughout the report, we consider the Russian River fishery as part of the Kenai River fishery. The study focuses on economic changes rather than on the total economic value of each fishery. That is, we examine the difference in economic conditions caused by a reallocation of Kenai River sockeye. We also examine the way in which different bag limits, run sizes, and ex-vessel prices affect the economic consequences of a given allocation.

We measure the difference in economic conditions in two ways: changes in net economic value and changes in economic impacts. Net economic value is the difference between benefits and costs, including benefits and costs that people don't actually have to pay for. We can expect a reallocation of Kenai River sockeye to change the net economic value of both the sport and the commercial fisheries. We are interested in the ***change*** in net economic value under a new allocation from the current net economic value. Economic impact is principally measured as the change in jobs caused directly and indirectly by a reallocation of Kenai River sockeye.

Sources of Information

We relied on a number of different sources for this study: assumptions provided by ADF&G biologists on sport and commercial harvests associated with given scenarios; commercial fisheries landings and ex-vessel price data for 1976-1994, with special focus on 1990-1993; data from a variety of sources on fishing conditions at 30 sport fishing sites by week for 1993; and, surveys of sport anglers, commercial fishing permit holders, and crew members. These surveys included:

- Telephone interviews with 487 randomly selected commercial fishermen. The 487 interviews include 40 percent of east side setnet operations in the Central District of Upper Cook Inlet and 35 percent of driftnet operations. Results to yes/no questions on this survey may vary due to sampling error by as much as plus or minus four percentage points.
- Telephone interviews at least once with 1,355 randomly selected resident sport anglers. Results to yes/no questions on this survey may vary due to sampling error by as much as plus or minus four percentage points.
- Telephone interviews with 213 commercial fishing crew. Results to yes/no questions on this survey may vary due to sampling error by as much as ten percentage points.
- Mail surveys completed by 4,278 non-resident sport anglers. Results to yes/no questions on this survey may vary due to sampling error by as much as two percentage points.

Analysis Methods

Scenarios

In conjunction with ADF&G, we developed ten scenarios to assess the potential range of change from reallocating a share of Kenai River sockeye. These scenarios combine assumptions about management (change in the target number of sockeye at the Kenai River sonar counter, change in the sport bag limit, change in the personal use bag limit), assumptions about fishing conditions (changes in run size and ex-vessel prices), and assumptions about harvests (changes in drift and setnet harvests of five salmon species, sport and dip net harvests, and spawning escapement).

Change in Net Economic Value

We estimated changes in net economic value separately for sport and commercial fisheries using two methods. One method uses statistical analysis of when and where people fished in the past to impute the net benefits people derive from fishing, based on an analysis of their actual choices among fishing options with different costs. The same analysis can be used to assess likely changes in fishing behavior if fishing options change.

In the case of resident sport anglers, we built a travel cost model. The travel cost method starts with a statistical analysis of the amount of money and time anglers spent on past fishing trips. The model then uses this information and observations about fishing conditions at different sites to explain when anglers choose to go fishing, where they choose to go, and how much they'll spend. The model also estimates the value (or benefit) of each site choice, above the actual cost of fishing at the site. It then estimates the sum of these net benefits for all anglers. When we compare the sum of net benefits in the base case with the sum of net benefits under a new allocation, we have an estimate of the change in net economic value.

For the commercial fishery, we used a method parallel to the travel cost model—the observed choices model. This model, developed from ADF&G fish ticket data, uses information about fishing participation, landings, and prices to explain when and where commercial fishermen will choose to fish. The model estimates the value (or benefit) of different fishing areas for each driftnetter. It also estimates the value of participating in different fisheries for setnetters who in the past participated in other fisheries. We then estimate the sum of net benefits for all commercial fishermen. We added to this sum the net benefits received by crew members, which we estimated in a separate analysis. Again, when we compare the sum of net benefits in the base case with the sum of net benefits under a new allocation, we have an estimate of the change in net economic value. We estimated net benefits of crew members by asking crew survey respondents to compare jobs they held recently—or could take instead of fishing—to their fishing jobs. We then did a statistical analysis of how their rankings depend on amount of money paid and job characteristics.

We used an alternative method of estimating changes in net economic value for both the sport and commercial fisheries called contingent valuation. Contingent valuation (CV) relies on surveys in which we ask fishermen directly whether they would be willing to pay (or accept as payment) a given amount in order to increase their catch (or to avoid a decrease in catch).

By varying the amount of money we ask different survey respondents to consider paying, we can estimate the distribution of values among sport and commercial fishermen.

Economic Impact

To estimate changes in economic impacts of sport fishing by resident anglers, we used the results of the travel cost model to estimate changes in fishing trips and expenditures of resident anglers. We then used an economic input-output model to trace the direct and indirect effects of changes in resident sport fishing expenditures on jobs and incomes.

We did not estimate a travel cost model for non-resident anglers because we did not count net economic value of non-residents. To estimate changes in economic impacts of sport fishing by non-residents, we surveyed non-residents who had previously fished in Southcentral Alaska and asked them how changes in the quality of sport fishing on the Kenai River would have affected the length of time they spent in Alaska. We also analyzed how spending per day by non-resident anglers varied with the length of their trips. We multiplied estimated changes in the number of non-resident days in Alaska by assumed expenditures per day to derive estimates of changes in non-resident expenditures, and then used an economic impact model to estimate direct and indirect effects of changes in non-resident sport fishing expenditures on jobs and incomes.

To estimate commercial fishing expenditures, we first estimated changes in permit holder and crew income, hours worked in commercial fishing and processing, and changes in processing workers' wages, based on changes in harvest volume. We adjusted our estimates of changes in hours worked and fishing and processing income for the resident share of fishermen and processing workers. We also estimated changes in other expenditures of the fishing and processing industry, and used an economic impact model to estimate the direct and indirect effects of changes in these expenditures on jobs and income.

Changes in Sport and Commercial Harvests

The current management target for late-run sockeye is 450,000 to 700,000 sockeye past the sonar counter near the Soldotna Bridge. We looked mainly at the effects of increasing the management target by 200,000 sockeye, under a number of different conditions. We also examined the potential effects of increasing the sonar count by just 100,000 sockeye and of decreasing the sonar count by 100,000.

ADF&G managers estimate that to get an increase of 200,000 sockeye at the river sonar counter, 221,000 sockeye would have to come in at the river mouth, which is 19 miles downstream from the sonar counter. Increasing the number of Kenai River sockeye passing the sonar by 200,000 sockeye would decrease the commercial catch by an estimated 245,000 sockeye in a medium run and by 417,000 sockeye in a low run. There would be no decrease in commercial catch during a high run—because managers believe during high runs the return to the river would be high enough to reach the higher management target, without reducing the commercial harvest. Including salmon from other runs, commercial fishermen would lose between zero and 550,000 salmon, depending on the size of the Kenai River run in any given year. In a year with a medium run, managers would reduce the commercial harvest by eliminating two or three emergency openings in the Central District of Upper Cook Inlet. In years of low runs, when they would eliminate a regular districtwide opening.

ADF&G estimates that sport anglers would catch about 45,000 of the additional sockeye—or about one in five—(regardless of run size) and 50,796 more sockeye if the higher management target were coupled with a higher bag limit. The rest of the additional sockeye would spawn. Personal use dipnet harvests could increase by 50,000 sockeye if bag limits in that fishery were also raised.

Importance of Sport and Commercial Fishing

This study confirms what sport and commercial fishing groups have each been saying for years: Kenai River sockeye are very valuable. Both the sport and the commercial fisheries for Kenai River sockeye contribute a great deal to Alaska's economy. Fifty percent of Southcentral households sport fish each year. These households account for 156,000 trips to the Kenai River annually, and spend $17 million on these trips. Non-resident fishing trips to the Kenai River (an estimated 52,000 in 1993) account for another $17 million in spending. Using the travel cost model, we estimate that the total net economic value of all July Kenai River sport and dip net fisheries to Southcentral households is about $8 million, or about $137 per fishing household. The Upper Cook Inlet driftnet and eastside setnet fisheries directly employ an estimated 2,893 people. Fishing operations had harvest revenues of $33 million in 1994. The estimated market value of limited entry permits for the Central District drfit fleet and the eastside setnetters is currently about $52 million.

Changes in Net Economic Value

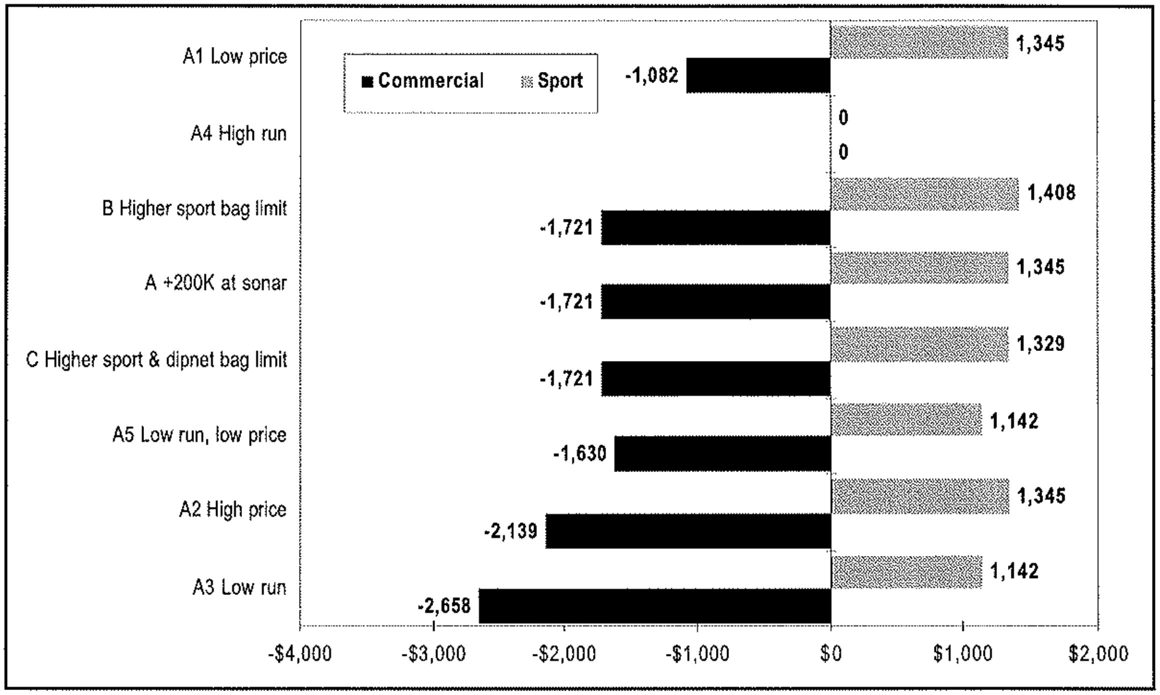
Before turning to a summary of our findings, we want to emphasize some important points. Economics—like fisheries management—is not an exact science. We used the available data from our 1993 and 1994 surveys and other sources to estimate potential changes in net economic value and economic impacts for both fisheries as closely as we could. But all our results are subject to some error. For some important variables—like crowding at fishing sites—we didn't have enough information to adequately assess the effects of a management change. And the factors that would most affect economic change—future run sizes and market prices—are impossible to predict with certainty. We discuss these sources of uncertainty later in this chapter.

Because of lack of data and other difficulties, we didn't attempt to quantify all the potential economic effects of re-allocating Kenai River sockeye. Those include—among other things discussed in Chapter XI and summarized below—potential effects on Northern District setnetters and Susitna River system sport and dip net anglers, who might benefit from reduced commercial harvests in the Central District. That we were not able to quantify such potential effects does not mean they are not important.

In this study we measured net economic value for the sport and commercial fisheries with a common dollar yardstick. But it's important to keep in mind that the nature of economic value is very different in the sport and commercial fisheries. Net value in the sport fishery is mostly non-monetary—the enjoyment people get from fishing. In the commercial fishery, it is the opposite: the value is mostly monetary—cash earned from the sale of fish. Both kinds of value are important, and policy makers have to keep both in mind when making decisions. And, as we said at the beginning of this report, economic factors are not the only—or even necessarily the most important—factors to be considered in decisions about managing public resources. None of the results of this study, taken by themselves, can justify any particular management change.

Estimated changes in net economic value for sport and commercial fisheries vary widely depending on scenario assumptions. Figure XII-1 summarizes the results for eight of the ten tested (we discuss scenarios targets other than +200,000 sockeye at the sonar later). Estimated commercial losses appear somewhat larger than sport gains in the scenarios that assume medium run, medium prices (Scenarios A, B, C). Estimated gains for the sport fishery appear larger in the scenario that assumes a medium run combined with low ex-vessel prices. But given the range of uncertainty in our results, we can't definitely conclude that losses or gains would prevail in those cases.

Figure XII-1. Changes in Net Economic Value Under Study Scenarios That Assume Increase of 200,000 Sockeye



Commercial losses would most likely exceed sport gains during low runs—because under those scenarios, commercial fishermen would have to give up a lot more fish to put extra sockeye into the Kenai River. And the higher the price, the larger the losses. If, on the other hand, ex-vessel prices were low during years of medium runs, sport gains would probably exceed commercial losses, because commercial fishermen would give up fewer fish, and each would be less valuable at lower prices. However, as we noted in the previous paragraph, we can't definitely conclude that actual sport gains would be larger in those circumstances.

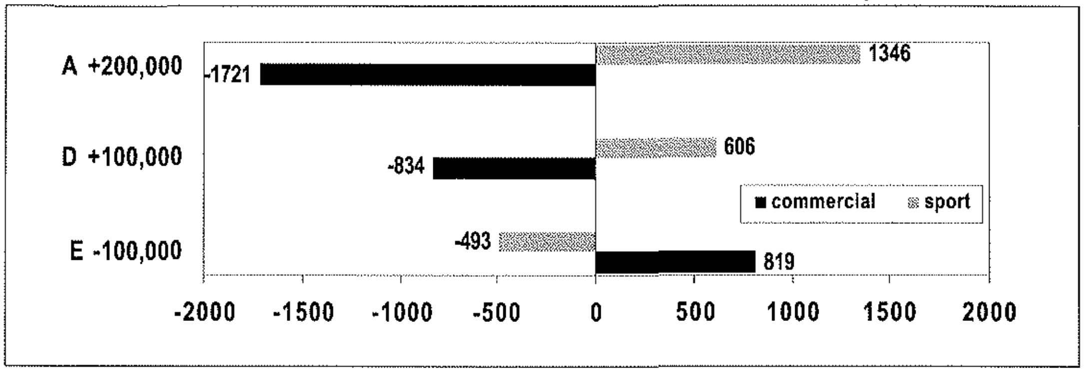
Under five of the eight scenarios involving an increase of 200,000 sockeye at the sonar counter, the estimated change in net economic value for sport anglers varies within 5 percent of Scenario A, which calls for an increase of 200,000 sockeye at the sonar counter under medium run size and medium price conditions. The exception is high run cases, when there are no reallocations. These scenarios include a higher sport bag limit (B), low price (A1), high price (A2), and higher sport and dipnet bag limits ("C").

Under the same five scenarios, changes in net economic value for commercial fishermen vary by as much as 38 percent of Scenario A—because changes in run size and price make a big difference in commercial losses. Under Scenarios A, B, and C (which all assume medium run, medium price levels), the change in net economic value for commercial fishermen is the same—because changes in sport or personal use bag limits don't affect value for the commercial fishery. In 2 of the last 11 years, medium runs and medium prices combined with higher sport and personal use bag limits. Commercial fishermen would experience a substantially smaller loss in net economic value under low price conditions (which happened in 2 of the last 11 years) and a substantially larger loss under high price conditions (which occurred in 1 of the last 11 years).

Most of our study scenarios assumed an increase of 200,000 sockeye at the Kenai River sonar counter. To help understand the relationships of policy targets and economic effects, we also included one scenario that would increase the sonar target by just 100,000 (Scenario D) and one scenario under which the sonar count target would be reduced by 100,000 (Scenario E). As shown in

Figure XII-2, we found that under the +100,000 scenario (D), changes in net economic value were about half as great as for the +200,000 scenario. Under the -100,000 scenario (E), the magnitude of changes in net economic value were about the same, but the signs were reversed. In other words, within a range of variation of +200,000 to -100,000, changes in net economic value were roughly proportional to the change in the sonar count.

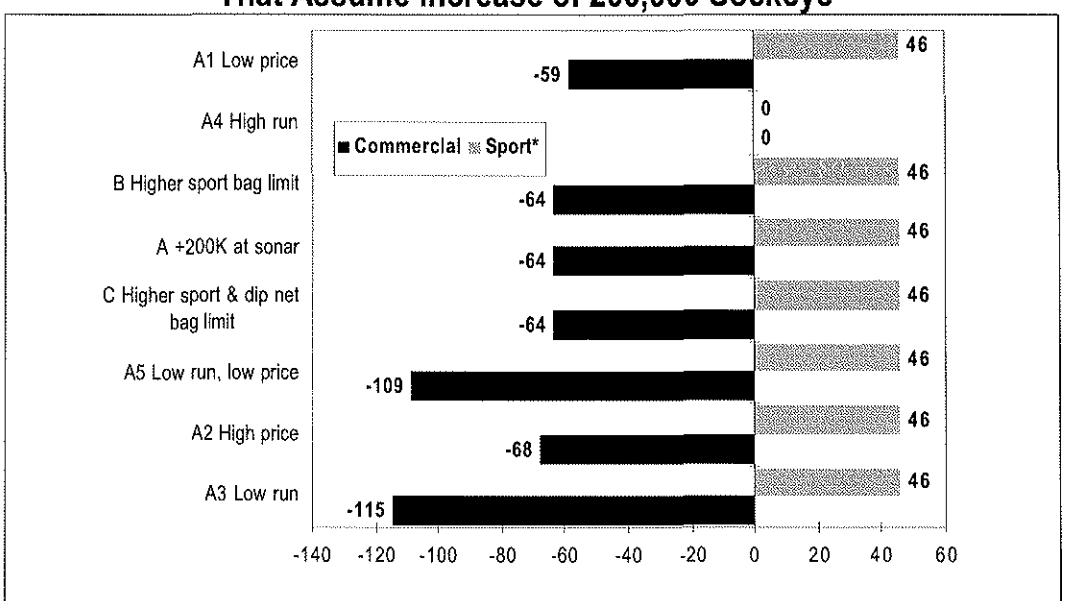
Figure XII-2. Changes in Net Economic Value Under Study Scenarios That Assume Increase or Decrease of 100,000 Sockeye



Economic Impact

We measured economic impacts primarily in terms of changes in the number of jobs directly and indirectly supported by fishing activity. The nature of economic impacts differs between the sport and commercial fisheries. Both create jobs and income in Alaska, but in the commercial fishery more than half the jobs and income are in catching the fish—while in the sport fishery the jobs and income are all created indirectly by fishermen's spending. Figure XII-3 highlights differences in the nature of economic impacts for the scenarios that assume an increase of 200,000 sockeye at the sonar counter.

Figure XII-3. Estimated Change in Alaska Jobs Under Study Scenarios That Assume Increase of 200,000 Sockeye



Medium estimate, based on medium estimate of changes in non-resident expenditures

Except under high run conditions (A4), reduced commercial fishing activity results in a decrease in jobs directly or indirectly supported by the commercial fishing sector. Job losses are highest under the low run (A3) and low run, low price (A5) scenarios. Those conditions occurred in two of the last 11 years.

Changes in economic impacts of sport fishing result from changes in sport fishing activity by both residents and non-residents. Changes in sport fishing expenditures by residents generate a net increase of only about 1 job. The reason for this is that increased expenditures by residents for Kenai River fishing trips are mostly offset by reduced expenditures by residents for trips to other Alaska fishing sites. In other words, in order to take advantage of better fishing on the Kenai River, resident sport anglers would take fewer trips (and spend less) at other Alaska sites.

Most of the increase in jobs related to sport fishing reflects more spending by visitors who might stay longer in Alaska, if sockeye fishing on the Kenai were better. Based on the survey responses of non-resident anglers, we estimated that about 13 percent of non-resident anglers might spend more time in Alaska if sport fishing were better on the Kenai River. Given different assumptions about how much more non-resident anglers would spend and future growth in the number of non-resident fishermen visiting Alaska, longer stays might cause non-resident anglers to spend between $630,000 and $3.3 million more in a season. This additional spending would generate between 13 and 70 additional jobs; our "medium estimate" is for an increase of 46 jobs.

These are rough, order-of-magnitude estimates. We cannot estimate the effects more precisely for several reasons. Non-resident anglers' survey responses weren't statistically related to hypothetical changes in fishing quality. Also, we don't know how non-resident anglers might adjust their total spending in Alaska if they decided to stay longer. Finally, we don't know whether the rapid growth of non-resident anglers visiting Alaska in recent years will continue. It is also possible that better fishing on the Kenai might cause more non-resident anglers to visit Alaska, but we had no data for estimating the magnitude of this effect.

Our best judgment is that in all scenarios the loss in jobs associated with commercial fishing would exceed the gain in jobs associated with sport fishing, as reflected in our "medium estimates" of changes in sport fishing economic impacts shown in Figure XII-3. However, given the uncertainty associated with our estimates of potential changes in non-resident sport fishing expenditures, we cannot state definitively that this would be the case.

We also looked at how an increase of just 100,000 in the sockeye management target (Scenario D) or a decrease of 100,000 (Scenario E) would affect jobs on the commercial side. (Because of limited data, we were not able to make estimates for these scenarios of jobs changes on the sport side.) Figure XII-4 shows that adding 100,000 sockeye would result in about half as many job losses on the commercial side as adding 200,000 would. Decreasing the number of sockeye returning to the river (and therefore increasing the commercial harvest) by 100,000 would create about as many jobs as the opposite scenario costs.

Comparisons of Net Economic Value, Economic Impact, and Qualitative Concerns

Before comparing net economic value and economic impact results, it is important to understand the relationship between the two measures. We presented a conceptual flow chart describing this relationship in Chapter III (Figure III-2). Figure XII-5 compares net economic value and economic impact results for just Scenario A (increasing the management target by 200,000 during medium run, medium price years).

Figure XII-4. Estimated Losses or Gains in Jobs for Commercial Fishery Under Study Scenarios That Assume Increase or Decrease of 100,000 Sockeye

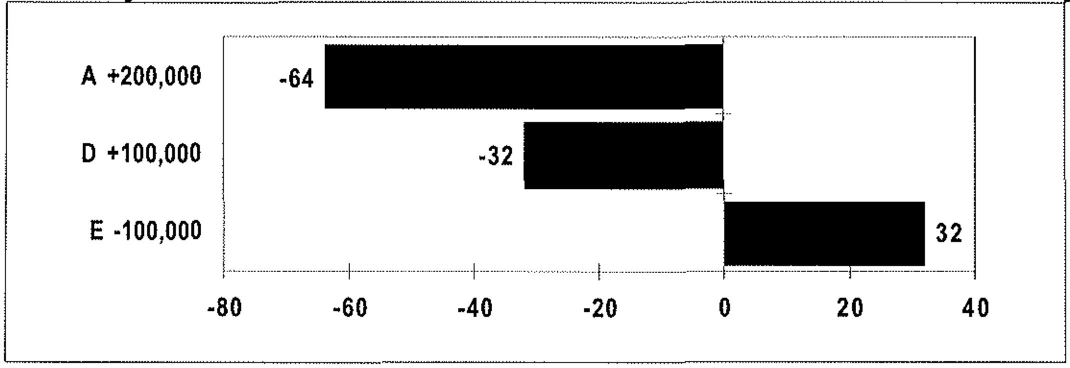
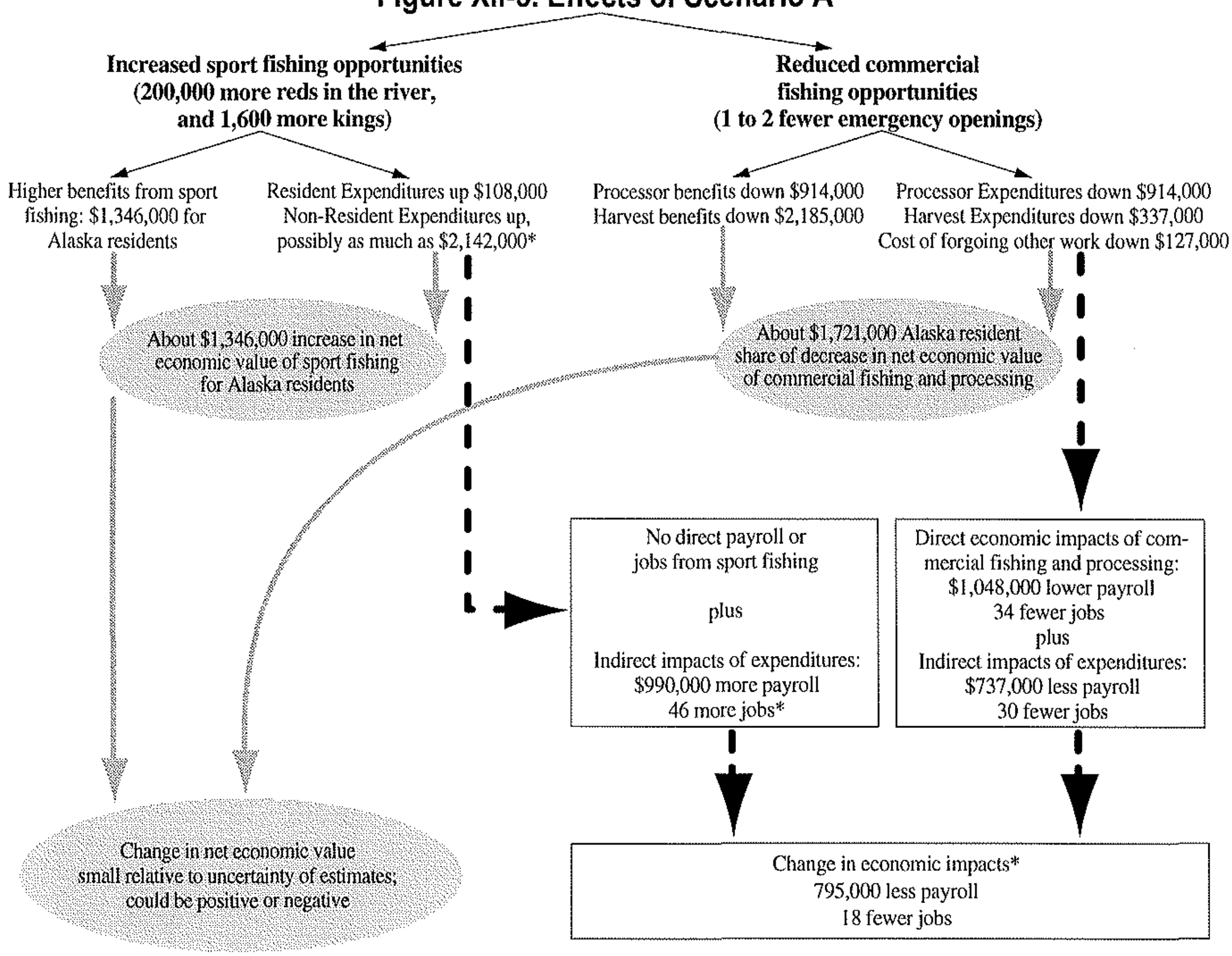


Figure XII-5. Effects of Scenario A



Note: Medium estimate of non-resident expenditures and impacts.

There are also qualitative concerns of economic significance. All scenarios resulting in an increase in sport angler trips carry the risk of damage to riverbanks and fish habitat. Also, biologists generally believe that at some point higher returns to the river increase the risk of overescapement—that is, that so many sockeye return to spawn that they damage spawning and rearing areas; biologists have not estimated how many sockeye would constitute overescapement in the Kenai River. We recognize these other potential effects but did not quantify them.

Table XII-1 below highlights our findings by scenario about potential changes in net economic value and economic impacts. Table XII-2 presents a more detailed comparison of changes in net economic value and economic impact.

Table XII-1. How Do Sport Gains Compare with Commercial Losses?

Scenario	Number of years occurred in last 11	Net Economic Value	Economic Impact
A - +200,000	2	too close to call	negative—losses due to commercial fishing exceed gains due to non- resident sport angler activity
B - higher sport bag limit	2	too close to call	negative
C - higher sport and dip net bag limits	2	too close to call	negative
D +100,000	2	too close to call	
E -100,000	2	too close to call	
A1 - low price	2	gains probably exceed losses	negative
A2 - high price	1	losses probably exceed gains	negative
A3 - low run	0	losses probably exceed gains	negative
A4 - high run	2	no policy change, no effects	
A5 - low run, low price	2	too close to call	negative
Low run, high price	0	losses probably exceed gains	negative

Reasons for Choices of Estimates of Net Economic Value

We noted early in this chapter that we used two methods of estimating net economic value. We called one method by two names, travel cost in the case of sport anglers, and observed choices in the case of commercial fishermen. The other method we used was contingent valuation.

We chose not to base our best estimates of net economic value on the contingent valuation method for two reasons. First, we did not ask contingent value (CV) questions for all 10 scenarios. To do so would have been an excessive burden on respondents. In addition, we did not decide on a final set of scenarios until after we had conducted the surveys containing the CV questions. Second, experts in the field of net economic value analysis recognize that CV questions are subject to both upward and downward bias. We think both types of bias may have affected our CV questions.

It is important to note that the estimates of net economic value based on the CV method are of the same order of magnitude as the estimates based on the travel cost/observed choices method. That the two methods produced similar results increases our confidence in our findings.

Table XII-2. Summary of Changes in Net Value and Economic Impacts for Allocation Scenarios

	Scenario Name and Code									
	+200K at sonar A	+200K Higher sport bag limit B	+200K Higher sport and dip net bag limits C	+100K at sonar D	-100K at sonar E	+200K Low price A1	+200K High price A2	+200K Low run A3	+200K High run A4	+200K Low run, low price A5
Sockeye run size assumptions										
Kenai River	3,500,000							1,500,000	5,000,000	1,500,000
Other rivers	2,200,000									
Change in commercial openings, July 15 - 25										
Regular openings	No change							1 fewer	No change	1 fewer
Emergency openings (d)	2-3 fewer	2-3 fewer	2-3 fewer	1-2 fewer	1-2 more	2-3 fewer	2-3 fewer	1-2 fewer	No change	1-2 fewer
Price Asumptions	$ 1.43	$ 1.43	$ 1.43	$ 1.43	$ 1.43	$ 1.00	$ 1.75	$ 1.43	$ 1.43	$ 1.00
Assumptions about harvest losses	(257,000)	(257,000)	(257,000)	(128,000)	128,000	(257,000)	(257,000)	(516,000)	0	(516,000)
Effects on the Sport and Personal Use Fisheries										
Change in net economic value (in $ thousands)	$1,346	$1,408	$1,329	$606	($493)	$1,346	$1,346	$1,142	$0	$1,142
Change in number of jobs (b)	46	46	46	(c)	(c)	46	46	46	0	46
Change in total payroll (b) (in $ thousands)	$990	$990	$990	(c)	(c)	$990	$990	$990	$0	$990
Effects on the Commercial Fishery										
Change in net economic value—Alaska Residents (in $ thousands)	($1,721)	($1,721)	($1,721)	($834)	$819	($1,082)	($2,139)	($2,658)	$0	($1,630)
Change in number of jobs	(64)	(64)	(64)	(32)	32	(59)	(68)	(115)	0	(109)
Change in total income+payroll (in $ thousands)	($1,784)	($1,784)	($1,784)	($892)	$892	($1,425)	($2,051)	($3,234)	$0	($2,675)
Total Measured Effects										
Change in net economic value—Alaska Residents	($375)	($313)	($392)	($228)	$327	$264	($793)	($1,516)	$0	($488)
Change in number of jobs	(18)	(18)	(18)	(c)	(c)	(13)	(22)	(69)	0	(63)
Change in total income+payroll	($794)	($794)	($794)	(c)	(c)	($435)	($1,061)	($2,244)	$0	($1,685)

(a) We used the contingent value estimate of net economic value for the change in the dip net bag limit for the dip net site only, and the travel cost estimate of net economic value for the change in the sonar count at the other 29 sites.
(b) These are medium estimates, based on medium estimate of changes in non-resident expenditures.

(c) Not estimated.

(d) Changes in emergency openings take place in the corridor for driftnetters and north of mid-Kalifonsky Beach for setnetters

Sources, Relative Magnitudes, and Implications of Uncertainty

Given the importance people attach to the Kenai River sockeye fishery, we recognize that people will want to know how much confidence they should place on the results. Ideally, we would report a range of values for each estimate that we think is likely to contain the true value. The answer to the question of the reliability of results depends on many different sources of uncertainty. In this section we briefly identify the major sources of uncertainty. We also describe what we did to minimize each source of uncertainty. Finally, we suggest what implications each source of uncertainty may have for study results. We have grouped our sources of uncertainty by type of estimate: sport fishing net economic value, commercial fishing net economic value, sport fishing economic impact, and commercial fishing economic impact.

Sport Fishing Net Economic Value

The major source of uncertainty in the sport fishing net economic value estimates is the reliability of resident sport angler survey results. We conducted four surveys of resident sport anglers. Three of the surveys were based on an original sample of 1,355 resident households selected by random digit dialing. This method produces a highly representative sample. We interviewed anglers by telephone. This method produces high quality information for individual respondents.

The uncertainty associated with the sport angler surveys mainly stems from the fact that even a large sample of anglers does not yield a large number of observations about trips to all fishing sites or about trips which include services rarely used by resident anglers, such as salmon fishing charters. In general, the fewer the observed number of trips to a site, the more uncertainty we have about costs of fishing at that site.

We also encountered a drop off in participation in the later sport angler surveys of the same households. We think that the burden of collecting so much information from respondents in part explains the lower participation. We also think that the same burden led to an under-reporting of fishing trips. We tried to compensate for this under-reporting in our analysis.

Table XII-3. Uncertainty About Sport Fishing Net Economic Value

Source	How Handled	Remaining Uncertainty	Relative Importance to Conclusions
Survey designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible
Reliability of resident sport angler survey results	Random telephone surveys, starting with interviews with 1,355 sport anglers. 83-57% response rates.	Margin of error of 10-20% of CV estimates and 20% of number of angler trips.	Largest remaining source of uncertainty
Data processing	Multiple checks on data accuracy	Negligible	Negligible
Methods for calculating net economic value	Used multiple, parallel methods for sport and commercial	Used best available methods; results comparable with studies elsewhere	Methods used generally provide similar estimates
Model designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible

Commercial Fishing Net Economic Value

The two largest sources of uncertainty in the estimation of commercial fishing net economic value are run size and price. We explicitly took this uncertainty into account by creating scenarios in which run size and price varied.

We used commercial fish landings data as our base for the model that estimates net economic value. While landings data contain errors, on the whole they reflect a highly reliable source of data about actual fishing choices by all permit holders.

Table XII-4. Uncertainty About Commercial Fishing Net Economic Value

Source	How Handled	Remaining Uncertainty	Relative Importance to Conclusions
Commercial price of fish	3 prices considered: low ($1.00), medium ($1.43), high ($1.75)	Future prices hard to predict	Large effect on commercial fishing losses in combination with run size
Run size	3 levels of fewer openings: low (2-3), medium (2-3), high (no fewer)	Future run sizes hard to predict	Low runs greatly increase commercial fishing losses
Survey designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible
Reliability of permit holder survey results	Random telephone surveys, starting with interviews with 487 permit holders. 90%-85% response rate	Effective sample size of 1,188; negligible sampling error. Probable overestimate in WTA and under-estimate in WTP	We base our estimate of net economic value on an alternate method which yields an estimate in between the CV WTA and WTP estimates
Reliability of crew survey results	Random telephone surveys with 213 crew members. 84% response rate	Margin of error of 10%	Small since most crew benefits are crew share incomes which vary mostly due to run size and price.
Reliability of fish landings data	We compiled data from 1976-1993 and based our model on 1990-93 data	Negligible	Small relative to differences due to run size and price
Data processing	Multiple checks on data accuracy	Negligible	Negligible
Methods for calculating net economic value	Used multiple, parallel methods for sport and commercial	Used best available methods; results comparable with studies elsewhere	Methods used generally provide similar estimates
Model designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible

Sport Fishing Economic Impact

The major source of uncertainty in our estimation of sport fishing economic impacts are expenditures of non-resident anglers. There are two components to this uncertainty. First, we cannot reliably predict the number of non-resident anglers. Recent trends indicate that the number of non-resident anglers is increasing. We decided to increase the assumed number of non-resident anglers from the 1993 base year by a low, medium, and high estimate of 20, 30, and 40 percent respectively. We therefore generated three estimates of sport fishing economic impact for an increase of +200,000 sockeye at the Kenai River sonar counter.

The second component of uncertainty with respect to non-resident anglers is the length of time they would, on average, extend their trips in response to higher quality fishing on the Kenai River. We discussed our analysis of this issue in detail, and decided to take survey responses at face value, although we think the estimate may be high. The resulting estimates of economic impact are nevertheless lower than the corresponding estimated loss expected due to a lower harvest by commercial fishermen.

Table XII-5. Uncertainty About Sport Fishing Economic Impact

Source	How Handled	Remaining Uncertainty	Relative Importance to Conclusions
Growth of non-resident sport fishery	Survey of past visitors; used survey responses although they appear to overestimate response	Large uncertainty about change in the number and length of stay of visitors	Explains most of change in economic impact of sport fishing
Survey designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible
Data processing	Multiple checks on data accuracy	Negligible	Negligible
Reliability of resident sport angler survey results	Random telephone surveys, starting with interviews with 1,355 sport anglers. 83-57% response rates.	Margin of error of 10-20% of CV estimates and 20% of number of angler trips	Small relative to differences due to assumptions about non-resident trips.
Reliability of non-resident sport angler survey results	Mail surveys of license holders, starting with interviews of 4,278. 61%-45% response rates	Negligible sampling error; Probable overstatement (upward bias) of expected length of trip extension	Large remaining uncertainty and potential effect on results. Impact of trip extensions is nevertheless unlikely to exceed commercial losses; impact of additional trips could also could reduce resident fishing.
Model designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible

Commercial Fishing Economic Impact

As in the case of commercial fishing net economic value, the major sources of uncertainty for commercial fishing economic impacts are price and run size. Scenarios explicitly take both sources of uncertainty into account.

We based our analysis of changes in harvest expenditures on permit holder survey responses. The permit holder survey is based on a random sample of permit holders and telephone interviews. We achieved a high response rate in both permit holder surveys (90 and 85 percent). The samples are representative of both driftnet and setnet permit holders. Telephone interviews produce complete and accurate information (within the limits of the knowledge and recall of the permit holders).

Table XII-6. Uncertainty About Commercial Fishing Economic Impact

Source	How Handled	Remaining Uncertainty	Relative Importance to Conclusions
Commercial price of fish	3 prices considered: low ($1.00), medium ($1.43), high ($1.75)	Future prices hard to predict	Large effect on commercial fishing losses in combination with run size
Run size	3 levels of fewer openings: low (2-3), medium (2-3), high (no fewer)	Future run sizes hard to predict	Low runs greatly increase commercial fishing losses
Survey designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible
Reliability of permit holder survey results	Random telephone surveys, starting with interviews with 487 permit holders. 90%-85% response rate	Effective sample size of 1,188; negligible sampling error.	Small relative to differences due to run size and price
Reliability of crew survey results	Random telephone surveys with 213 crew members. 84% response rate	Margin of error of 10%	Small since most crew benefits are crew share incomes which vary mostly due to run size and price.
Reliability of fish landings data	We compiled data from 1976-1993 and based our model on 1990-93 data	Negligible	Small relative to differences due to run size and price
Data processing	Multiple checks on data accuracy	Negligible	Negligible
Model designs	Reviewed by independent experts	Used best available methods; results comparable with studies elsewhere	Negligible

Summary of Findings

- ***As measured by net economic value, relative gains and losses for sport and commercial fishermen would depend largely on conditions in a particular year.*** In years when sockeye prices were high and runs were low, net value losses for commercial fishermen would likely be higher than sport gains. In years when prices were low and runs were medium, sport gains would probably be bigger than commercial losses.

- ***As measured by economic impacts, reducing the commercial harvest would typically cost the economy more jobs and payroll than would be created by the sport fishery.*** One reason is that the commercial fishery creates jobs and payroll in two ways—from the market value of the harvest itself, and from fishery-related spending in other industries. The sport fishery creates jobs only through fishery-related spending; unlike commercial fishermen, sport anglers don't earn money while they're fishing—although they enjoy a great deal of non-monetary value.

- ***How many jobs and how much payroll an improved sport fishery would create statewide would depend mostly on how much more non-residents spent.*** Alaskans would certainly take more trips and spend more for Kenai River fishing, if the fishing were improved. But our analysis showed that in order to take more trips to the Kenai, resident households would take fewer trips to other Alaska fishing sites. So essentially most of resident spending would simply be shifted from one place to another within the state. But if better fishing induced non-residents to stay longer in Alaska and spend more than they otherwise would have, that spending would represent additional money in the economy.

- ***Increasing the Kenai River management target would cost the commercial industry nothing in years of high salmon runs***—because enough salmon would return to the river that managers would not have to curtail commercial fishing (Scenario A4).

- ***Commercial fishermen would give up the most net value in years when sockeye runs were low and prices were medium or higher.*** That's because ADF&G managers assume that in a low-run year, fishermen would have to give up a lot more fish to allow 200,000 more sockeye into the Kenai River—and at higher prices, each fish would be worth more.

- ***Increases in net economic value of the sport fishery would be somewhat larger if the bag limits were increased at the same time an extra 200,000 sockeye came into the river*** (Scenario B). Sport fishermen would place a higher value on the combination of more fish and higher bag limits.

- ***A reduction in Cook Inlet sockeye harvests is unlikely to have much effect on Alaska consumers***—because most Cook Inlet sockeye is sold outside the state.

- ***Gains in net value for the sport fishery would be only about half as large if the number of sockeye were increased by just 100,000 (Scenario D.***

- ***An increase of $1.3 million in net value for the sport fishery would translate into a $22 gain in value for each resident sport fishing household.***

- ***The economy would experience a net loss of about 18 jobs and $800,000 in payroll, if managers allowed 200,000 more sockeye into the Kenai River in a year when the run size and the price were both medium.*** The improved sport fishing would create about 46 new jobs and $990,000 in payroll in industries that supply goods and services to sport anglers. But the reduction in the commercial harvest would cost the economy the equivalent—in work hours—of about 64 jobs and $1.8 million in payroll. Of those jobs, 24 would be among fishermen, 10 among processing workers, and 30 in other Alaska industries.

- ***Each fish entering the mouth of the river would add about $6 in net value for the sport fishery and about $4.50 in Alaska payroll.*** Each 100,000 fish would create the equivalent of about 20 new jobs. By contrast, each fish entering the mouth of the river would cost the commercial fishery about $6.30 in net value and reduce Alaska payroll by $8.00. Each loss of 100,000 fish would cost the economy the equivalent of about 30 jobs. So the combined per fish effect would be a slight decline in net value and a drop of about $4 in Alaska payroll.

- ***Much of the increase in net value for resident sport fishing households would be created because residents would substitute trips to the Kenai and Russian rivers for trips to other Alaska sites.*** Cost savings would contribute to the change in net value. Our surveys of resident households found that on average a fishing trip to the Kenai River costs $105. Trips to other sites cost an average of $155. One of the reasons the Kenai River is so popular is that it is easily accessible , and anglers don't have to own or charter boats—they can drive to the Kenai and catch sockeye from the riverbank.

- ***Resident households with sport anglers would make 4,000 additional trips to Kenai River sites and spend $550,000 more, if 200,000 more sockeye were available. But 80 percent of those trips and that spending would come at the expense of trips to other Alaska fishing sites.*** Our analysis showed that in order to make more trips to the Kenai, many sport anglers would take fewer trips to other Alaska sites and spend less. The net increase in trips to all Alaska sites would be about 650, and the net increase in spending for fishing trips would be about $108,000.

- ***About 2,500 non-resident households could each stay about eight days longer in Alaska and spend $2.1 million more in a season,*** if there were 200,000 more fish available. We think the actual increases would probably be smaller. In our survey of non-resident anglers, respondents didn't give us enough information to allow us to make a more definite estimate.

- ***By reducing the supply of sockeye, the proposed reduction in Cook Inlet commercial sockeye harvests could increase ex-vessel prices of Cook Inlet sockeye by as much as 1 cent per pound.*** But we think that even such a small price increase is unlikely—because Cook Inlet sockeye make up a relatively small share of all Alaska sockeye, and because the growing supply of farmed salmon worldwide is holding down salmon prices.

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ECONOMIC EFFECTS OF MANAGEMENT CHANGES FOR KENAI RIVER LATE-RUN SOCKEYE APPENDIXES A-L

PREPARED FOR

Alaska Department of Fish and Game

January 1996

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Part V. Appendixes

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Appendix A

Documentation of Travel Cost and Contingent Value Analyses for the Sport Fishery

Appendix A. Documentation of Travel Cost and Contingent Value Analyses For Sport Fishery

Travel Cost Analysis

ISER developed a travel cost model to help estimate some of the potential economic effects of increasing the number of Kenai River sockeye available to sport anglers. The model analyzes changes in the economic value of sport fishing by resident anglers in Southcentral Alaska and changes in sport fishing expenditures by resident anglers under the 10 study scenarios.

A major source of information for the travel cost analysis was sport anglers themselves. In 1993 ISER did telephone interviews, and in some cases follow-up mail surveys, with hundreds of Alaska households with sport anglers and with non-resident households that had fished in Alaska. In 1994 we also re-interviewed some of the 1993 respondents. (The surveys are described more in Appendix F.)

For the travel cost model we used just information about sport fishing in Southcentral Alaska supplied by households surveyed within the region. (Anglers who live in Southcentral Alaska account for more than 95 percent of all Southcentral sport fishing trips by Alaska residents.) We conducted interviews with 450 Southcentral households with sport anglers, asking about numbers of fishing trips, sites fished, expenditures, and other information.

Other sources included the Alaska Department of Fish and Game, which supplied us with information on sport harvests, timing of salmon runs, sonar fish counts, sites of heaviest use, and fishing regulations. We also gathered information from the Alaska State Climate Center, the U.S. Forest Service, the *Anchorage Daily News,* the *Milepost,* the *Alaska Atlas and Gazetteer,* and *Tide Tables.*

For the travel cost model we developed equations to estimate changes in *choice of fishing sites* and *frequency of trips* that could result from changes in management of Kenai River sockeye. In developing the site-choice equation we were able to use information from only those survey households that provided weekly data on their choices of fishing sites; that amounted to about half (251) of the respondents. For the participation equation, we were able to use data from all 450 respondent households.

The site-choice equation estimates the probability of an angler's choice of a given fishing site, while the participation equation estimates the probability of an angler's decision to make at least one trip in a given week. We estimated the probability that the angler makes at least one fishing trip in week t (P_t) and the probability that the same angler chooses site i in week t ($P_{i|t}$). The probability that an angler makes a fishing trip and chooses site i in week t is the product of the probability that he makes a fishing trip in week t and the probability that he chooses site i in week t, given that he makes at least one fishing trip during the week.

After estimating these two probabilities with logit regressions, we extrapolated to the population of resident anglers in Southcentral Alaska. The number of trips to site i in week t is calculated by multiplying these probabilities by the number of resident anglers in the region. The probability that an angler choose a site in a given week can be represented as the product of conditional probabilities:

$$P_{it} = P_{i|t} P_t$$

where,

$P_{i|t}$ = the probability that an angler would select site i given that he makes a trip in week *t*.
P_t = the probability that an angler would make at least on fishing trip during week *t*.

Choice of Fishing Site

Data on Choice of Site

We analyzed the choice of sport fishing sites among Southcentral residents using weekly data on 1,298 fishing trips reported by 251 anglers over 27 weeks, from April 29 to November 3. Each week of the 27-week season was defined as from Thursday to Wednesday and including a weekend. The distribution of sport fishing trips taken by Southcentral anglers across the weeks is displayed in Table A-1. The origin points for the trips are shown in Table A-2

Table V-1 in Chapter V lists the 30 Southcentral sport fishing sites included in the model. We aggregated fishing sites, using several guidelines. We defined the most popular sites in each management area narrowly, so site characteristics could be meaningfully identified. We clustered sites geographically and by the primary means of access (plane, boat, or car), so travel costs could be meaningfully assigned to the group. Finally, we grouped sites by type of fishing. . Table A-3 shows which individual fishing locations were aggregated together into the 30 sites, and the weighted number of trips to each.

Table A-4 lists 14 species included in the model. In some instances, we grouped a number of species under one category—for example, "ground and other finfish."

Table A-1. Distribution of Sport Fishing Trips

Week	Date	Number of Trips
1	April 29 - May 5	10
2	May 6 - May 12	27
3	May 13 - May 19	37
4	May 20 - May 26	40
5	May 27 - June 2	84
6	June 3 - June 9	82
7	June 10 - June 16	95
8	June 17 - June 23	99
9	June 24 - June 30	92
10	July 1 - July 7	71
11	July 8 - July 14	82
12	July 15 - July 21	101
13	July 22 - July 28	92
14	July 29 - August 4	73
15	August 5 - August 11	77
16	August 12 - August 18	65
17	August 19 - August 25	57
18	August 26 - September 1	44
19	September 2 - September 8	26
20	September 9 - September 15	15
21	September 16 - September 22	8
22	September 23 - September 29	4
23	September 30 - October 6	4
24	October 7 - October 13	3
25	October 14 - October 20	6
26	October 21 - October 27	3
27	October 28 - November 3	1
		total=1298

Table A-2. Origins of Sport Fishing Trips

Origin	Number of Respondents	Number of Trips
Anchorage	115	537
Anchor Point	3	10
Big Lake	4	23
Chugiak	3	21
Eagle River	13	70
Homer	12	43
Hope	1	2
Houston	1	5
Kenai	14	132
Nikiski	1	2
Nikolaevsk	1	4
Ninilchik	1	2
Palmer	19	120
Seward	3	9
Soldotna	20	151
Sterling	4	15
Tyonek	3	7
Wasilla	30	143
Willow	1	2
	total = 251	total = 1298

Table A-3. Survey Estimates of Southcentral Alaska Resident Fishing Trips by Site[1], May - Oct 93 and July 93

	May-Oct		July	
	No. of Trips	Percent	No. of Trips	Percent
1. Willow Creek	23,669	3.8%	4,492	2.3%
2. Other Willow/Cant	24,072	3.8%	6,651	3.4%
3. Little Susitna	24,970	4.0%	4,766	2.4%
4. Wasilla Creek	3,161	0.5%	1,718	0.9%
5. Kepler & Wasilla	15,468	2.5%	4,017	2.1%
6. Fish Creek Dip Net	14,589	2.3%	9,486	4.9%
7. Big Lake & Tribs	9,458	1.5%	5,996	3.1%
8. Other MatSu Fresh	27,932	4.5%	7,803	4.0%
9. Ship Creek	16,429	2.6%	1,848	0.9%
10. Other Anch Area	26,147	4.2%	6,993	3.6%
11. Deshka River	12,167	1.9%	4,437	2.3%
12. Other W/Susitna,	33,714	5.4%	6,125	3.1%
13. Areas 11-14 Salt	9,454	1.5%	2,036	1.0%
14. Anchor R Whiskey	18,246	2.9%	4,539	2.3%
15. Resurrection Bay	48,163	7.7%	11,104	5.7%
16. Other Kachemak B	27,156	4.3%	8,125	4.2%
17. Homer Spit Shore	12,617	2.0%	3,106	1.6%
18. Other Area 15 (Kenai) Salt	10,746	1.7%	3,454	1.8%
19. Kenai PU Dipnet	7,422	1.2%	4,408	2.3%
20. Upper Kenai R	12,345	2.0%	5,706	2.9%
21. Lower Kenai R	114,291	18.3%	58,372	29.9%
22. Russian R	29,799	4.8%	12,100	6.2%
23. Kasilof R	13,552	2.2%	160	0.1%
24. Ninilchik to Anc	15,909	2.5%	1,555	0.8%
25. Swason&Swan Cano	9,504	1.5%	2,134	1.1%
26. N Kenai Fresh	6,026	1.0%	1,928	1.0%
27. Other Kenai Fres	26,183	4.2%	5,021	2.6%
28. areas 9 & 10 fre	17,700	2.8%	3,206	1.6%
29. PWS Salt	3,317	0.5%	1,130	0.6%
30. Other AK	11,690	1.9%	2,944	1.5%
Item: Kenai Sites 19-22	163,857	26.2%	80,586	41.3%
Total	625,896		195,360	

[1]Detailed sites aggregated to 30 sites used in travel cost model

Table A3A. Estimated Total Trips by Southcentral Alaska Residents, May - Oct 1993
By Detailed and Aggregated Sites

SCSITEGP: 1302 1. Willow Creek

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
WILLOW CREEK FRESHWA	1302	23669	100.0	100.0	100.0
	Total	23669	100.0	100.0	

Valid cases 23669 Missing cases 0

SCSITEGP: 1356 2. Other Willow/Cantwell Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
KASHWITNA RIVER FRES	1301	235	1.0	1.0	1.0
CASWELL CREEK FRESHW	1303	2899	12.0	12.0	13.0
MONTANA CREEK FRESHW	1304	7771	32.3	32.3	45.3
SUNSHINE CREEK FRESH	1305	2896	12.0	12.0	57.3
TALKEETNA RIVER AND	1307	3639	15.1	15.1	72.4
SHEEP CREEK FRESHWAT	1308	2887	12.0	12.0	84.4
LITTLE WILLOW CREEK	1309	1185	4.9	4.9	89.4
GOOSE CREEK FRESHWAT	1310	273	1.1	1.1	90.5
OTHER STREAMS FRESHW	1312	1239	5.1	5.1	95.6
OTHER LAKES FRESHWAT	1313	1048	4.4	4.4	100.0
	Total	24072	100.0	100.0	

Valid cases 24072 Missing cases 0

SCSITEGP: 1104 3. Little Susitna

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
LITTLE SUSITNA RIVER	1104	24970	100.0	100.0	100.0
	Total	24970	100.0	100.0	

Valid cases 24970 Missing cases 0

SCSITEGP: 1106 4. Wasilla Creek

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
WASILLA CREEK (RABBI	1106	3161	100.0	100.0	100.0
	Total	3161	100.0	100.0	

Valid cases 3161 Missing cases 0

SCSITEGP: 1151 5. Kepler & Wasilla Area Lakes

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
KEPLER LAKE COMPLEX	1110	11264	72.8	72.8	72.8
FINGER LAKE FRESHWAT	1112	4203	27.2	27.2	100.0
	Total	15468	100.0	100.0	

Valid cases 15468 Missing cases 0

SCSITEGP: 1122 6. Fish Creek Dipnet

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent

FISH CREEK (BIG LAKE	1122	14589	100.0	100.0	100.0
	Total	14589	100.0	100.0	

Valid cases 14589 Missing cases 0

SCSITEGP: 1152 7. Big Lake & Tribs

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
FISH CREEK (BIG LAKE	1103	2937	31.0	31.0	31.0
BIG LAKE FRESHWATER	1114	6522	69.0	69.0	100.0
	Total	9458	100.0	100.0	

Valid cases 9458 Missing cases 0

SCSITEGP: 1156 8. Other MatSu Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
KNIK RIVER AND TRIBU	1105	5965	21.4	21.4	21.4
COTTONWOOD CREEK FRE	1107	118	.4	.4	21.8
EKLUTNA POWER PLANT	1108	296	1.1	1.1	22.8
NANCY LAKE FRESHWATE	1115	1484	5.3	5.3	28.1
OTHER SITES IN NANCY	1119	2619	9.4	9.4	37.5
OTHER STREAMS FRESHW	1120	1910	6.8	6.8	44.4
OTHER LAKES FRESHWAT	1121	15540	55.6	55.6	100.0
	Total	27932	100.0	100.0	

Valid cases 27932 Missing cases 0

SCSITEGP: 1219 9. Ship Creek

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SHIP CREEK FRESHWATE	1219	16429	100.0	100.0	100.0
	Total	16429	100.0	100.0	

Valid cases 16429 Missing cases 0

SCSITEGP: 1256 10. Other Anch Area Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
JEWEL LAKE FRESHWATE	1202	1128	4.3	4.3	4.3
C STREET (TAKU-CAMPB	1205	853	3.3	3.3	7.6
CHENEY LAKE FRESHWAT	1206	347	1.3	1.3	8.9
DELONG LAKE FRESHWAT	1207	5158	19.7	19.7	28.6
EAF - SIXMILE LAKE F	1209	479	1.8	1.8	30.5
FT. R - OTTER LAKE F	1213	1480	5.7	5.7	36.1
FT. R - CLUNIE LAKE	1214	469	1.8	1.8	37.9
BIRD CREEK FRESHWATE	1220	3279	12.5	12.5	50.5
CAMPBELL CREEK FRESH	1221	1313	5.0	5.0	55.5
TWENTYMILE CREEK FRE	1222	395	1.5	1.5	57.0
EAGLE RIVER FRESHWAT	1224	129	.5	.5	57.5
OTHER STREAMS FRESHW	1225	2425	9.3	9.3	66.8
OTHER LAKES FRESHWAT	1226	8693	33.2	33.2	100.0
	Total	26147	100.0	100.0	

Valid cases 26147 Missing cases 0

SCSITEGP: 1403 11. Deshka River

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
DESHKA RIVER (KROTO	1403	12167	100.0	100.0	100.0

Total	12167	100.0	100.0	

Valid cases 12167 Missing cases 0

SCSITEGP: 1456 12. Other W/Susitna, Cook I Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
LAKE CREEK FRESHWATE	1404	13749	40.8	40.8	40.8
FISH LAKE CREEK AND	1405	3816	11.3	11.3	52.1
ALEXANDER CREEK FRES	1406	5053	15.0	15.0	67.1
TALACHULITNA RIVER F	1408	908	2.7	2.7	69.8
CHUITNA RIVER FRESHW	1409	194	.6	.6	70.4
THEODORE RIVER FRESH	1410	316	.9	.9	71.3
KUSTATAN RIVER FRESH	1412	1319	3.9	3.9	75.2
OTHER STREAMS FRESHW	1416	7117	21.1	21.1	96.3
OTHER LAKES FRESHWAT	1417	1242	3.7	3.7	100.0
	Total	33714	100.0	100.0	

Valid cases 33714 Missing cases 0

SCSITEGP: 1455 13. Areas 11 - 14 Salt

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
FISH CREEK AREA (NOT	1101	1056	11.2	11.2	11.2
SALTWATER SITES	1201	8398	88.8	88.8	100.0
	Total	9454	100.0	100.0	

Valid cases 9454 Missing cases 0

SCSITEGP: 1501 14. Anchor R Whiskey Glch

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
ANCHOR RIVER, WHISKE	1501	18246	100.0	100.0	100.0
	Total	18246	100.0	100.0	

Valid cases 18246 Missing cases 0

SCSITEGP: 1506 15. Resurrection Bay

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
RESURRECTION BAY SAL	1506	48163	100.0	100.0	100.0
	Total	48163	100.0	100.0	

Valid cases 48163 Missing cases 0

SCSITEGP: 1551 16. Other Kachemak Bay

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
TUTKA BAY SALTWATER	1502	396	1.5	1.5	1.5
HALIBUT COVE SALTWAT	1503	741	2.7	2.7	4.2
OTHER KACHEMAK BAY S	1505	26019	95.8	95.8	100.0
	Total	27156	100.0	100.0	

Valid cases 27156 Missing cases 0

SCSITEGP: 1504 17. Homer Spit Shore

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
HOMER SPIT SALTWATER	1504	12617	100.0	100.0	100.0

Total	12617	100.0	100.0	

Valid cases 12617 Missing cases 0

SCSITEGP: 1555 18. Other Area 15 Salt

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
LOWER COOK INLET/OUT	1507	1208	11.2	11.2	11.2
OTHER SALTWATER	1508	7483	69.6	69.6	80.9
KENAI R. MOUTH	1543	2055	19.1	19.1	100.0
	Total	10746	100.0	100.0	

Valid cases 10746 Missing cases 0

SCSITEGP: 1532 19. Kenai PU Dipnet

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
CHINA POOT LAKE - P.	1531	387	5.2	5.2	5.2
KENAI RIVER - P.U. D	1532	3575	48.2	48.2	53.4
NINILCHIK BEACH (DEE	1539	1593	21.5	21.5	74.8
CLAM GULCH BEACH (SE	1540	1151	15.5	15.5	90.4
OTHER SALTWATER SHEL	1541	716	9.6	9.6	100.0
	Total	7422	100.0	100.0	

Valid cases 7422 Missing cases 0

SCSITEGP: 1512 20. Upper Kenai R

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
D. KENAI RIVER - SKI	1512	12345	100.0	100.0	100.0
	Total	12345	100.0	100.0	

Valid cases 12345 Missing cases 0

SCSITEGP: 1542 21. Lower Kenai R

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
A. KENAI RIVER - COO	1509	77182	67.5	67.5	67.5
B. KENAI RIVER - SOL	1510	4001	3.5	3.5	71.0
C. KENAI RIVER - MOO	1511	9186	8.0	8.0	79.1
KENAI R. UNSPECIFIED	1542	23922	20.9	20.9	100.0
	Total	114291	100.0	100.0	

Valid cases 114291 Missing cases 0

SCSITEGP: 1524 22. Russian R

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
RUSSIAN RIVER FRESHW	1524	29799	100.0	100.0	100.0
	Total	29799	100.0	100.0	

Valid cases 29799 Missing cases 0

SCSITEGP: 1513 23. Kasilof R

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
KASILOF RIVER FRESHW	1513	13552	100.0	100.0	100.0

	Value	Frequency	Percent	Valid Percent	Cum Percent
	Total	13552	100.0	100.0	

Valid cases 13552 Missing cases 0

SCSITEGP: 1554 24. Ninilchik to Anchor Pt Rvrs

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
ANCHOR RIVER FRESHWA	1514	4456	28.0	28.0	28.0
DEEP CREEK FRESHWATE	1516	3200	20.1	20.1	48.1
NINILCHIK RIVER FRES	1517	8253	51.9	51.9	100.0
	Total	15909	100.0	100.0	

Valid cases 15909 Missing cases 0

SCSITEGP: 1552 25. Swason&Swan Canoe

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SWANSON RIVER FRESHW	1519	4468	47.0	47.0	47.0
SWANSON RIVER CANOE	1520	4502	47.4	47.4	94.4
SWAN LAKE CANOE SYST	1521	534	5.6	5.6	100.0
	Total	9504	100.0	100.0	

Valid cases 9504 Missing cases 0

SCSITEGP: 1557 26. N Kenai Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
QUARTZ CREEK FRESHWA	1525	3794	63.0	63.0	63.0
CRESCENT LAKE FRESHW	1526	1420	23.6	23.6	86.5
RESURRECTION CREEK (	1527	812	13.5	13.5	100.0
	Total	6026	100.0	100.0	

Valid cases 6026 Missing cases 0

SCSITEGP: 1556 27. Other Kenai Fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SKILAK LAKE FRESHWAT	1522	904	3.5	3.5	3.5
HIDDEN LAKE FRESHWAT	1523	118	.5	.5	3.9
OTHER STREAMS FRESHW	1529	10931	41.7	41.7	45.7
OTHER LAKES FRESHWAT	1530	14230	54.3	54.3	100.0
	Total	26183	100.0	100.0	

Valid cases 26183 Missing cases 0

SCSITEGP: 959 28. areas 9 & 10 fresh

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
GULKANA RIVER (PAXSO	901	453	2.6	2.6	2.6
GULKANA RIVER (SOURD	902	1635	9.2	9.2	11.8
KLUTINA RIVER FRESHW	903	464	2.6	2.6	14.4
MENDELTNA CREEK FRES	904	171	1.0	1.0	15.4
TONSINA RIVER FRESHW	905	2551	14.4	14.4	29.8
TYONE CREEK FRESHWAT	906	2319	13.1	13.1	42.9
LAKE LOUISE (MILE 16	908	1295	7.3	7.3	50.2
VAN (SILVER) LAKE FR	911	408	2.3	2.3	52.5
SUMMIT LAKE (NEAR PA	913	295	1.7	1.7	54.2
OTHER STREAMS FRESHW	915	1490	8.4	8.4	62.6
OTHER LAKES FRESHWAT	916	363	2.1	2.1	64.7
COPPER RIVER DIPNET	917	4719	26.7	26.7	91.3
EYAK RIVER FRESHWATE	1008	187	1.1	1.1	92.4

OTHER STREAMS FRESHW	1014	1349	7.6	7.6	100.0
	Total	17700	100.0	100.0	

Valid cases 17700 Missing cases 0

SCSITEGP: 1059 29. PWS Salt

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
VALDEZ ARM/BAY (INCL	1001	1940	58.5	58.5	58.5
OTHER SALTWATER	1007	1378	41.5	41.5	100.0
	Total	3317	100.0	100.0	

Valid cases 3317 Missing cases 0

SCSITEGP: 5059 30. Other AK

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
OTHER SALTWATER	505	886	7.6	7.6	7.6
OTHER SALTWATER	1606	173	1.5	1.5	9.1
OTHER STREAMS FRESHW	1613	194	1.7	1.7	10.7
COLD BAY AREA SALTWA	1701	222	1.9	1.9	12.6
NEWHALEN RIVER FRESH	1806	852	7.3	7.3	19.9
ILIAMNA LAKE FRESHWA	1809	310	2.7	2.7	22.6
TOGIAK RIVER SYSTEM	1905	275	2.4	2.4	24.9
QUARTZ LAKE FRESHWAT	2017	2068	17.7	17.7	42.6
TANGLE LAKES AND TAN	2026	1124	9.6	9.6	52.2
OTHER STREAMS FRESHW	2032	996	8.5	8.5	60.7
OTHER LAKES FRESHWAT	2033	884	7.6	7.6	68.3
ANIAK RIVER FRESHWAT	2102	1487	12.7	12.7	81.0
OTHER STREAMS FRESHW	2106	1487	12.7	12.7	93.7
KUZITRIN RIVER FRESH	2210	360	3.1	3.1	96.8
KOYUKUK RIVER DRAINA	2407	372	3.2	3.2	100.0
	Total	11690	100.0	100.0	

Valid cases 11690 Missing cases 0

Table A-4. Fish and Shellfish Available in the Southcentral Region

1) Chinook (king) salmon
2) Coho (silver) salmon
3) Sockeye (red) salmon
4) Other salmon
5) Trout
6) Dolly Varden/Char
7) Steelhead
8) Grayling
9) Whitefish
10) Herring
11) Halibut
12) Ground and Other Finfish
13) Clams, Other Shellfish
14) Crab and Shrimp

Explanatory Variables for Site-Choice Equation

Estimating a site choice equation requires developing a set of variables to predict the choice of sites by anglers. We constructed variables for each of the 30 sport angling sites in the region. Fishing quality at each site per week is an important variable; anglers are of course more likely to go to sites with high catch rates and more likely to go in weeks when the catch rates are high. Characteristics of specific sites also help explain anglers' choices. Anglers may prefer sites with amenities and facilities— such as public cabins, gas stations, restaurants, or campgrounds. Anglers are also influenced by the regulations (such as bag limits) at particular sites. Finally, other factors—like ownership of a cabin at a particular site—may influence anglers' choices.

Probably the most important variable in the travel cost model is the cost of the trip—which is the sum of the fuel cost, the depreciation on vehicles, lost income for those who could have worked during their travel and fishing time, and other trip expenditures for food, lodging, bait, and guides. An angler is more likely to go to a particular fishing site if it costs less, as long as it has the same fishing quality as other sites that are more expensive to reach.

Treatment of Time

The traditional site-choice equations often exclude travel and on-site fishing time from the costs of the fishing trip. These studies estimate the probability (P_{it}) that an angler selects a site as a function of fishing quality variables for that site and certain travel costs. Those travel costs include fuel, food, bait, lodging, and guide costs but not the cost of time. Travel time and on-site fishing times are used as variables to explain the out-of-pocket trip costs. We think people's time is valuable; therefore, this method underestimates the cost of the trip and willingness to pay.

If on-site time is considered at all in these traditional equations, it is typically treated as an "exogenous variable" that is fixed for that trip. Trip expenditures are then estimated using anglers' reported on-site time as one of the independent explanatory variables—rather than as the dependent result of angler, site, and weather characteristics. This assumption makes sense for some guided fishing trips—such as a half-day halibut charter—but it doesn't characterize most Alaska resident fishing trips. If the variable for fishing hours on-site is in fact "endogenous"—that is, chosen by the angler—treating it as exogenous in the expenditure equations will provide inefficient and biased regression results leading to inaccurate predications of travel costs.

A simple way to test whether on-site time is endogenous or exogenous may be to regress the variable on all other exogenous variables in the same equation. If a statistically significant relationship can be found, then fishing hours on-site is determined within the equation and thus is endogenous. On the contrary, if there is no statistically significant relationship, fishing hours on-site is just another exogenous variable. Based on theory as well as the results of our test, we believe that on-site fishing time is endogenous. Therefore, in this study, on-site fishing time and trip expenditures are simultaneously determined. We estimate an equation to predict on-site time, using all the exogenous variables, shown in Table A-6.

We treat the cost of time differently for anglers who said that they could have worked instead of fishing from those who did not have paid work as an alternative. Our travel cost model includes the cost of travel time and on-site time as a portion of total trip costs. Using survey responses about who could have worked, how much they could have earned, and how long they spent both in travel time and on site time, we estimated a regression to find the average cost of time. The results of this regression were included to estimate the cost of time for those people who could have been working instead of going fishing. A separate travel cost variable was applied to households which could not have worked (about 2/3 of our sample), to value their travel time; on-site time was not valued for this group.

Expenditure Equations

We used survey data on 876 summer fishing trips statewide to estimate food, bait, lodging, and guide costs. We used a censored regression (tobit) model for the estimation, since there are no negative expenditures. We used an instrumental variable for on-site time, constructed from the fitted values of the equation shown in Table A-5. Tables A-6 through A-9 display the results of these expenditure equations. The variable definitions are the same as for Table A-5, except that lfhours is the fitted value for on-site time.

Table A-5. Regression Results for On-Site Fishing Time

Variable	Coefficient	Standard Error	t-ratio
Constant	5.0760	1.858	2.732
Hrs_trip	0.33357	0.06444	5.176
Npeople	-1.7678	0.1705	-10.369
Fuelwat	5.2706	3.511	1.501
Boatramp	-1.5064	0.8796	-1.713
Derby	0.54448	0.7320	0.744
Pcabin	0.70694	1.140	0.620
Campgr	1.2615	1.377	0.916
Commerc	-4.3074	3.570	-1.206
Trout	-0.33488	0.8133	-0.412
Salt	-0.52177	0.6456	-0.808
Boat	1.7261	0.4621	3.735
Income	-0.016475	0.0057	-2.889
Skill	0.27369	0.2695	1.016
Nretire	-0.22585	0.3628	-0.622
Ksalmon	-0.52032	0.5680	-0.916
Halibut	-1.8748	0.7517	-2.494
Cabin	-0.22358	1.262	-0.177
Camper	0.70352	0.6949	-1.012
Cpueking	-0.64228	2.221	-0.289
Cpuemax1	-0.043629	0.3499	-0.125
Cpuemax2	2.5404	2.011	1.263
Peakking	1.3823	0.5532	2.499
Peakmax1	1.0929	0.5867	1.863
Peakmax2	-0.34934	0.5712	-0.612
Kingbag	1.6203	0.5982	2.709
Max1bag	-0.010567	0.1254	-0.084
Max2bag	-0.36131	0.1041	-3.472
Crowding	-0.40573	0.7791	-0.521
Tg40_1	0.044381	0.08714	0.509
Pg10_1	0.20788	0.2279	0.912
Othearn	-0.015879	0.5692	-0.028
Othearnd	0.0032519	0.0006931	4.692
Sigma	6.4069	0.1439	44.556

N=994; Log-likelihood= -3254.3
Restricted (Slopes=0) Log-L= -3365.9
Significance Level= 0

Definition of Variables for Table A-5

Ifhours:	total person hours on-site
One:	constant
Hrs_trip:	hours taken to get to a site
Npeople:	number of people in a trip
Fuelwat:	fuelwat=1 if fuel and water are available at the site, otherwise Fuelwat=0
Boatramp:	Boatramp=1 if boatramp is available, otherwise Boatramp=0
Derby:	Derby=1 for any derby at the site, otherwise Derby=0
Pcabin:	Pcabin=1 if public cabin is available, otherwise Pcabin=0
Campgr:	Campgr=1 if camp ground is available, otherwise Campgr=0
Commerc:	Commerc=1 if commercial lodging is available, otherwise Commerc=0
Trout:	Trout=1 if target species is trout, otherwise Trout=0
Salt:	Salt=1 if water type is salt, otherwise Salt=0
Boat:	Boat=1 if an angler owns a boat, otherwise Boat=0
Income:	Household income in $1000
Skill:	Skill=1 if an angler is not a beginner, otherwise Skill=0
Nretire:	number of retired person in a household
Ksalmon:	Ksalmon=1 if target species is king salmon, otherwise Ksalmon=0
Halibut:	Halibut=1 if target species is Halibut, otherwise Halibut=0
Cabin:	Cabin=1 if an angler owns a cabin at the site they fish, otherwise Cabin=0
Camper:	Camper=1 if an angler owns a camper, otherwise Camper=0
Cpueking:	Catch rate for king salmon
Cpuemax1:	Catch rate for the species that was caught most
Cpuemax2:	Catch rate for the species that was caught second most
Peakking:	Peakking=1 if availability of king salmon is rated as peak, otherwise Peakking=0
Peakmax1:	Peakmax1=1 if availability of the species caught most is rated as peak, otherwise Peakmax1=0
Peakmax2:	Peakmax2=1 if availability of the species caught second most is rated as peak, otherwise Peakmax2=0
Kingbag:	Bag limit for king salmon
Max1bag:	Bag limit for the species caught most
Max2bag:	Bag limit for the species caught second most
Crowding:	Crowding=1 if a site is crowded, otherwise Crowding=0
Tg40_1:	Number of days during the study week that the mid-range temperature was above 40 degrees Fahrenheit
Pg10_1:	Number of days during the study week that precipitation exceeded 0.10 inches
Othearn:	Othearn=1 if an angler could have earned any amount of money elsewhere during the fishing trip, otherwise Otherrn=0
Othernd:	Dollar amount that an angler could have earned elsewhere during the fishing trip

Table A-6. Censored Regression Results for the Food Cost Equation (On-site time treated as endogenous)

Food cost = f(One, Ifhours, Hrs_trip, Trout, Income, Nretire, Camper)

Variable	Coefficient	Standard Error	t-ratio
Constant	-56.352	10.62	-5.305
Ifhours	4.2195	0.7327	5.759
Hrs_trip	5.3857	1.406	3.830
Trout	-34.362	14.02	-2.450
Income	0.41344	0.1015	4.075
Nretire	-25.312	6.842	-3.700
Camper	-42.145	11.61	-3.629
Sigma	95.891	2.877	33.326

N=876
Log-likelihood= -3748.8
Restricted (Slopes=0) Log-L= -5058.65
Chi-Squared(9)= 216
Significance Level= 0

Table A-7. Censored Regression Results for the Bait Cost Equation (On-site time treated as endogenous)

Bait cost = f(One, Ifhours, Income, Nretire)

Variable	Coefficient	Stan. Error.	t-ratio
Constant	-23.782	6.248	-3.806
Ifhours	3.0309	0.4012	7.555
Nretire	-15.573	3.898	-3.996
Sigma	60.715	1.655	36.684

N=876
Log-likelihood= -4019.5
Restricted (Slopes=0) Log-L= -4752.32
Chi-Squared(5)= 132
Significance Level= 0

Table A-8. Censored Regression Results for the Lodging Cost Equation (On-site time treated as endogenous)

Lodging cost = f(One, Ifhours, Hrs_trip, Boat, Nretire, Halibut)

Variable	Coefficient	Stan. Error.	t-ratio
Constant	-204.96	20.60	-9.951
Ifhours	6.1979	1.359	4.562
Hrs_trip	6.9357	2.400	2.890
Boat	-41.803	14.30	-2.922
Nretire	-47.690	15.78	-3.022
Halibut	64.562	18.63	3.466
Sigma	137.03	7.953	17.231

N=876
Log-likelihood= -1300.5
Restricted (Slopes=0) Log-L= -4726.1
Chi-Squared(4)= 1982
Significance Level= 0

Table A-9. Censored Regression Results for the Guide Cost Equation (On-site time treated as endogenous)

Guide Cost = f(One, Ifhours, Hrs_trip, Boat, Ksalmon, Halibut, Cpuemax2, Pg10_1)

Variable	Coefficient	Stan. Error.	t-ratio
Constant	-1227.8	151.9	-8.084
Ifhours	17.100	5.371	3.184
Hrs_trip	18.941	8.433	2.246
Boat	-463.25	80.89	-5.727
Ksalmon	320.16	77.53	4.130
Halibut	751.34	96.27	7.804
Cpuemax2	598.13	201.3	2.971
Pg10_1	85.697	26.89	3.187
Sigma	401.85	39.41	10.198

N=1496
Log-likelihood= -633.61
Restricted (Slopes=0) Log-L= -1624.9
Chi-Squared(4)= 2964
Significance Level= 0

Site Choice Equation

Once we had estimated on-site fishing time and trip expenditures, we were able to develop the site choice equation. The site-choice equation estimates the probability (P_{it}) that an angler selects site *i* in week *t*; with *i*=1 to 30 and *t*=1 to 27. A discrete choice model was used:

$$P_{it} = \frac{e^{x_{it}b}}{\sum_{i=1}^{30} e^{x_{it}b}}$$

where, $X_{it}b$— a linear combination of variables (X_{it}) and coefficients (b)—explain the probability (P_{it}) that an angler selects the site *i* in week *t* ; *i*=1 to 30 and *t*=1 to 27.

We estimated this equation using maximum likelihood techniques, testing a large number of variables. We tested weekly and annual fishing quality, annual catch, peak fishing times, household-site interactions, site characteristics, and bag limits. We report below only the variables that appear in our final equation. The linear combination of the selected explanatory variables is :

$$\begin{aligned} Xb_{it} = {} & b_1 Tripcost_i + b_2 Nhtravl_i + b_3 Nifhours_i + b_4 Yifhours_i + b_5 Trout_i + b_6 Dolly_i \\ & + b_7 Kingdf_i + b_8 Sockdf_i + b_9 Kingrept_{it} + b_{10} Silver_i \\ & + b_{11} Sockeye_i + b_{12} Ksonar_{it} + b_{13} Pinkchum_i + b_{14} Halipeak_{it} + b_{15} Troutbag_{it} \\ & + b_{16} Campgr_i + b_{17} Crowding_i + b_{18} Sewdby_i \end{aligned}$$

The estimation results reported in Table A-10 are generally plausible. A positive sign on the coefficient for an explanatory variable means that the higher the value of the variable, the more likely it is that an angler will select site *i* over the alternative sites. One the other hand, a negative sign means the higher the value of the variable, the less likely an angler will choose site *i*. The two final columns are indexes of the power of each variable to explain the level and variance of the dependent variable, the probability of chosing a site.

Table A-10. Coefficient Estimates for the Site Choice Equation

Variable	Coefficient	Std. Error	t-ratio	Mean	Std.Dev.	Coeff.* Mean	Coeff.* Std.Dev
Tripcost	-0.0035016	0.0004773	-7.206	236.5	142.8	-0.83	-0.50
Travtime	-0.092842	0.01196	-7.761	4.959	5.632	-0.46	-0.52
Nifhours	-0.16922	0.04320	-3.917	3.905	3.517	-0.66	-0.60
Yifhours	-0.010504	0.05283	-0.199	1.236	2.388	-0.01	-0.03
Trout	0.0000050369	0.000001895	2.658	6963	16200	0.04	0.08
Dolly	0.0000078114	0.000001549	5.043	12100	31700	0.09	0.25
Kingdf	1.5537	0.2200	7.063	.00844	0.1481	0.13	0.23
Sockdf	0.50876	0.07105	7.160	0.1409	0.4101	0.07	0.21
Kingrept	0.10003	0.01793	5.578	1.295	2.014	0.13	0.20
Silver	0.000018265	0.000002842	6.427	6821	13700	0.12	0.25
Sockeye	0.0000047022	0.000001064	4.421	16300	34800	0.08	0.16
Ksonar	0.0020336	0.0006783	2.998	5.721	32.19	0.01	0.07
Pinkchum	0.000030181	0.00001386	2.177	1677	3077	0.05	0.09
Halipeak	1.3449	0.1322	10.171	0.1667	0.3727	0.22	0.50
Troutbag	0.15562	0.01854	8.392	2.081	1.825	0.32	0.28
Campgr	1.7246	0.9522	1.811	0.8905	0.3123	1.54	0.54
Crowding	-1.7190	1.020	-1.685	0.3105	0.4627	-0.53	-0.80
Sewdby	1.1473	0.3114	3.684	0.00312	0.0558	0.00	0.06

N = 38730
Log-likelihood = -3806.3
Restricted (Slopes=0) = -4390.9
Chi-Squared (15) = 1169.2
Significance Level = 0.32173E-13

Definition of Variables for Table A-10

$Tripcost_i$ (for those who could have worked): trip cost to get to site *i*: fuel cost + food cost + bait cost + lodging cost + guide cost + vehicle depreciation cost + lost wage for travel and on-site time.

$Tripcost_i$ (for those who could not have worked): trip cost to get to site *i*: fuel cost + other trip expenditures + vehicle depreciation cost

$Travtime_i$: travel time to get to site *i* for those who could not have worked

$Nifhours_i$: on-site fishing hours by anglers who could not have worked.

$Yifhours_i$: on-site fishing hours by anglers who could have worked.

$Trout_i$: annual total catch for trout at site *i* from the ADF&G statewide harvest survey.

$Dolly_i$: annual total catch for Dolly Varden at site *i* from the ADF&G statewide sport harvest survey.

$Kingdf_i$: annual fishing quality for king salmon at site *i*, which is total annual catch for king salmon divided by days of fishing by anglers at the *i*th site.

$Sockdf_i$: annual fishing quality for sockeye salmon at the *i*th site, which is total annual catch for sockeye salmon divided by days of fishing by anglers at the *i*th site.

$Kingrept_{it}$: fishing quality for king salmon at the *i*th site per week published in the *Anchorage Daily News*. The data was coded 0 to 6. Zero indicates closed or no report; six indicates best fishing quality.

$Silver_i$: annual total catch for silver salmon at the *i*th site from the ADF&G statewide sport harvest survey.

$Sockeye_i$: annual total catch for sockeye salmon at the *i*th site from the ADF&G statewide sport harvest survey.

$Ksonar_{it}$: The sonar count in the Kenai River, measured near the Soldotna Bridge.

$PinkChum_i$: annual total catch for pink or chum salmon at the *i*th site from the ADF&G statewide sport harvest survey.

$Halipeak_{it}$: Halipeak=1 if Halibut is peak available at the *i*th site in week *t*, otherwise Halipeak=0. This data was developed from the ADF&G brochures.

$Troutbag_{it}$: Bag limit for trout at the *i*th site in week *t*.

$Campgr_i$: Campgr=1 if a campground is available, otherwise campgr=0.

$Crowding_{it}$: Crowding=1 if the *i*th site is crowded in week *t*, otherwise Crowding=0.

Sewdbyit: Sewdby=1 if Seward Silver Salmon Derby is held in week t, otherwise Sewdby=0.

Fishing quality of course influences anglers' decisions about where to fish. Anglers are more likely to go to sites with high catch rates, and more likely to go fishing in weeks when catch rates are high. Fishing quality at each site can be indicated by several variables. For instance, the total annual catch for each major species at each site is one measure of fishing quality—but it doesn't show weekly variation in fishing quality at the same site over the season. Another indicator of fishing quality is the total catch per day at each site—which is the total annual catch divided by days fished. This indicator can give anglers more information about their individual chances of catching fish. A better sign of fishing quality—that shows weekly variation across sites—is the weekly information published in the *Anchorage Daily News* and weekly peak fishing time data from ADF&G brochures.

In our estimation results, all the coefficients of fishing quality variables have positive signs. The annual total catches for trout *(Trout),* Dolly Varden *(Dolly),* silver salmon *(Silver),* sockeye salmon *(Sockeye),* and pink or chum salmon *(Pinkchum)* at each site are factors that Southcentral anglers consider when deciding where to fish. The estimation results show that anglers prefer to fish at sites with high annual catches for major species.

The factors most affecting anglers' choices about where to fish for king salmon are catch per angler day *(Kingdf)* and published weekly fishing quality information *(Kingrept).*

Many Southcentral anglers like to fish for sockeye in the Kenai and Russian Rivers. The model shows that anglers consider the annual total catch *(Sockeye),* the catch per angler day *(Sockdf),* and the sonar count *(Ksonar)* when they're deciding where to fish. Anglers are more likely to go sockeye fishing at sites with high catch rates and to go fishing in weeks when the catch rate is high.

Anglers are particularly interested in fishing for halibut when halibut fishing is reported to be at its peak *(Halipeak).* The model indicates that total annual catch of halibut and catch per angler day are less important considerations.

Some regulations and site characteristics also affect anglers' decisions about where to go fishing. A higher bag limit for trout *(Troutbag)* and availability of a campground *(Campgr)* attract more anglers to a site. The Seward Silver Salmon Derby *(Sewdby)* in late August draws many anglers. The model shows that anglers are less likely to go to a fishing site if it is crowded *(Crowded).*

Many regulations and site characteristics we tested did not seem to be relevant to anglers' decisions about where to fish. In general, fishing quality seems to be the biggest consideration.

When anglers choose fishing sites, costs as well as benefits affect their decisions. Anglers won't travel to a site if it is more expensive than other sites with the same fishing quality. Travel costs include much more than just fuel costs. Anglers may need to pay for food, bait, lodging, or guide costs. In addition, capital depreciation and maintenance costs of vehicles anglers use to get to fishing sites should be included as part of travel costs. Finally, for those anglers who could have worked during their travel and on-site fishing time, we have to consider lost earnings. Therefore, the total travel cost is the sum of fuel costs, other trip expenditures, vehicle depreciation and maintenance costs, and lost earnings for those who could have worked. For those who didn't have the option of working instead of fishing, the total travel cost is the sum of fuel costs, other trip expenditures, and vehicle depreciation and maintenance costs only. The model results show that travel costs *(Tripcost),* travel time *(Travtime),* and on-site time *(Nifhours* and *Yifhours)* are important in explaining anglers' decisions about where to fish. The signs of all these variables are negative—which means anglers are willing to reduce their travel costs and shorten their travel and on-site time.

We tested many more variables than those included in the site-choice equation. In particular, we tested variables for household-site interactions— such as ownership of a cabin near a site—and variables such as wind, temperature, and tide. None showed a significant relationship to angler's site-choice decisions.

Overall, our site-choice equation for Southcentral anglers indicates that among all the factors they consider when deciding where to go fishing, they are most influenced by fishing quality, availability of facilities, and travel costs.

Participation Equation

The participation equation estimates Southcentral anglers' decisions about when and how often to go fishing. Estimating the participation equation requires a different set of explanatory variables than the site choice equation. One important explanatory variable that affects an angler's decision about whether to go fishing in a given week is the *inclusive value.* This variable links an angler's site-choice decision in week t with his participation decision in the same week. The inclusive value is calculated from the denominator of the site choice equation, which is an index of relative site quality summed across all 30 sites. Evaluated for each angler and week, the inclusive value for angler j in week t is given by the formula:

$$Incl_{jt} = \ln \sum_{i=1}^{30} e^{x_{ijt}\beta}$$

Other explanatory variables in the participation equation include weather characteristics like temperature, wind, and precipitation in week t, and personal characteristics of anglers such as income, number of anglers in a household, the amount of money anglers could have earned during fishing trips, level of fishing skill, and whether given trips were entirely for fishing or partly for other reasons.

In this study, we divided our sample in two groups—frequent and infrequent anglers. The frequent anglers are those who expected to take more than 6 fishing trips 1993, while the infrequent anglers expected to take fewer than 6 fishing trips[2]. We estimated a separate participation equation for each type of angler. We used a multinominal logit model to estimate the frequent angler's participation decisions per week and a binomial logit model to estimate the infrequent angler's participation decisions per month.

The Frequent Anglers' Weekly Participation Equation

To analyze the frequent anglers' weekly participation decisions, the weekly participation model estimates the probabilities that a frequent angler makes zero, one, or two or more trips in week t. The expected number of trips by an angler in week t can be represented as :

Expected number of trips in week $t = 1\pi_1 + m\pi_2$

where,

π_1: the probability that a frequent angler makes one trip in week t.

[2] In the pre-season survey, anglers in the sample were asked their expected number of fishing trips during the summer months.

π_2: the probability that a frequent angler makes two or more trips in week *t*.

m: the mean value of the number of trips by frequent anglers who make two or more trips in week *t*.

The probability that a frequent angler makes no trip in week *t*, π_0, is equal to 1- π_1-π_2. The functional form of the weekly participation equation is as follows:

$$\pi_{tn} = \frac{e^{W_{tn}}}{1+e^{W_{t1}}+e^{W_{t2}}},\ n=1,2$$

where,

π_{tn} = the probability that an angler makes n trip or trips in week t, n=1, 2

W_{tn} = the linear combination of coefficients and variables.

We estimated the coefficients of this model with maximum likelihood techniques, and report the results in Table A-11. Positive signs on the coefficients for explanatory variables mean that the higher the value of the variable, the more likely it is that a frequent angler goes fishing in week *t*. One the other hand, negative signs mean that the higher the value of the variable, the less likely it is that a frequent angler goes fishing in week *t*.

The results in Table A-11 suggest that frequent anglers' decisions about whether to take one or more than one fishing trip in a week can be affected by fishing quality, weather, and personal characteristics. The positive signs on the coefficients for the inclusive value variable (*Inc*) shows that an angler is more likely to go fishing when the overall fishing quality is good.

The equation results indicate that anglers who own boats make more trips than ones without boats (*Boat*). Anglers with more fishing skill make more trips than ones with less skill (*Skill*). The more anglers in a household, the more fishing trips the household makes (*Many*). The model also shows that anglers who could work instead of fishing were less likely to make fishing trips than anglers who didn't have the option of working (*Avgearn*). Finally, anglers whose reason for a trip is mainly fishing are more likely to make trips than anglers who fish as an incidental part of a trip with other purposes (*Avgreasn*).

The model also shows that an angler who took fishing trips during the winter is more likely to take fishing trips in week *t*. And the more fishing trips an angler made in 1992, the likelier he is to make more than one trip in week *t* in 1993. But the number of trips an angler made in 1992 does not seem to influence his decision about making just one trip in week t in 1993. Finally, the model shows that frequent anglers are discouraged by cold temperatures *(Tg40_1* and *Anctemp),* precipitation *(Pg10_1),* and high winds *(Wind20).*

Table A-11. Weekly Participation Equation for Frequent Anglers

Variable	Coefficient	Std. Error	t-ratio	Mean	Std.Dev.	Coeff.* Mean	Coeff.* Std.Dev
For taking one trip in week t							
Constant	-10.535	0.7857	-13.408				
Incs	0.42062	0.1143	3.678	5.1032	0.4321	0.76	0.06
Boat	-0.029071	0.09121	-0.319	0.4349	0.4958	-0.02	-0.02
Skill	0.44588	0.1053	4.235	0.6946	0.4606	0.35	0.23
Many	0.24022	0.09210	2.608	0.3491	0.4767	0.11	0.15
Avgearn	0.000021903	0.0001146	0.191	133.5488	469.5501	-0.02	-0.05
Avgreasn	0.0094412	0.002269	4.162	82.0332	22.2431	0.90	0.24
Tg40_1	0.26882	0.07775	3.457	6.154	1.9285	1.69	0.53
Anctemp	0.064052	0.009235	6.935	52.0672	8.9307	3.88	0.67
Wind20	-0.19914	0.07506	-2.653	0.8147	0.5471	-0.16	-0.11
Pg10_1	-0.16979	0.03809	-4.457	1.2761	1.3312	-0.21	-0.21
Winter	0.60614	0.09252	6.551	0.2887	0.4532	0.16	0.25
Trips92	-0.00010373	0.001306	-0.079	26.733	36.2779	0.03	0.04
For taking two or more trips in week t							
Constant	-20.689	3.488	-5.931				
Incs	0.76207	0.2010	3.792	5.1032	0.4321	2.60	0.22
Boat	0.43437	0.1549	2.804	0.4349	0.4958	0.18	0.21
Skill	0.49771	0.1825	2.727	0.6946	0.4606	0.42	0.28
Many	0.34296	0.1523	2.253	0.3491	0.4767	0.17	0.23
Avgearn	-0.00096285	0.0004009	-2.402	133.5488	469.5501	-0.20	-0.72
Avgreasn	0.020727	0.004561	4.544	82.0332	22.2431	1.86	0.50
Tg40_1	0.82944	0.4791	1.731	6.154	1.9285	2.13	0.67
Anctemp	0.098904	0.01725	5.733	52.0672	8.9307	5.07	0.87
Wind20	-0.32973	0.1224	-2.693	0.8147	0.5471	-0.25	-0.16
Pg10_1	-0.11886	0.06183	1.922	1.2761	1.3312	-0.16	-0.17
Winter	0.40171	1.568	2.561	0.2887	0.4532	0.10	0.16
Trips92	0.0068310	0.001322	5.168	26.733	36.2779	0.20	0.28

N = 5705
Restricted (Slopes=0) = -2867.4
Significance Level = 0.32173E-13

Log-likelihood = -2518.0
Chi-Squared (15) = 698.75

Definition of Variables in Table A-11

$Incs_t$: Inclusive value that represents overall fishing quality index in week t.
Boat: Boat=1 if an angler owns a boat, otherwise Boat=0.
Skill: Skill=1 if an angler is experienced, otherwise Skill=0.
Many: Many=1 if the number of anglers in a household exceeds 2, otherwise Many=0.
Avgearn: the amount of money an angler could have earned if he hadn't taken the fishing trip.
Avgreasn: the percentage of a given trip attributable to fishing activities.

$Tg40\_1_t$:	the number of days in week t when the temperature exceeds 40 degrees.
$Anctemp_t$:	the average temperature in Anchorage in week t.
$Wind20_t$:	the number of days in week t with wind speeds exceeding 20.
Winter:	Winter=1 if an angler took at least one fishing trip in week t, otherwise Winter=0.
Trips92:	the number of fishing trips taken by an angler in 1992.

Table A-11 shows the estimated coefficients for frequent anglers' decisions about when and how often to take fishing trips. The first set of regression results represent the probability that an angler makes one trip in week *t*, while the second set of regression results represent the probability that an angler makes two or more trips in week *t*, as follows:

W_{t1} (for one trip in week t)
= -10.535 + 0.42062 Ins - 0.029071 Boat + 0.44588 Skill + 0.24022 Many
+ 0.000021903 Avgearn + 0.0094412 Avgreasn + 0.26882 Tg40_1
+ 0.064052 Anctemp - 0.19914 Wind20 - 0.16979 Pg10_1
+ 0.60614 Winter - 0.00010373 Trips92

W_{t1} (for two or more trips in week t)
= -20.689 + 0.76207 Ins - 0.43437 Boat + 0.49771 Skill + 0.34296 Many
- 0.00096285 Avgearn + 0.020727 Avgreasn + 0.82944 Tg40_1
+ 0.098904 Anctemp - 0.32973 Wind20 - 0.11886 Pg10_1
+ 0.40171 Winter - 0.0068310 Trips92

INFREQUENT ANGLERS' MONTHLY PARTICIPATION EQUATION

The expected number of trips in a given week taken by an infrequent angler in month k can be represented as:

Expected number of trips in month k = $L\pi$, where:

π: the probability that an infrequent angler makes one or more trips in month k.

L: the average number of trips per month by infrequent anglers who make one or more trips in month k.

The probability that the infrequent angler takes one or more trips in month k is as follows:

$$\pi_k = \frac{e^{W_k}}{1+e^{W_k}}$$

where W_k = the linear combination of coefficients and variables. The linear combination of coefficients and variables (W_k) is as follows:

$$W_k = \beta_1 \text{ Constant} + \beta_2 \text{ Incs} + \beta_3 \text{ Boat} + \beta_4 \text{ Skill} + \beta_5 \text{ Many} + \beta_6 \text{ Camper} + \beta_7 \text{ Anctemp} + \beta_8 \text{ Daylight}$$

Table A-12. Monthly Participation Equation for Infrequent Anglers

Variable	Coefficient	Stan. Error.	t-ratio
Constant	-11.306	0.7961	-14.201
Incs	0.65774	0.1299	5.063
Boat	-0.59018	0.1141	5.173
Skill	0.22005	0.1143	1.925
Many	0.20053	0.1246	1.609
Camper	0.44939	0.1923	2.337
Anctemp	0.039382	0.01050	3.752
Daylight	0.26089	0.02629	9.924

N = 1504
Log-likelihood = -1016.9
Restricted (Slopes=0) = -1252.7
Chi-Squared (15) = 471.48
Significance Level = 0.32173E-13

Definition of Variables in Table A-12

$Incs_k$:	Inclusive value that represents overall fishing quality index in month k.
Boat:	Boat=1 if an angler owns a boat, otherwise Boat=0.
Skill:	Skill=1 if an angler is experienced, otherwise Skill=0.
Many:	Many=1 if the number of anglers in a household exceeds 2, otherwise Many=0.
Camper:	Camper=1 if an angler owns a camper, otherwise Camper=0.
$Anctemp_k$:	the average temperature in Anchorage in month k
$Daylight_t$:	the average length of daylight in month k

Table A-12 shows the coefficient estimates for the infrequent angler's decision about when and how often to take fishing trips in month *k*. Some of the same variables that influence frequent anglers also influence infrequent anglers.

The positive sign on the coefficient for overall fishing quality *(Incs)* shows that a casual angler is more likely to go fishing when the overall fishing quality is good. The regression results indicate that anglers who own boats *(Boat)* or campers *(Camper)* make more trips than ones without boats or campers. Anglers with more skill *(Skill)* makes more trips than ones with less skill. The more anglers in a household *(Many),* the more fishing trips the household makes. The model shows that an infrequent angler is more likely to go fishing when temperatures are high and daylight is long. However, unlike frequent anglers, infrequent anglers don't seem to be much influenced by wind and precipitation.

Developing the Spreadsheet Model

The travel cost model analysis produces a system of equations which together estimate the expenditures per fishing trip, angler's willingness to pay for fishing trips, distribution of trips across sites, and total number of trips for each week. To estimate the effects of the proposed management changes on these measures, it is necessary to re-express these equations in a spreadsheet model where we can model **changes** in site characteristics associated with each scenario.

This model consists of linked Excel spreadsheets. The equations must reference many variables which differ by one or more of site, trip origin week or household. The model sheet is linked to other sheets which contain the appropriate data. In the travel cost model, each week is independent of all other weeks, and the model generates only one week at a time. To model more than one week, the model is set to reference each week in turn, and the results for that week are copied to a separate sheet.

Data which varied by individual household or trip in the original travel cost model is aggregated for the spreadsheet model. We defined seven separate origins for grouping households.

Table A-13. Southcentral Alaska Households by Origin Groups

Origin	Number of Households
Anchorage	43,411
Palmer, Wasilla, Sutton	6,386
Houston, Big Lake, Willow	911
Talkeetna, Trapper Creek	860
Homer to Ninilchik	2,431
Kenai to Sterling	5,645
Eastern Kenai	1,035
Total	**60,678**

The estimate of the number of fishing households is based on 1993 Alaska Deprtment of Labor population figures and 1990 household size figures to produce an estimate of total 1993 households, and our 1993 Sportfish survey results to estimate the proportion of total households that actually fished in 1993.

Mileage to sites and costs associated with vehicle travel to sites are aggregated averages for each of these seven origins. Household data, such as average number of household members on a trip, level of skill of best angler in the household, or potential earnings given up to go on a fishing trip were averaged across only three origins, Anchorage, the Mat-Su Borough, and the Kenai Peninsula Borough. Where the differences between the three boroughs were not statistically significant, I used only one number—the average for all southcentral angling households. Finally, information on target species, originally a characteristic of an individual trip, was treated as a site variable which changed month to month.

We used the structural form (that is, including on-site time as an endogenous variable) for expenditures and site choice. The spreadsheet model predicts the behavior of the angling households with mean characteristics as expressed in the independent variables of the participation equations. In order to better model the behavior of households which took many trips, we weighted the household characteristics by the number of 1993 trips. So, in calculating mean characteristics, a household which took 10 trips in 1993 will count twice as much as a household that took only five trips. Even with this adjustment the spreadsheet model does not predict trips as well as the original travel cost model.

For a variety of reasons, we also believe that anglers under-reported their trips in the 1993 Sportfish Survey. We analyzed reported trips for 1993, expected trips for 1993, winter fishing trips in 92/93, and (for a subsample) reported trips in 1994, and developed a trip weight based on the month, the households' winter fishing activity, and how many trips the household expected to take in 1993. This trip weight is included in reporting survey results; it was not incorporated into the original travel cost model. In order to approximate the effect of this trip weight in the spreadsheet model, we calculated the mean trip weight for each month and multiplied the predicted trips for each month by this average trip weight.

Table A-14. Comparison of Mean and Median Annual Trips per Angling Household, 1993 Survey and Travel Cost Model Estimates.

		No Trip Weights		With Trip Weights	
		Median	*Mean*	*Median*	*Mean*
Frequent Anglers	Survey	5.00	7.57	7.68	12.14
	Model		3.68		5.66
Casual Anglers	Survey	2.00	3.46	2.81	4.71
	Model		3.00		3.81

The spreadsheet model shows less variation than the data on which it is based. Expenditures don't vary as much across sites and weeks as they do in the survey data; trips don't vary as much across weeks. For example, in the survey data, the mean cost per trip in July is $133. For the Kenai River sites, the mean cost was $99, and for all other sites combined, $156. The model shows an average trip cost in July of 143—about 8% higher than the survey results. But the model estimate for the cost of July Kenai trips is $132 (32 percent higher), and for trips to other sites, $146 (6 percent lower).

Linking Participation and Site Choice Model Sectors

The participation equations predict the probability of:
frequent anglers taking 1 trip in a given week
frequent anglers taking more than 1 trip in a given week
frequent anglers taking 0 trips in a given week (the residual)
casual anglers taking 1 or more trips this month
casual anglers taking 0 trips this month
For the two probabilities of more than one trip, we used survey data to calculate the mean. For casual anglers this monthly mean was divided by 4 or 5 (depending on the month) to produce weekly trips.

Table A-15. Mean Trips for Households With More than One Trip

Angler Origin	Mean Trips
Frequent Anglers - per Week	
Anchorage	2.9256
Mat-Su	3.0698
Kenai	4.878
Infrequent Anglers - per Month	
Anchorage	2.0027
Mat-Su	2.7869
Kenai	1.7722

The participation equation generates the total number of trips by all households; the site choice equation distributes the trips across the 30 sites. For a household with more than one trip per week, their site choice for each trip is independent of their other trip or trips. The wpreadsheet model does not match a site to a household per se. Rather, it assigns trips in aggregate. For example, in week 13, it assigns 25,000 trips from 60,000 households distributed across the 7 origins to 30 sites: 2,500 trips from Anchorage to Resurrection Bay, 155 trips from the Palmer-Wasilla area to Willow Creek, etc.

Estimating Willingness to Pay

The change in willlingness to pay resulting from a quality change which shifts the demand curve outward is the change in the area below the demand curve, or:

$$\Delta NEV = \int_{P_0}^{\infty} D^{8}(p)dp - \int_{P_0}^{\infty} D\,(p)dp.$$

Small and Rosen (1981, p. 122-127) show that this reduces to the change in the inclusive value, weighted by the probability of taking a trip, divided by the coefficient of the trip cost variable:

$$\Delta NEV = \frac{x^* I^* - x\ I}{\beta}$$

where x and I represent the estimated number of fishing trips and the inclusive value, respectively, before the change, x^* and I^* represent the same quantities, after the change, and β represents minus one times the coefficient on trip cost in the site choice equation.

Scenario Modeling

The sites directly affected by adding more fish to the Kenai are 1542 (Kenai, Below Skilak Lake), 1512 (Kenai above Skilak Lake), 1524 (Russian River) and 1532 (Combination of all Kenai Peninsula Personal Use Dip netting). Based on assumptions from ADF&G about sonar count, sport catch and dipnet harvest, we reviewed the variables in the site choice equation to model change across scenarios. For two of the variables, we couldn't model the changes:

sp1rept, the weekly king fishing quality report in the Anchorage Daily News; it was at its maximum for 1542 and zero for 1512; neither was going to change

crowding—would have changed, given the increases in trips we are predicting. But we have it modelled as a dichotomous variable, and it is already 1 at 1512 and 1542, and mistakenly 0 at 1524. Our inability to model the increased crowding may tend to overestimate the change in consumer surplus. We did model the change in:

Ksonar, the sonar count, affecting sites 1542, 1512, 1524

kingdf, total king harvest/angler days, affecting site 1542 (sites 1512 and 1524 are coded 'king not available' in the relevant weeks).

sockdf, the total red harvest/angler days, affecting sites 1512, 1542, 1524, and, in the liberalized personal use scenario, 1532.

sp3, the total sockeye harvest, which affects sites 1512, 1542, 1524, and, in the liberalized personal use scenario, 1532.

King annual harvest would be affected, but is not part of the site choice equation, and so doesn't enter into the scenario modeling.

For the four variables we use to model the scenarios, ADF&G gave us assumptions for total harvests and sonar counts for each scenario. To model the change in catch per unit effort (CPUE) for sport anglers, we treated the ADF&G assumption as a fixed exogenous change in the total harvest. A larger harvest will mean a higher catch per unit of effort, but will also mean more anglers. Our CPUE variable is calculated as annual harvest/angler day, taking into account both higher catch rates and more anglers to arrive at the assumed total harvests.

In addition to providing the levels of sonar count and total harvest, ADF&G provided the assumption that all the fish would be added past the in the week of July 22-28; fishing would change (and therefore we model changed catch rates and annual harvests) through the week of July 29-August 4.

With all the scenario variables and model variables in place, we evaluated the model for the base case (the 1993 data from which it was estimated, a mid-run year), a hypothetical low run year (1993 data but with low run values for the Kenai Sonar and sockeye and king harvests and catch per unit effort) and the six scenarios. The changes in economic value are the changes in willingness to pay between each of the five scenarios with mid-size run assumptions and the base year, and between the low run scenario and the low base year.

Contingent Value Analysis

Our second method for estimating net economic value for sport anglers is contingent value analysis. In this method, we asked a sample of Southcentral Alaska anglers whether they would be willing to pay a fixed fee (randomly assigned) under a variety of scenarios for improved fishing quality and relaxed regulations. These questions followed a dichotomous-choice framework. We analyzed the data obtained from these contingent valuation questions in a statistical model to estimate a hypothetical demand function for various improvements in fishing quality.

A strength of contingent valuation is that the survey questions can be tailored more precisely to the specific cases analyzed in the study. The main weakness is that the answers one obtains from survey questions may vary significantly, depending on how the questions are worded (Mitchell and Carson, 1989). Since it is difficult to know to what degree the answers are biased, it is of utmost importance to select the approach that is least subject to bias, even if it appears to have a larger variance. The discrete-choice approach (also called a referendum or take-it-or-leave-it method) appears less precise in that it often generates larger confidence intervals, but is likely to be less biased than other approaches. We applied an iterated referendum approach with randomly set bids (double-bounded dichotomous choice) that is becoming increasingly popular as a relatively accurate and unbiased estimator (see Mitchell and Carson, 1989, pp. 91-97).

The data for the contingent value analysis were collected from a telephone survey of 650 Southcentral Alaska households conducted in January 1995. The survey also included questions about household characteristics and fishing activities in 1994 and earlier years. The sample frame consisted of two separate subsamples: a random sample of 490 households, and a panel sample of 160 households. The panel households comprised part of a random sample of Alaska households originally interviewed in October and November of 1993. Appendix E describes the sample frame and survey methods in detail.

Because the panel sample includes only those households from the original sample that we were able to contact again, we recognize that a potential sample selection bias may be present in the data. Households that move less frequently, for example, are more likely to be included in a panel sample than in a purely random sample. These households may be place systematically different values on sport fishing. Appendix E contains an analysis of how we addressed the sample selection problem through construction of survey weights. All contingent value estimates derived from the sport survey are weighted to correct for potential selection bias.

Contingent value protocols require a significant time cost for both interviewer and respondent to clarify the valuation problem. To reduce respondent fatigue and improve survey accuracy, interviewers first elicited respondents' interest in sport fishing and dip net fishing in the Kenai River area under scenarios of expanded fishing opportunities. We did not ask respondents to value the changes in opportunities if they said that their households did not fish in the Kenai River area for sockeye salmon and would not even under the improved scenario. Consequently, our value estimates do not include existence values for people who were unlikely to use the resource. The contingent values will, however, include the value of the option to fish for households who had not fished in the past, but said they might in the future. This is particularly important for the dip net fishery. About three times as many respondents said they might consider participating in the dip net fishery under an expanded Kenai River fishery as had actually participated in the three years we asked about.

Each survey household had the opportunity to respond to three specific scenarios. Two pertained to sport fishing for sockeye with rod and reel, and one pertained to dip net fishing. The two sport fish questions addressed a higher bag limit and an increased escapement into the river that would reduce the average time it took to catch a fish. Respondents were then asked whether they had recently participated in the Kenai River dip net fishery or might be interested if state managers expanded that fishery. Those who indicated an interest were asked whether they preferred an earlier season opening or an increased bag limit as the best way to expand the fishery. Then respondents were asked a question pertaining either to a change in the dip net bag limit or a longer fishing season, whichever they indicated they preferred. This means that the values estimated from the dip net questions probably represent an upper bound to the value of expanding the dip net fishery.

Unfortunately, the time constraints for the study required us to complete survey field work before the study scenarios had been finalized. For this reason, the valuation questions do not apply as directly to the scenarios as we would have hoped. Nevertheless, the answers do provide valuable information about the net values of increasing opportunities in the sport and dip net fisheries. Table A-16 contains the exact questions read to survey respondents. Appendix F contains a copy of the survey questionnaire.

Table A-16. Contingent Value Questions

Sport fish higher bag limit. The Department of Fish and Game could raise the bag limit if they could watch the run more closely. Anglers could pay for this extra work through a fish stamp. Those who wanted to keep 6 fish per day instead of 3 would buy the stamp, and the money would go to the Department of Fish and Game. Would your household pay $? for a fish stamp to increase your bag limit from 3 to 6 ?
Sport fish higher catch rates. One way the Department of Fish and Game could put more fish in the river would be to buy out some commercial permits, and reduce the commercial allocation. Sport anglers could pay to buy out commercial permits if they had to buy a fish stamp to fish for Kenai red salmon. Would your household pay $? for a fish stamp if there were 200 thousand more red salmon in the Kenai?
Dip net earlier season. Suppose anglers who wanted to dip net the earlier opening had to buy an early season permit. Would your household pay $? for a permit?
Dip net higher bag limit. Suppose dip netters who wanted to keep 12 fish per day instead of 6 had to buy a permit. Would your household pay $? for a permit?

Elicitation Method

Dichotomous-choice contingent valuation questions have been widely used to elicit from consumers values that they place on goods or services that are not traded in private markets—such as sport fishing opportunities. The drawback of the method, however, is that larger numbers of observations are required to identify the underlying distribution of resource values accurately (Cameron and Quiggin, 1994). Adding a follow-up question to the questionnaire can improve the efficiency of dichotomous-choice surveys. After respondents react to the first offered amount, they are asked again to pay either a larger or smaller amount, depending on their initial responses.

We used such a two-stage dichotomous-choice valuation framework for four contingent value questions asked of sport anglers. We first asked respondents whether they would be willing to pay or accept a randomly chosen amount— the bid value— for the harvest change. If respondents answered affirmatively, interviewers then asked if respondents would agree to a higher bid. If anglers declined the bid in the first question, interviewers asked if respondents would agree to a lower bid.

One of the advantages of the double-bounded dichotomous choice approach is that the randomly assigned bids do not need to correspond closely to the true distribution of underlying willingness to pay in order for the method to produce unbiased contingent value estimates. However, if the distribution of bids corresponds more closely to the actual distribution of willingness to pay in the population, the estimates will be more efficient. We constructed bids for the contingent valuation portion of our Alaska resident sport angler survey through several steps.

Construction of Survey Bid Amounts

In pre-tests, we first asked open-ended contingent value questions of 20-25 respondents. Of the two questions about rod and reel fishing, the question about bag limit had the most valid responses. The pre-test willingness to pay responses are shown in Table A-17.

Table A-17. Pre-test Results for Willingness to Pay for Higher Sport Fish Bag Limit

Bid Level	No. of Bids
protest	2
$0	6
$2	1
$5	2
$10	2
$15	1
$20	3
Total	17

Based on these results, we hypothesized a lognormal distribution. To estimate the mean and variance of the distribution, we took the natural log of the bid values plus 1 (since the log of zero is undefined). This results in a mean of 1.43 and standard deviation of 1.31. Next, we arbitrarily selected a set of bids within the range indicated by the pretest, which we felt would be easy for respondents to compare to their own values. That is, we selected bids based on round numbers in the range of $1 to $50. Then, we assigned probabilities to these arbitrary bids so that they would conform to our assumed lognormal the distribution. An Excel spreadsheet generates random bids from our assumed distribution, and then uses a lookup table to round the random bid to one of our chosen bid levels. The rounding ranges were based on the probability mid-points between the bid levels. Table A-18 shows the probability distribution of bids assigned for the two sport fish questions.

Table A-18. Probability Distribution of Randomly Assigned Bids for Sport Fish Contingent Value Questions

Bid Level	For randomly generated bids		Probability of bid range
	from	to	
$1	$0	$1.47	21%
$2	$1.47	$2.46	13.1%
$3	$2.46	$3.47	10.0%
$4	$3.47	$4.47	7.7%
$5	$4.47	$5.90	8.3%
$7	$5.90	$8.31	9.6%
$10	$8.31	$12.09	9.1%
$15	$12.09	$18.82	8.3%
$25	$18.82	$32.77	6.8%
$50	$32.77	infinity	5.8%

We asked each respondent two bid levels. Respondents who were willing to pay the initial bid were offered a higher amount; those who not willing were offered a lower amount. Therefore, the initial bid possibilities exclude both the bottom and top bids ($1 and $50). Using our assumed lognormal distribution, we generated a random "higher bid" which is constrained to amounts above the top of the range represented by the first bid. It likewise generates a "lower bid" constrained to amounts below the bottom of the range represented by the first bid. Respondents received the same initial bid offers for their willingness to pay for higher catch rates as for the higher bag limits.

We did not assign anyone a zero bid, for the following reason. The questionnaire asked anglers who would not pay either of the two bids offered if they would be willing to pay any amount at all. Respondents who said they would not be willing to pay any amount were then asked to tell us why not. From these responses, we could ascertain obvious protest bids and exclude those observations from the quantitative analyses.

We used a parallel approach for the two dip net contingent value questions. We had fewer pre-test data points, because not all respondents indicated an interest in dip netting. Table A-19 shows the distribution of pre-test willingness to pay responses for the dip net bag limit question. The mean of the natural logarithm of willingness to pay was 1.36, with a standard deviation of 1.47.

Table A-19. Pre-test Results for Willingness to Pay for Higher Dip Net Bag Limit

Dip Net Bid Level	No. of Bids
$0	4
$10	2
$20	2
Total	8

Table A-20 shows the probability distribution of bids assigned for the two dip net contingent value questions.

Table A-20. Probability Distribution of Randomly Assigned Bids for Dip Net Contingent Value Questions

Dip Net Bid Level	For Randomly Generated Bids From	To	Probability of bid range
$0.50	0	$0.74	13.0%
$1.00	$0.74	$1.45	12.2%
$2.00	$1.45	$2.46	12.6%
$3.00	$2.46	$3.87	12.1%
$5.00	$3.87	$6.96	15.4%
$10.00	$6.96	$14.82	16.5%
$25.00	$14.82	$33.33	11.0%
$50.00	$33.33	$0.00	7.3%

Estimation Methods

Given survey respondent *i*'s choices about whether or not to agree to a random bid, t_i, for a change between scenario 1 and scenario 2, we assume a willingness to pay, or bid function, as follows:

$$(1)\ V_i^{1,2} = V(X_i) + \varepsilon \geq t_i,$$

where the WTP for a move from scenario 1 to scenario 2, $V_{i1,2}$, depends on the set of household characteristics, X_i, and an unobserved random component of WTP, ε.. The *X* variables are derived from survey questions about household characteristics, fishing activities, and fishing preferences.

If one assumes that ε has a logistic distribution, the probability $p(y_i|t_i)$ that the individual agrees to the randomly set bid t_i may be written as

$$(2)\quad p(y_i|t_i) = \frac{1}{\left[1+e^{-(V_i - t_i)}\right]}$$

Cameron (1988) shows how one can estimate a censored logistic regression equation for the WTP function V for a dichotomous choice problem defined by equation (2). Cameron and James (1987) discuss the analogous procedure for estimating V if one assumes that e follows a normal distribution.

Our procedure follows Cameron's general approach, but differs in two key respects. First, we use a two-stage, iterated procedure for eliciting WTP. Second, our analysis of the pre-test bid data suggests that the distribution of e is lognormal. If we define y_k for k=1,2,3,4, as follows:

y_1	1 if yes to first bid t_{1i}, yes to second (higher) bid t_{Hi}, 0 otherwise
y_2	1 if yes to first bid t_{1i}, no to second (higher) bid t_{Hi}, 0 otherwise
y_3	1 if no to first bid t_{1i}, yes to second (lower) bid t_{Li}, 0 otherwise
y_4	1 if no to first bid t_{1i}, no to second (lower) bid t_{Li}, 0 otherwise

then the probability of each of the four outcomes may be written as follows:

$$(3)\quad \begin{aligned} p(y_1) &= p(y_{Hi}|t_{Hi})p(y_{1i}|t_{1i}) \\ p(y_2) &= (1 - p(y_{Hi}|t_{Hi}))p(y_{1i}|t_{1i}) \\ p(y_3) &= p(y_{Li}|t_{Li})(1 - p(y_{1i}|t_{1i})) \\ p(y_4) &= 1 - p(y_1) - p(y_2) - p(y_3) \end{aligned}$$

If the WTP function $V(X)$ is linear, the weighted log likelihood function for the parameter vector β is

$$(4)\quad \begin{aligned} \text{Log } L = {} & y_1 w \log\left[1 - \Phi((\log t_H - X'\beta)/\sigma)\right] \\ & + y_2 w \log\left[\Phi((\log t_H - X'\beta)/\sigma) - \Phi((\log t_1 - X'\beta)/\sigma)\right] \\ & + y_3 w \log\left[\Phi((\log t_1 - X'\beta)/\sigma) - \Phi((\log t_L - X'\beta)/\sigma)\right] \\ & + (1 - y_1 - y_2 - y_3) w \log\left[\Phi((\log t_L - X'\beta)/\sigma)\right] \end{aligned}$$

where w is the weight vector that adjusts for differing sample selection probabilities. With the exception of the weighting variable and the lognormal distribution of the errors, the log likelihood function (4) appears similar to that used by Hanneman et al., (1991) for an analogous iterated take-it-or-leave-it problem.[3]

Results

We estimated a value function $V(X)$ for the four contingent value questions applying maximum-likelihood techniques to equation (4). In all contingent value equations, we tested whether a number of variables representing characteristics of survey households significantly affected the individual's WTP. These variables included the number of fishing trips taken in 1994, ownership of a cabin used as a base for fishing activities, respondent's age, household income, number of people in the household, and level of fishing skill. Half the survey respondents were told that the money they paid for expanded fishing opportunities would be used to buy back commercial limited entry permits in order to reduce the commercial harvest. The remainder were told that the money would be applied to acquisition of habitat. The use of the money showed no significant relationship to respondents' WTP in any contingent value question.

The statistical results for each of the four questions are shown in Tables A-21 through A-24. Since the dependent variable is the natural logarithm of willingness to pay, one takes the antilog of the coefficients to estimate the value for each question.

The value function for the sport fish higher bag limit question derived from Table A-21 differs, depending on whether the household had fished the Kenai River area over the three previous years (1992-1994). For households that had fished in the study area, the constant term evaluates to $7.80, less about 1.8 percent for each year lived in Alaska. WTP increased by 51 percent, however, if the household owned a boat or a cabin used for fishing, and increased by 50 percent if the respondent was over 45. For households that had not fished in the study area within the past three years, WTP for the bag limit increase was $4.60 plus 2.9 percent for each year lived in Alaska.

Table A-22 provides the value function for sport fish increased escapement. Households that had not fished in the study area were willing to pay $7.70 plus 7.7 percent for each angler in their household. Households that had fished the Kenai River area were willing to pay $8.68 plus 7.7 percent for each angler in their household, if the respondent was 45 or younger. If the respondent was over 45, WTP for households who had fished the study area was 43 percent higher. In addition, households that

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[3]Cameron and Quiggin (1994) question whether responses to iterated contingent value bidding schemes reflect an identical underlying willingness to pay. Specifically, they estimated WTP from the first and follow-up dichotomous choice questions assuming the errors followed a bivariate normal distribution. They found that while the implied values were similar and drawn from the same distribution, they were not identical.

Cameron and Quiggin suggest that their results imply that the respondents' WTP may change during the course of the interview. If this were true, it would call into serious question the validity of a large body of contingent valuation research. A more plausible hypothesis, however, may be that their assumption of a normally distributed WTP across the population diverges significantly from the true distribution.

We tested this hypothesis by estimating Cameron and Quiggin's model for the sport fish bag limit question, assuming first a bivariate normal distribution for WTP and then a bivariate lognormal distribution. Under the normality assumption, we obtained results similar to those of Cameron and Quiggin, with the estimated coefficient for ρ calculated at 0.9 and testing significantly less than one. Assuming a bivariate lognormal distribution, however, the estimated coefficient for ρ was 0.97 and not significantly different from one. The lognormal equations also outperformed the normal equivalents in a likelihood ratio test. The likelihood ratio showed no significant improvement in fit. Neither the estimated WTP nor its variance in the bivariate lognormal version differ significantly for the initial and follow-up questions, and the WTP did not differ significantly from that estimated with equation (4). Equation (4) does provide a significant reduction in the variance estimate for WTP from the other models, however.

reported not getting enough fish because it took too long to catch them were also willing to pay 23 percent more.[4]

Table A-21. Contingent Value Estimation Results for Sport Fish Higher Bag Limit

Dependent Variable is Natural Logarithm of Willingness to Pay

Variable	Coefficient	Standard Error	t-ratio
Fished	2.054	0.135	15.211
Fboatcabin	0.414	0.184	2.251
Fsenior	0.407	0.185	2.197
Fresyear	-0.0182	0.0086	-2.100
Notfished	1.527	0.176	8.685
Nfresyear	0.0285	0.0095	3.011
Sigma	1.174	0.0668	17.559

Table A-22. Contingent Value Estimation Results for Sport Fish Higher Catch Rates

Dependent Variable is Natural Logarithm of Willingness to Pay

Variable	Coefficient	Standard Error	t-ratio
Fished	2.161	0.135	16.018
Fishlong	0.206	0.195	1.054
Fsenior	0.361	0.185	1.951
Notfished	2.042	0.104	19.550
Nanglers	0.0746	0.0439	1.700
Sigma	1.043	0.0626	16.667

In the higher escapement question, respondents were randomly given several different quantitative measures associated with the change in escapement into the Kenai River. Respondents were told the target change in escapement itself—either 100,000 or 200,000 more fish—and the percent reduction in average time it would take to catch a sockeye salmon. Respondents were also told to expect a randomly varying percentage increase in other anglers that would result from better fishing. None of these variables turned out to have a significant effect on WTP. The results suggest that anglers are willing to pay more for higher sockeye catch rates than for increased bag limits. If some anglers rarely catch their limit, then it makes sense that they would not be willing to pay much for increasing the limit.

Table A-23 provides the value function estimated for respondents who preferred an earlier season to a higher bag limit as the best way to increase opportunities for dip netting. If the respondent was 45 or younger, these households were willing to pay an average of $9.34. Respondents who were over 45 indicated that their households would be willing to pay $16.41. Households that indicated that lack of fishing time prevented them from catching enough fish were willing to pay about one-third more than other households.

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[4]Only those who had fished could report not catching enough fish because the fishing was too slow.

The t statistic for the coefficient on fishlong in Table A-19 is only 1.1. We include it in the equation, however, because it was positive and significant in the bid function estimated from the first-stage question (using Cameron and James' (1987) method).

Table A-23. Contingent Value Estimation Results for Dip Net Earlier Season

Variable	Coefficient	Standard Error	t-ratio
Constant	2.234	0.0835	26.77
Senior	0.564	0.195	2.890
Notime	0.318	0.208	1.527
Sigma	0.785	0.0671	11.70

Table A-24 shows the estimated value function for dipnetters who preferred a higher bag limit to an earlier season. Apparently, large households have a greater interest in higher dip net bag limits. Households that preferred the higher bag limit would pay $11.67 plus 8.6 percent for each household member, unless they felt the short dipnet season prevented them from getting enough fish. Households that reported not getting enough fish because the fishery was not open enough days, but who still preferred a higher limit, would pay less than half as much as other households of the same size.

Table A-24. Contingent Value Estimation Results for Dip Net Higher Bag Limit

Dependent Variable is Natural Logarithm of Willingness to Pay

Variable	Coefficient	Standard Error	t-ratio
Constant	2.457	0.202	12.180
Npeople	0.0822	0.0529	1.553
Fishdays	-0.847	0.295	-2.870
Sigma	0.877	0.0894	9.814

Variables Included in Contingent Value Equations

Constant	Constant term
Escape	1 if change in escapement of sockeye into the Kenai River is randomly set at 200,000, 0 if set at 100,000
Fishdays	1 if household reported not getting enough fish because the fishery was not open enough days, 0 otherwise
Fishlong	1 if household reported not getting enough fish because it took too long to catch a fish, 0 otherwise
Nanglers	Number of anglers in the household
Notime	1 if household reported not getting enough fish because of inadequate time to go fishing, 0 otherwise
Npeople	Number of people in the household
Senior	1 if age of respondent exceeded 45 years, 0 otherwise
Fished	1 if household went fishing in the Kenai River area at least once within the last three years, 0 otherwise
Fboatcabin	1 if household owns either a boat or a cabin used for fishing and *Fished*, 0 otherwise
Fresyear	Number of years respondent lived in Alaska x *Fished*
Fsenior	*Senior* x *Fished*
Notfished	1—*Fished*
Nfresyear	Number of years respondent lived in Alaska x *Notfished*
Sigma	Dispersion parameter s in equation (4)

Using the contingent value results, we can estimate total net values for each of the four questions. We did not ask survey respondents who did not fish for Kenai River sockeye and showed no interest in fishing for them in the future whether they would pay more for a higher bag limit or higher catch rates. Nor did we ask the people who said they would not fish, or did not know if they would fish for Kenai sockeye even with higher catch rates, whether they would pay for higher catch rates. For estimating aggregate values, we assume these households had a zero value for these questions. We only asked the dip net questions of respondents in households who expressed an interest in dip netting, and assume contingent values are positive only for this group.

Table A-25 shows the estimated total values for the four contingent value questions. The total value estimate is the product of the number of households and the estimated WTP per household. Total values range from $167,000 for the dip net earlier season to $565,000 for the increased sockeye catch rate. Each of these values refers to a different potential change in management of the Kenai River sockeye fisheries. It is not appropriate, therefore, to add the WTP for the change in bag limit to the WTP for an increased sport catch rate to obtain an estimate of the value of increased escapement with a higher bag limit. That is because we do not know if the survey respondents' values of the bag limit change would go up or go down if the escapement also increased. It could go up, for example, because anglers would be more likely to catch their limit when there are more fish in the river. However, it could also go down if anglers would respond to increased escapement by going fishing more often, in which case they might be able to get enough fish without an increase in the bag limit.

We asked the two dip net contingent value questions to separate groups of survey respondents. The number of households shown in Table A-25 indicates the population represented by these survey households. Although these two portions of the population do not overlap, one must use caution in adding the two dipnet contingent values together to produce an overall value for a liberalized dipnet fishery. The values refer to the portion of the population that prefers this option. State fishery managers must choose one or the other option. Our results suggest that more households prefer that the state increase the dipnet bag limit. The majority that prefers this option also values it more highly than those who prefer the longer season.

Table A-25. Contingent Value Estimates of Changes in Sport Fishing Amenities

	WTP per Household	Number of Households	Total Value
Higher sockeye sport bag limit	$7.41	62,826	$465,855
Increased sockeye sport catch rate	$10.37	54,505	$565,287
Earlier dip net season opening	$11.14	14,956	$166,586
Higher dip net bag limit	$14.80	17,833	$263,868

The standard errors for the censored normal regression results reported in Tables A-21 to A-24 provide a basis for estimating confidence intervals for the contingent value estimates shown in Table A-25. Table A-26 shows the lower 5 percent and upper 5 percent per household values for estimated WTP for each of the four questions. For example, we estimate that the value per household of the higher sockeye bag limit lies between $6.47 and $8.49 90 percent of the time. The standard errors for the iterated dichotomous-choice method yield narrow confidence intervals, allowing for precise estimates of contingent values. The difference between the upper 5 percent value and the most likely value is slightly larger than the difference between the most likely and the lower 5 percent value because of the asymmetry of the lognormal distribution.[5]

Table A-26. 90 Percent Confidence Intervals for Contingent Value Estimates of Changes in Sport Fishing Willingness to Pay per Household

	Lower 5 percent	Most Likely	Upper 5 percent
Higher sockeye sport bag limit	$6.47	$7.41	$8.49
Increased sockeye sport catch rate	$9.08	$10.37	$11.85
Earlier dip net season opening	$9.84	$11.14	$12.60
Higher dip net bag limit	$12.86	$14.80	$17.02

We may combine the estimated per household WTP with the confidence intervals given in Table A-26 with the number of households represented in the survey questions (shown in Table A-25) to obtain confidence intervals for the total value of the four hypothesized changes in management. Table A-27 displays 90 percent confidence intervals for each of the questions. The confidence intervals suggest between 10 and 20 percent margin of error for the various contingent value estimates.[6]

[5]Alternatives to the censored (log)normal regression model used in this study include variations on bootstrapping techniques. Cooper (1994) discusses various methods to estimate confidence intervals with dichotomous-choice contingent value questions, comparing Cameron's (1991) analytic method derived from the single-stage probit to alternatives involving numerical analyses. He finds that the confidence intervals derived from the censored normal regression are only slightly less accurate for Cameron's method than for the more complex numerical methods. The confidence intervals reported in Table
A-23 use Cameron's method, taking advantage of the much lower standard errors available from the two-stage iterated protocol.

[6]The numbers in Table A-24 assume the population of anglers represented by the survey is precisely known. In fact, we estimated the proportion of the population interested in Kenai River fishing options from our surveys. The survey sampling error introduces an approximately 3 percent additional margin of error that is not included in the table.

Table A-27. 90 Percent Confidence Intervals for Contingent Value Estimates of Changes in Sport Fishing Net Values

(Thousands of dollars)

	Lower 5 percent	Most Likely	Upper 5 percent
Higher sockeye sport bag limit	407	466	534
Increased sockeye sport catch rate	495	565	646
Earlier dip net season opening	147	167	189
Higher dip net bag limit	229	264	304

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Appendix B

Documentation of Commercial Fishery Economic Value Analysis

Appendix B. Documentation of Commercial Fishery Economic Value Analysis

Observed Choices Method Analysis

Our observed choices method analysis estimates changes in costs of Central District set net and Cook Inlet drift permit holders and crew based on a statistical analysis of historical economic and management data. This method analyzes information on how the fisheries have actually been prosecuted in the past to estimate how profits vary under different stock abundance and market conditions. The main data we analyze are Alaska Department of Fish and Game landings records, along with the information on fishery openings in each district each week. We estimate how net permit holder earnings vary with run size, salmon prices, open fishing hours, and the availability of other fishing opportunities.

Profits and fishing costs are not observed directly in fish harvest data. Instead, we observe participation in a variety of fisheries at different times and under different conditions. Rather than estimate profits or costs directly, we estimate cost and profit relationships indirectly, by assuming that participation is an indicator of expected profitability. In order for this method to be able to estimate net values, the number of permit holders actually fishing has to vary with fishing and market conditions. If the number of people fishing is always the same, or varies randomly from week to week and year to year, it will not be possible to link changes in participation with changes in factors that affect profitability.

Weekly Choice Horizon

Fisheries managers have a variety of tools with which they may limit commercial fish harvesting activities in order to conserve stocks and allocate harvests. In the Cook Inlet set and drift fisheries, however, managers have relied nearly exclusively on varying times during which fishing is permitted (commercial openings) in various areas in the Inlet. Commercial fishing operations plan their activities around scheduled openings and "emergency openings" that can be predicted to occur during the peak fishing weeks of the season.

If an increase in the return of sockeye salmon to the Kenai River is adopted as a permanent change in the Kenai River management plan, then the pattern of openings under the new policy will be fairly predictable over the course of the season. Permit holders will be able to decide when it is best for them to plan to go fishing and when to do other things. Regular 12-hour openings occur on Mondays and Fridays of each week from the third week of June through August for both fisheries. The predictable weekly cycle of openings lends itself to the use of a weekly choice horizon for the analysis.

Although the fisheries open in June every year, many permit holders do not start fishing until emergency openings begin at the peak of the sockeye season. Emergency openings may occur at any time, but usually begin early in July and continue into August. While the pattern is similar for both fisheries, the set fisheries usually close earlier in the season than the drift fisheries. State biologists generally open both fisheries nearly every day for several weeks after the minimum escapement targets have been met for Kenai River sockeye. This usually occurs in the third week of July.

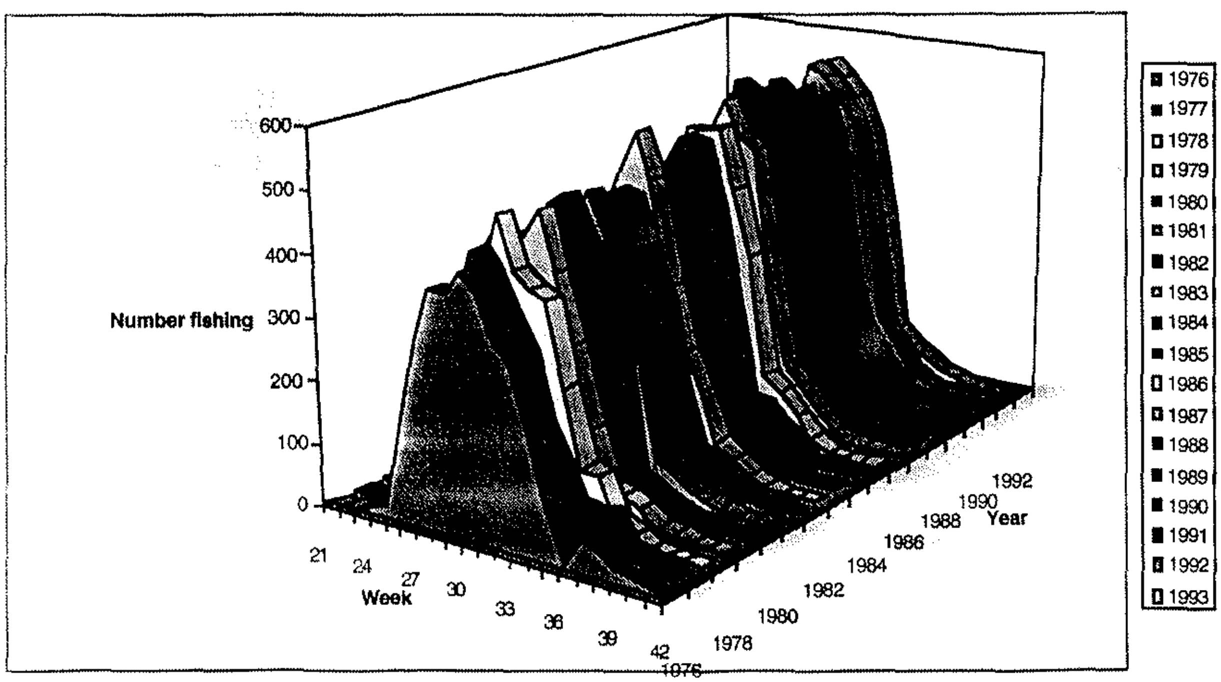
If managers change the target escapement for the Kenai River, then they would be most likely to vary the emergency openings during the second and third weeks of July. Exact timing of the changes, of course, would vary depending on the timing of the runs each year. These weeks correspond to weeks 29 and 30 of the calendar year. The analysis of changes in commercial fishing net values therefore focuses on estimating effects of regulatory changes in fishing hours during weeks 29 and 30.

An anticipated changes in hours of commercial openings during a given fishing week may cause some permit holders to decide to change fishing operations for the entire week. For example, if emergency openings are unlikely to occur during the second week of July, some permit holders may skip that week of fishing entirely (i.e., forego the regular openings as well). Others may choose not to begin fishing for the year until the third week in July, or to skip the year entirely if the price is low or the expected run size is small. Estimation of changes in net values from allocation changes requires estimating how changes in fishing hours will affect these participation decisions.

Preliminary Data Analysis

Casual examination of landings data for the Cook Inlet set and drift fisheries show that participation does in fact vary across the season and across years. Figure B-1 shows the number of setnet permit holders recording landings by week and year from 1976 through 1993, the latest year for which complete data are available. The figures shows clearly that participation varies greatly over the season, with the pattern varying somewhat from year to year. the data shows that very few operations began fishing before week 26 (third week in June) when regular openings now usually begin, even when the season was open during this period. Hardly anyone ever fished after week 36 (around September 1). Participation increases strongly every year as the run builds and then falls rapidly as returns tail off, but the pattern differs somewhat each year. Participation figures for the drift fishery show a similar pattern, except that the drift fisheries were closed due to oil spills during the 1987 and 1989 seasons.

Figure B-1. Number of People Fishing Cook Inlet Set Net (SO4H) Permits by Year and Week



To illustrate that the variation in participation shown in Figure B-1 is associated with changes in profitability of fishing, we estimate a statistical relationship called a *supply response* by economists. This relationship assumes that amount of fishing effort supplied by each gear group each week depends on the average harvest per week, the average ex-vessel price, and the earnings from alternative work. Both harvest rates—a simple measure of catch per unit of effort—and the price should increase profits and draw more people into the fishery. Higher earnings in alternative work would be likely to decrease fishing. We use the Alaska average construction wage to represent an index of alternative earnings. While price and harvest rates vary each week, we only consider year-to-year changes in real wages. Prices and wages are adjusted for inflation to 1993 dollars using the Anchorage Consumer Price Index.

We fitted the statistical relationship for supply responses shown in Figure B-1 for setnet and drift permit holders from 1976 through 1993 -- all the years for which weekly harvest and participation data are available. The equation estimated for setnet permit holders is:

(B-1) log(number of permits-number fished)=

6.22 - 0.18*log(price) - 0.20*log(pounds) + 0.42*log(wage)

where "log" refers to the natural logarithm. The equation says that a 10 percent increase in salmon prices *decreases* the number of permit holders *not fishing* in a given week by 1.8 percent. The predicted effect of a 10 percent increase in catch rates reduces the number of idle permit holders by a slightly larger amount—2.0 percent. If higher prices and harvest rates decrease the number of unfished permits, then they increase the number of people fishing, as we expected. We selected the precise form of equation (B-1) because it provided the best fit to the data.

The comparable equation for drift permit holders is:

(B-2) log(number of permits-number fished)=

-2.16 - 1.32*log(price) - 0.71*log(pounds)+3.64*log(wage)

The effects of price and harvest rate on the number of idle permit holders are much larger for drift fleet than for the setnet operations. Economists call this a more *elastic supply response*. It means that the costs incurred by drift fishermen to fish an additional week of the season are likely to be larger and incremental profits smaller than those of setnet operations. Table B-1 contains the complete statistical results for the setnet equation, while Table B-2 contains the compete results for the drift fleet.

It is possible to use equations (B-1) and (B-2) to make an estimate of the effects on net values of a change in commercial harvests by solving each equation for the price as a function of the catch rate, for any given number of people fishing. This supply price measures the minimum or "break-even" price required to the bring the observed number of participants into the fishery, and thus approximates incremental costs. We could estimate the change in supply price as a function of changes in weekly harvest rates under management changes. We do not perform this estimate for two reasons. First, the estimated effects of harvest rates on costs is quite sensitive to the functional form chosen for the equation, and we have no rationale for selecting the form we chose, except that it provides the best fit to the data. The other reason is that a more accurate method is available that can take into account individual differences among fishing operations and information on weekly fishery openings.

Table B-1. Supply Response for Setnet Permit Holders

Dependent Variable: log(number of permits-number fished)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
Constant	6.21598	0.74238	8.37306
log(price)	-0.18109	5.67572e-002	-3.19060
log(pounds)	-0.19558	1.59841e-002	-12.23571
log(wage)	0.42245	0.21345	1.97913

Number of Observations	305
R-squared	0.74042
Corrected R-squared	0.73783
Sum of Squared Residuals	12.80574
Standard Error of the Regression	0.20626
Rho	0.53018
Mean of Dependent Variable	6.21687

Note: Equation estimated with generalized least squares correcting for first-order autocorrelation

Table B-2. Supply Response for Drift Permit Holders

Dependent Variable: log(number of permits-number fished)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
Constant	-2.16096	3.63761	-0.59406
log(price)	-1.32177	0.24150	-5.47306
log(pounds)	-0.70746	6.26760e-002	-11.28752
log(wage)	3.64403	1.05089	3.46755

Number of Observations	210
R-squared	0.76593
Corrected R-squared	0.76252
Sum of Squared Residuals	1.48169e+002
Standard Error of the Regression	0.84809
Rho	0.52851
Mean of Dependent Variable	4.83834

Note: Equation estimated with generalized least squares correcting for first-order autocorrelation

Definition of Variables in Tables B-1 and B-2

log(number of permits-number fished):	Natural logarithm of difference between number of permanent and temporary setnet or driftnet permits and the number making landings that week
log(price):	Natural logarithm of average ex vessel price of salmon (all species) landed that week
log(pounds):	Natural logarithm of average pounds of salmon (all species) landed per vessel participating that week
log(wage):	Natural logarithm of the Alaska annual average construction wage

Weekly Choice Model for Drift Fishermen

The choice model identifies profitable fishing opportunities by examining individual choices from among a set of discrete alternatives over a weekly time horizon. In estimating profit and cost functions for the fishing business from observed choices of permit holders, we presume that fishing operators consider crew payments, including crew shares of gross revenues, as costs when they decide when and where they will fish. If changes in harvest levels reduce crew shares below the crew members' opportunity costs, captains will have to raise the crew share percentages in order to retain their crew. This change would reduce profits to permit owners by still more but leave incomes of crew members unaffected.

Cook Inlet drift and set fisheries involve completely different types of operations with different fishing choices. Drift fishermen use relatively small, fast boats to pursue schooling salmon as they migrate toward the mouths of spawning streams. This mobility gives them a wide set of choices for where to look for fish in any given time period. We model the drift fisheries, therefore, in a two-stage choice structure summarized in Figure B-2. Drift captains first choose whether or not to participate in the fishery during a given week. Then they select the area in Cook Inlet in which they do the bulk of their fishing.

We assume that the probability of selection of a given fishing area depends on the expected profit. That is, if a salmon permit owner expects to receive profits π_{it} from activity i in week t, then

$$\pi_{it} = Gross\ Revenue_{it} - Operating\ Cost_{it}$$

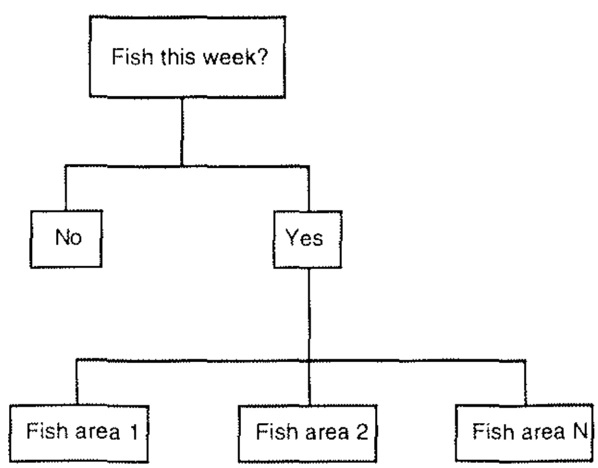
If p_{it} is the probability that the individual will choose area i in period t, then we assume p_{it} depends on profits, π_{it}, the equation we estimate assumes that the natural logarithm of the relative probability of selecting two areas i and j is proportional to the ratio of the profits:

$$\text{(B-3)} \quad \log \frac{p_{it}}{p_{jt}} = \frac{\pi_{it}}{\pi_{jt}}$$

The equation corresponding to the probability of selecting area i out of N area choices, given that the permit holder goes fishing that week, is

$$\text{(B-4)} \quad p_{it} = \frac{e^{\alpha\pi_{it}}}{\sum_{j=1}^{N} e^{\alpha\pi_{jt}}}$$

Figure B-2. Choice Structure for Drift Permit Holders



We do not have weekly data on components of operating costs such as fuel, food, gear replacement, or labor. Instead, we assume that operating costs from fishing in an area depend on pounds landed, distance from residence and home port to the area, and the relative time available to fish in each area. Some fishing areas are open longer or more often than others during specific weeks of the season. Fishing time might either raise or lower operating costs. On the one hand, more fishing time needed to catch a given amount might increases costs of fuel, food, labor, etc.
On the other hand, longer fishing hours per week, *for any given expected total catch,* provides more flexibility to schedule fishing around tide changes, weather, and other time commitments.

We estimate equation (B-4) for Cook Inlet drift permit holders using weekly landings data for weeks 26 through 36 for the years 1990 through 1993. The selected fishing area is defined as the statistical area in which the permit holder landed more than 50 percent of total salmon pounds during a given week. In about five percent of the cases, no single area accounted the majority of landings. These observations were excluded from the analysis of the choice of area, but included in the analysis of whether or not go fishing that week. Gross revenue and pounds landed are derived from state landings records, and weekly fishing hours by area are derived from the annual management reports. We combined adjacent statistical areas 24510 and 24570 because relatively few boats fished primarily in these areas. This gives us a total of six area choices in which Cook Inlet drift fishermen regularly harvest salmon.

In order to estimate the choice equation, we first need to predict what catch and gross value would be in the areas that were available for fishing but which the individual permit holder did not select that week. We estimated regression equations for pounds and value landed for each of the six areas as a function of hours of fishing openings in each area each week, separately including corridor and non-corridor openings for east-side areas. Other variables added to these equations were vessel length and horsepower, and separate constant terms for each week and year. The results of these equations are shown in the tables at the end of this appendix.

Table B-3 shows the complete statistical results for equation (B-4) estimated for choice of fishing area. Data series for quantity and gross revenue use the predicted levels of these variables from the equations in the tables at the end of this appendix. The coefficient on profits, α, is 0.0005. It makes sense that this coefficient is small, because revenues from a week of fishing generally exceed one thousand dollars. The coefficients shown in Table (B-4) imply an equation for profits expected from fishing in a given area. Dividing all the coefficients in the table by α, the coefficient on profits, one obtains the following equation:

$$\text{Profit} = \text{Gross Revenue} - 0.85*\text{Quantity} - 0.0000014*\text{Quantity}^2$$

$$+ 3327*\log(\text{hours}) - 25*\text{miles}$$

The equation suggests that incremental costs are approximately constant for differing harvest rates, but rise when catch rates are large. Longer openings significantly increase profits, and costs rise with distance (miles) from Homer.[1]

[1] Most of the drift boats use Homer as their home port. However, many deliver their catch to processors in the Kenai area. The choice of Homer over Kenai probably has little effect on the results.

Table B-3. Equation for Choice of Fishing Area, Drift Permit Holders

Multinomial Logit Estimation:

Dependent variable: maxarea

Area	Count	Percent
24450	2319	18.18
24460	6647	52.12
24470	1393	10.92
24510+24570	203	1.59
24580	815	6.39
24590	1376	10.79

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
revenue	5.13656e-004	1.88387e-005	27.26604
quantity	-4.38164e-004	2.32155e-005	-18.87373
quantsq	-7.11764e-009	4.31890e-010	-16.48022
log(hours)	1.70948	3.00317e-002	56.92255
miles	-1.28522e-002	5.43324e-004	-23.65481

auxiliary statistics	at convergence	initial
log likelihood	-18999	-22846
number of observations	12753	
percent correctly predicted	32.965	

Definition of Variables in Table B-3

maxarea	Statistical area with the largest harvest that week
revenue	Ex-vessel revenue from salmon fishing that week
quantity	Weekly salmon harvest, in pounds
quantsq	Square of quantity
log(hours)	Natural logarithm of total hours of regular and emergency fishery
miles	Statute miles from Homer to middle of the statistical area

The participation choice depends on the expected maximum profit that could be obtained from any of the area choices. Using the specific formulation chosen for equation (B-4), one can construct an index from the fitted values of the equation that is equal to this expected weekly profit, plus a constant scale factor. This index is called the "inclusive value," and is given by the formula,

(B-5) $$Incl_t = \log\left(\sum_{i=1}^{N} e^{\alpha\pi_{it}}\right)$$

where $\alpha\pi_{it}$ represents the predicted profits in each area and week from equation (B-4). Since the constant scale factor does not vary, a change in calculated inclusive value from a change in fishing conditions represents an estimate of the change in net value for a week of fishing. The Inclusive value is based only on weekly relative profits, so it does not include items that might vary across permit holders or over time but not across fishing areas.

The participation equation we estimate is:

$$p_t = e^{-7.54+0.57*Incl+0.008*hours+0.099*length-0.00027*hp}$$

Hours represents the maximum fishing time available that week. *Length* and *hp* refer to length and horsepower of the vessel usually used by the permit holder for drift salmon fishing. We derived values for these variables from state landings and vessel license records. Permit holders with larger vessels were more likely to go fishing for any expected maximum operating profit, possibly indicating the ability to fish profitably in less desirable weather conditions. Higher horsepower for the vessel diminished participation, possibly indicating higher overall operating costs. Table B-4 shows complete statistical results for the participation equation.

Table B-4. Equation for Participation Choice, Drift Permit Holders

Logit Estimation
Dependent variable: fish

Value	Label	Count	Percent
0	not fish	16354	55.73
1	fish	12993	44.27

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	-7.54144	0.12011	-62.78654
include2	0.56807	1.68302e-002	33.75313
hours	8.01067e-003	6.96548e-004	11.50054
length	9.87493e-002	1.92151e-003	51.39163
hp	-2.67129e-004	8.57887e-005	-3.11380

auxiliary statistics	at convergence	initial
log likelihood	-14739	-20342
number of observations	29347	
percent correctly predicted	71.418	

Definition of Variables in Table B-4

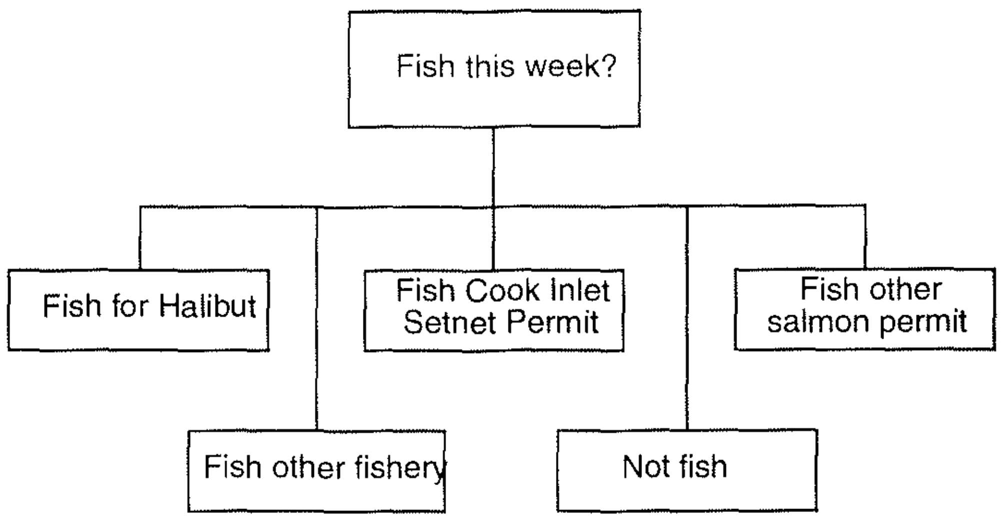
one	Constant term
include2	Inclusive value from Table (B-3), given by equation (B-5)
hours	Total hours of regular and emergency fishery openings during the
length	Vessel length (feet), ADF&G registration file
hp	Vessel horsepower, ADF&G registration file

Weekly Choice Model for Setnet Fishermen

Setnet operators face different choices from drift boat captains because they are restricted to a single fishing location. Instead of modeling fishing choices as a choice of areas, we focus on a subset of approximately ten percent of setnet permit holders who engaged in other fishing activities during the Cook Inlet salmon season as well as setnet fishing. A preliminary analysis of landings for this group when they are fishing their setnet permits shows that their catch rates are representative of the fishery as a whole.

For the setnet permit holders who have alternative fishing opportunities, we model a choice of several alternative activities, including fishing the setnet permit, participating in other fisheries, and not fishing that week. Figure B-3 summarizes the choice structure for setnet fishermen. Alternative fisheries modeled include halibut, other salmon fisheries, and all other fisheries.

Figure B-3. Choice Structure for Setnet Permit Holders



We assume as before that the choice of activity depends on the expected net earnings from the activity. We use the same equation as before, except that the subscript i in equation (B-4) now corresponds to the alternative activity instead of to the alternative area. The *not fishing* alternative represents all productive non-fishing uses of people's time. While other salmon, and other fisheries are available for fishing in every week—at least one setnet permit holder made landings in these fisheries every week in every year—the halibut fisheries are assumed to be available only in weeks when Alaska halibut landings took place. Setnet fisheries are also not assumed to be available choices during weeks when the Central District setnet fishery was closed.

We assume profit functions for each alternative fishery that are similar to the ones estimated for the drift fishery, based on the same data sources. We again estimate equations to predict the catch and gross revenue from each fishing alternative from landings data for setnetters during weeks 26 through 36 from 1990 through 1993. For setnet landings, these equations model weekly catch and value as a function of open fishing hours north and south of the Blanchard Line, constant terms for each week and year, and the average weekly harvest for the individual computed over the weeks that the permit holder actually recorded landings. For other fisheries, we predict catch and value as a function of the length, gross and net tons, and horsepower of the boat that the permit holder usually used for this fishery, as well as separate constant terms for the weeks and years. The results of these equations are shown in the tables at the end of this appendix.

Table B-5 shows the complete statistical results for equation (B-4) estimated for setnetters' weekly choices of activities during the salmon fishing season from 1990 through 1993. The profit equation assumed was as follows:

$$\pi(q) = r - c(q),$$

where the cost function $c(q)$ is

$$c(q) = \left(\beta_1 q + \beta_2 q^2 + \beta_3 q^3\right)$$

for salmon alternatives and

$$c(q) = \left(\beta_1 q + \beta_2 q^2\right)$$

for other fishery alternatives. The coefficient on profits, α, is very small, about one in one million. The setnet profit function implied by the coefficients in Table B-5 is approximately linear, with an incremental cost of 7.8 cents per pound.

Table B-5 Equation for Participation Choice, Setnet Permit Holders

Multinomial Logit Estimation
Dependent variable: fish2

Value	Label	Count	Percent
0	not fish	1372	34.74
2	setnet	1033	26.16
3	halibut	120	3.04
4	other salmon	1401	35.48
5	other fish	23	0.58

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
notfish	0.28380	4.11937e-002	6.88947
halibut	-2.47749	0.10842	-22.85131
salmon	0.31424	5.31694e-002	5.91012
other	-4.30083	0.23958	-17.95165
revenue	1.05934e-009	8.76686e-011	12.08342
salmonq	-8.21056e-011	5.49190e-012	-14.95030
salmqsq	8.00877e-022	6.68704e-023	11.97654
salmq3	-2.12747e-033	2.13573e-034	-9.96133
otherq	2.81737e-004	2.55494e-005	11.02718
otherqsq	-3.39031e-009	5.24998e-010	-6.45776

auxiliary statistics	at convergence	initial
log likelihood	-4449.5	-6355.7
number of observations	3949	
percent correctly predicted	44.619	

Definition of Variables in Table B-5

notfish	Constant term for the not fish alternative
halibut	Constant term for the halibut fishery alternative
salmon	Constant term for the other salmon fishery alternative
other	Constant term for the other fishery alternative
revenue	Ex-vessel harvest revenue for the week
salmonq	Harvest quantity of salmon (pounds), for salmon alternatives
salmqsq	Harvest quantity of salmon squared
salmq3	Harvest quantity of salmon cubed
otherq	Harvest quantity (pounds), for halibut and other fishery alternatives
otherqsq	Other harvest quantity squared

We also estimated a participation equation for all setnet permit holders with a simple yes/no choice for whether the setnet permit holder fished during a given week. However, we were not able to obtain a better result than that estimated for equation (B-1) using aggregated data.

The setnet results estimated in Table B-5 confirm the preliminary results in Table B-1 that the setnet fishery has much lower incremental costs than the drift fishery—85 cents per pound compared to 8 cents per pound. This does not necessarily mean that profits for drift permit holders as a whole are smaller, because these figures do not take fixed costs into account. However, they suggest strongly that most of the effects of a potential reduction in harvests for setnet operations would be to reduce profits, while harvest reductions for the drift fleet will lead mainly to a reduction in participation.

Estimation of Net Values

In the scenarios analyzed for this study, state fisheries managers alter the number of regular and emergency openings for the drift and set net fisheries in Cook Inlet in order to increase escapement of sockeye salmon to the Kenai River. If we assume the medium scenario for sockeye returns—about 3.5 million fish—Alaska Department of Fish and Game staff predict that they can achieve an increased escapement of 200,000 sockeye (to the Kenai River sonar counter) by allowing two or three fewer emergency corridor openings during the latter part of July. State officials predict that allowing one or two fewer emergency openings would increase escapement by 100,000 fish. Allowing one or two more emergency openings would increase commercial harvest and reduce the sonar count by 100,000. Emergency openings vary in length, but generally range from 8 to 19 consecutive hours.

Under the low scenario for sockeye returns—less than 1.5 million fish—ADF&G staff predict that they would have to require that the commercial fleet forego one regular opening as well as one or two emergency openings in the corridor in order to achieve an increased escapement of 200,000 sockeye. The loss of a regular opening has a much greater impact on the fleet, because it affects the all areas of Cook Inlet, not just the corridor north of mid-Kalifornsky Beach. We discuss the scenarios and fishing areas in greater detail in Chapter IV.

The landings models predict that the fleet will respond to the changes in openings in several ways. For drift operators, changing time open for fishing in an area first changes the predicted catch that week if the captain chose to fish there (catch and revenue equations in at the end of this appendix). The change in potential expected catch and revenues affects the best area in which to fish, if the operator were to go fishing that week (area choice equation shown in Table B-3). Finally, the change in expected profit from fishing opportunities—measured as the change in inclusive value calculated in equation (B-5) from the choice equation—affects the decision to go fishing at all that week (participation equation shown in Table B-4).

The inclusive value—defined according to the formula in equation (B-5)—corresponds to the expected maximum profit available to the drift permit holder from the choice sets available that week. Commercial permit holders have other uses of their time besides fishing. Some of these alternate activities may earn money. The participation equation for drift permit holders measures the relative value of fishing compared to other uses of time. The formula for estimating the effect on net value for a permit holder for a week of a change in fishing hours, landings, and gross value, as follows:

$$\text{(B-6)} \qquad \textit{Change in drift value} = \frac{\log\left(1+e^{v_{1t}}\right)-\log\left(1+e^{v_{2t}}\right)}{\alpha\gamma}$$

where v_{kt} is the exponent in the participation equation given by equation (B-5) evaluated for scenario k, α is the coefficient on revenue in equation (B-4) -- estimated as 0.000514 in Table B-3 -- and γ is the coefficient on inclusive value in the participation equation (estimated as 0.568 in Table B-4). The total change in net value for the fishery as a whole is simply the change in net value calculated above times the number of permit holders.

For set net operators, the landings model predicts a simpler response to changes in openings, since set netters do not have the opportunity to change their fishing area during the season. Changing time open for fishing in their area changes the predicted catch and revenues for the week if the operator decides to fish that week (catch and revenue equations at the end of this appendix). The change in potential expected catch and revenues affects the decision to fish at all that week (participation equation shown in Table B-5). We derive the change in expected set net value is defined as the change in set net inclusive value derived from applying equation (B-5) to the participation equation in each scenario. That is, the change in value realized from moving from scenario one to scenario two is:

$$\text{(B-7)} \qquad \text{Change in setnet value} = (\text{Incl}_1 - \text{Incl}_2)/\alpha$$

where α is the coefficient on revenue in the setnet choice equation (shown as 1.059×10^{-9} in Table B-5). The change in net value may be less than the change in profits, because some setnetters have other income earning opportunities. These opportunities are reflected in the inclusive value, which includes a contribution from other fisheries and non-fishing activities, as estimated in the participation equation shown in Table B-5. Appendix K discusses the economic theory that motivates the use of the formulas shown in equations (B-6) and (B-7).

Table B-6 shows the estimated changes in pounds harvested, estimated average net value per permit holder, and total net value for the setnet and drift fisheries for the medium run size scenario, under three different alternative escapement targets. The table does not include changes in net value for the high run scenario, since no change in commercial fisheries management would be required in this case. All the net value estimates shown in Table B-6 assume an average sockeye price of $1.43, the average landed price of Cook Inlet sockeye in 1994.

Each management alternative requires a change in fishing hours during the third and fourth weeks of July, as mentioned above and as described in chapter IV. We adjusted the assumed changes in fishing hours so that the model predicted the desired escapement target. The model is based on data for from the 1990-93 fishing seasons, and its predictions closely follow ADF&G assumptions for the medium run size assumption. The model requires longer set net closures than drift net closures to achieve ADF&G targets, but set openings in practice typically last longer than drift openings.

Scenario A (+200K) involves a reduction in commercial harvest of around 230,000 salmon. We project that this would cause a net loss to setnet operations of around one million dollars, or $0.98 per pound. The drift fleet would suffer a net loss of about $260,000, or $0.61 per pound. In Scenario D, in which commercial harvests are increased by around 110,000 fish, the drift fleet would gain a net $106,000, or $0.47 per pound. Set netters would see a $0.91 per pound gain, or $464,000.

Table B-6. Predicted Changes in Hours, Landings, and Net Value Under Medium Run Size Scenario and Three Allocation Scenarios

Sockeye price = $1.43

Change in Drift Net Values					
	Change in average per permit			Number of	Total
Allocation scenarios	hours	pounds	net value	permits	net value
+200,000 sockeye	-16	-430,865	-$451	583	-$262,981
+100,000 sockeye	-8	-223,239	-212	583	-123,655
-100,000 sockeye	7	226,194	182	583	105,983

Change in Setnet Values					
	Change in average per permit			Number of	Total
Allocation scenarios	hours	pounds	net value	permits	net value
+200,000 sockeye	-32	-1,072,144	-$1,409	745	-$1,049,823
+100,000 sockeye	-16	-514,737	-656	745	-488,990
-100,000 sockeye	17	512,277	623	745	464,307

Table B-7 shows the estimated changes in pounds harvested, estimated average net value per permit holder, and total net value for the setnet and drift fisheries for the low run size scenario, under three different alternative sockeye price assumptions. In the low run size scenarios (Scenarios A3 and A5), the losses in net value with an allocation of 200,000 sockeye to the Kenai River are somewhat lower for set netters than in the medium run case for comparable price assumptions.

Table B-7. Predicted Changes in Hours, Landings, and Net Value Allocating 200,000 More Sockeye to Kenai River Mouth with Low Run Size Scenario and Three Salmon Price Scenarios

Change in Drift Net Values

	Change in average per permit			Number of	Total
Price scenario	hours	pounds	net value	permits	net value
$1.00	-28	-1,746,159	-$758	583	-$442,136
$1.43	-24	-3,043,029	-2,648	583	-1,543,740
$1.75	-24	-3,531,862	-4,648	583	-2,709,871

Change in Setnet Values

	Change in average per permit			Number of	Total
Price scenario	hours	pounds	net value	permits	net value
$1.00	-28	-724,298	-$752	745	-$560,042
$1.43	-25	-708,447	-1,106	745	-823,795
$1.75	-24	-709,817	-1,384	745	-1,030,871

Allocation of additional salmon to the sport fishery creates much larger losses for the drift fleet in low run years, however. These losses occur because we assume that ADF&G fishery managers will require an Inlet-wide fishery closure in order to meet the Kenai River escapement goal while protecting other salmon stocks. The largest losses occur when low runs coincide with better than average salmon prices. If sockeye prices reach $1.75 in the low run size scenario, we project in Table B-7 that the change in net value to drift net operators will approach $3 million dollars. The landings model projects that the loss of a regular opening causes a larger reduction in drift net catch than ADF&G biologists' assumptions when prices are in the medium and high range, but a smaller reduction when prices are low. The model projects that when sockeye prices and returns are both low, fewer drift boats will be fishing, and it will be easier to manage the harvest.

Residence Adjustments

Most, but not all, Cook Inlet salmon permit holders are Alaska residents. In this study, we count only changes in net value that residents receive or give up as a result of fisheries management changes. We have two alternatives ways of determining residency for commercial fishers. A strict definition would consider as residents only those permit holders who paid resident fees for their limited entry permits. This definition corresponds roughly to counting benefits of sport anglers only if they hold an Alaska resident fishing license. A more liberal definition of residence would include all commercial fishermen who use an Alaska address when applying for their permits.

Table B-8 shows the average percent of 1990-93 landings made by Alaska residents under the two definitions of residency. Using the broader residency definition, we estimate that residents land 73 percent of the drift net harvest and 89 percent of set net harvest. We choose the broader definition of residency because it more closely corresponds to the definition we use for sport and dip net anglers. (We obtained sport and dip net results from surveys of households based on random digit dialing of telephone numbers in various Alaska communities. We did not ask sport anglers if they held resident fishing licenses.) Table B-8 shows that imposing a stricter definition of residence would have only a one or two percent effect on the results.

Table B-8. Percentage of Drift Net and Set Net Permit Holders Who Are Alaska Residents

		Average percent of 1990-93 landings made by Alaska residents
Drift Net		
	Resident permit fees	71.4%
	Alaska permit address	72.7%
Set Net		
	Resident permit fees	86.3%
	Alaska permit address	88.8%

Source: ISER calculations, based on data provided by the Alaska Commercial Fisheries Entry Commission

Table B-9 estimates total changes in net values for resident permit holders under the medium and low run-size scenarios for three assumed sockeye price levels. We calculated these estimates by assuming that the division of net benefits between resident and non-resident permit holders is proportional to their respective average shares of landings shown in Table B-8. In the medium run case, low sockeye prices reduce the losses experienced by the drift fleet to about one third of the net loss under the base price scenario. For the setnet fishermen, however, the net losses are only about 40 percent lower. The difference results for the higher incremental costs of drift fishermen, providing them with much lower net earnings in low price years. In high price scenario in the medium run case, net losses are much smaller for both drift and set fishermen. In the high price scenario with medium sockeye returns, the effects of changes in harvests to promote varying escapement goals are about one-third larger for both gear groups.

Table B-9. Estimated Changes in Net Earnings for Resident Drift and Setnet Permit Holders Under Various Run Size and Price Scenarios and Management Alternatives

(Thousands of dollars per year)

Change in drift net values						
	Medium run size			Low run size		
	Sockeye price			Sockeye price		
Allocation scenario	$1.00	$1.43	$1.75	$1.00	$1.43	$1.75
+200,000 sockeye	-$39	-$191	-$244	-$321	-$1,122	-$1,970
+100,000 sockeye		-$90				
-100,000 sockeye		$77				
Change in setnet values						
	Medium run size			Low run size		
	Sockeye price			Sockeye price		
Allocation scenario	$1.00	$143	$1.75	$1.00	$1.43	$1.75
+200,000 sockeye	-$523	-$932	-$1,237	-$497	-$732	-$915
+100,000 sockeye		-$434				
-100,000 sockeye		$412				

Documentation for Drift and Setnet Pounds and Value Equations

Definition of Variables

one	Constant term
d19*xx*, d*xx*	Dummy variable = 1 in year 19*xx*, 0 otherwise
week*yy*, w*yy*	Dummy variable = 1 in week *yy*, 0 otherwise
log(ave lbs)	Natural logarithm of average weekly pounds
log(ave val)	Natural logarithm of average weekly ex-vessel value
sh*yy*	Central district setnet fishery open hours in week *yy* north of Blanchard Line
ss*yy*	Central district setnet fishery open hours in week *yy* south of Blanchard Line
hours*yy*	Cook Inlet drift fishery open hours in week *yy* outside the 3-mile corridor
hoursi*yy*	Cook Inlet drift fishery open hours in week *yy* inside the 3-mile corridor
loglen	Natural logarithm of vessel length (feet), ADF&G registration file
loggton	Natural logarithm of vessel gross tons, ADF&G registration file
lognton	Natural logarithm of vessel net tons, ADF&G registration file
loghp	Natural logarithm of vessel engine horsepower, ADF&G registration file

Documentation for Equations

Setnet equations

(Constant term represents 1993 week 34)

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(set lbs)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	1.52537	0.27861	5.47500
d90	0.42092	0.12586	3.34436
d91	0.27329	0.16794	1.62734
d92	0.19241	0.13438	1.43185
w26	[illegible]	1.16918	-5.91291
w27	0.25336	1.36739	0.18529
w28	2.91324	1.53544	-1.89733
w29	-8.90775	3.68071	-2.42012
w30	-1.42880	0.51692	-2.76405
w31	-3.65582	1.81916	-2.00962
w32	-2.08505	0.56522	-3.68888
w33	-.0848519	1.06225	-.0798795
w35	-.0730835	0.20160	-0.36251
log(ave lbs)	0.64730	.0312769	20.69581
sh27	-0.56386	0.46965	-1.20059
sh28	-0.33477	1.39118	-0.24064
sh29	-0.60885	0.35159	-1.73170
sh30	0.63664	0.32757	1.94350
sh31	0.74113	0.17165	4.31761
sh32	0.38501	0.11111	3.46502
sh33	.087098	0.34983	0.24897
ss27	0.35236	0.42838	0.82253
ss28	1.15784	1.12939	1.02520
ss29	2.98886	1.05667	2.82857
ss30	0.13051	0.32490	0.40169
ss31	0.49352	0.31716	1.55606
ss32	0.29703	0.12940	2.29538

Number of Observations	1033
R-squared	0.63159
Corrected R-squared	0.62207
Sum of Squared Residuals	1.10855e+003
Standard Error of the Regression	1.04973
Durbin-Watson Statistic	1.69847
Mean of Dependent Variable	7.64009

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(set value)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	1.56649	0.26030	6.01795
d90	0.53708	0.12819	4.18962
d91	0.26520	0.17094	1.55147
d92	0.38247	0.13699	2.79196
w26	-0.39429	0.17214	-2.29056
w27	1.04172	1.39208	0.74832
w28	-2.00852	1.56245	-1.28549
w29	-8.17405	3.74445	-2.18298
w30	-1.47415	0.52672	-2.79873
w31	-3.74746	1.85168	-2.02382
w32	-2.48455	0.57530	-4.31868
w33	0.18711	1.08099	0.17308
w35	2.67421e-2	0.20522	0.13031
log(ave val)	0.58878	2.91054e-2	20.22910
sh27	-0.32503	0.47806	-0.67990
sh28	-0.43405	1.41601	-0.30653
sh29	-0.46096	0.35804	-1.28745
sh30	0.43343	0.33324	1.30063
sh31	0.83014	0.17477	4.74984
sh32	0.47692	0.11307	4.21783
sh33	2.9186e-3	0.35601	8.1982e-3
ss27	7.54744e-2	0.43622	0.17302
ss28	1.11997	1.14939	0.97440
ss29	2.80660	1.07512	2.61051
ss30	0.45834	0.33076	1.38573
ss31	0.52214	0.32286	1.61722
ss32	0.35476	0.13168	2.69403

Number of Observations	1033
R-squared	0.65531
Corrected R-squared	0.64640
Sum of Squared Residuals	1.14809e+003
Standard Error of the Regression	1.06829
Durbin-Watson Statistic	1.68512
Mean of Dependent Variable	7.56611

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(halibut val) [illegible]

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	1.82779	1.56642	1.16537
loglen	[illegible]	[illegible]	1.87558
loggton	[illegible]e-002	[illegible]	0.26605
lognton	[illegible]	[illegible]	2.69759
lognp	[illegible]	[illegible]	2.02051
d90	-[illegible]	[illegible]	-0.89131
d91	[illegible]	[illegible]	0.35040
w26	[illegible]	[illegible]	0.79510
w27	1.57006	1.37421	1.14251
w33	[illegible]	[illegible]	1.22147
w35	[illegible]	[illegible]	0.71183

Number of Observations	[illegible]
R-squared	[illegible]
Corrected R-squared	[illegible]
Sum of Squared Residuals	3.52566e+002
Standard Error of the Regression	0.97092
Durbin-Watson Statistic	1.65499
Mean of Dependent Variable	7.91497

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(halibut value)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	2.09346	1.56384	1.33866
loglen	0.81812	0.43874	1.86469
loggton	5.25167e-002	0.19180	0.27381
lognton	0.49775	0.18279	2.72306
lognp	0.24304	0.12203	1.99162
d90	-0.23716	0.64331	-0.36865
d91	0.79106	0.97180	0.81402
w26	1.11055	1.37998	0.80476
w27	1.57454	1.37020	1.14913
w33	1.14067	0.93302	1.22256
w35	0.50507	0.70288	0.71857

Number of Observations	385
R-squared	0.31930
Corrected R-squared	0.30109

Sum of Squared Residuals	[illegible].80511e-002
Standard Error of the Regression	0.06809
Durbin-Watson Statistic	1.65258
Mean of Dependent Variable	[illegible].31646

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(other salmon lbs)

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	25.45547	4.05615	6.27577
loglen	-4.21371	1.19372	-3.52990
loggton	-1.01930	0.21748	-4.68693
lognton	2.33947	0.44606	5.24478
loghp	-0.80166	0.26594	-3.01443
d90	-0.36177	0.29949	-1.20797
d91	-0.39574	0.32167	-1.23028
d92	-0.23458	0.32854	-0.71402
w26	-2.18036e-2	0.36063	-6.04601e-2
w27	0.39535	0.36425	1.08538
w28	0.69233	0.35115	1.97159
w29	0.62612	0.37620	1.66434
w30	2.69237e-2	0.39616	6.79618e-2
w31	0.22000	0.41147	0.53468
w32	0.12660	0.41125	0.30783
w33	0.25576	0.40961	0.62439
w35	-0.60651	0.59782	-1.01454

Number of Observations	227
R-squared	0.20412
Corrected R-squared	0.14348
Sum of Squared Residuals	3.59244e+002
Standard Error of the Regression	1.30793
Durbin-Watson Statistic	1.27535
Mean of Dependent Variable	8.76571

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: LOG other salmon value

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	10.95826	1.88311	5.39729
loglen	-3.48445	1.14279	-3.04906
logton	-1.66908	0.20820	-3.21364
lunton	1.72264	0.42703	4.03403
loghp	-1.48068	1.25459	-1.88805
d90	7.47465e-002	0.28671	0.26070
d91	-0.53455	0.30794	-1.73587
d92	0.39079	0.31452	1.24247
w26	0.31596	0.34524	0.91519
w27	0.63163	0.34871	1.81130
w28	1.00468	0.33617	2.98857
w29	0.77151	0.36015	1.69475
w30	0.23096	0.37926	0.60897
w31	0.25996	0.39392	0.65995
w32	3.73394e-2	0.39371	9.48405e-2
w33	1.57489e-2	0.39213	4.01624e-2
w35	-0.11512	0.57232	-0.20115

Number of Observations	227
R-squared	0.23525
Corrected R-squared	0.17699
Sum of Squared Residuals	3.29245e+002
Standard Error of the Regression	1.25213
Durbin-Watson Statistic	1.31312
Mean of Dependent Variable	8.58727

```
********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable:    log(other us)

Independent          Estimated              Standard              t-
 Variable            Coefficient             Error             Statistic

     one              -0.68461              1.75723             -0.38971
   logien              3.53190              0.57296              6.16426
   lognp              -0.87411              0.35327             -2.47998


Number of Observations                     30
R-squared                                   0.61381
Corrected R-squared                         0.58520
Sum of Squared Residuals                   28.65912
Standard Error of the Regression            1.03386
Durbin-Watson Statistic                     [illegible]
Mean of Dependent Variable                  [illegible]


********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable:    log(other value)

Independent          Estimated              Standard              t-
 Variable            Coefficient             Error             Statistic

     one               2.43539              2.01382              1.20934
   logien              1.51997              0.66924              2.27121
   lognp              -0.15451              0.41460             -0.37269


Number of Observations                     25
R-squared                                   0.26219
Corrected R-squared                         0.19511
Sum of Squared Residuals                   29.91855
Standard Error of the Regression            1.16616
Durbin-Watson Statistic                     1.60035
Mean of Dependent Variable                  7.35835
```

Drift equations

Constant term represents 1993 week 34.

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(lbs), area=24450

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	[illegible]	0.52670	2.78611
logien	0.62743	0.15366	4.08308
lognp	0.13102	3.97561e-002	3.29570
d1990	1.42273	8.64930e-002	16.44904
d1991	1.03620	9.89439e-002	10.47258
d1992	[illegible]	[illegible]	12.75431
week26	[illegible]	[illegible]	-4.34224
week27	[illegible]	[illegible]	7.33650
week28	-7.35012	1.77746	-4.13518
week29	3.10569	0.87799	3.53727
week30	-6.64602	0.80896	-8.21557
week31	-28.04571	1.87287	-14.97470
week32	-1.34139	0.40306	-3.32801
week33	0.89939	0.18988	4.73653
week35	-0.24185	0.26883	-0.89962
hours28	3.23526	0.69449	4.65849
hours29	-1.36399	0.19969	-6.83054
hours30	0.97761	9.26253e-002	10.55448
hours31	3.78971	0.54805	6.91487
hoursi28	0.25386	0.29667	0.85572
hoursi29	1.27241	0.23332	5.45356
hoursi30	1.71754	0.15964	10.75859
hoursi31	4.36081	0.27082	16.10226
hoursi32	0.72968	8.55512e-002	8.52919

Number of Observations	2292
R-squared	0.75340
Corrected R-squared	0.75090
Sum of Squared Residuals	1.37059e+003
Standard Error of the Regression	0.77738
Durbin-Watson Statistic	1.95234
Mean of Dependent Variable	8.16693

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(value), area=4450

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	0.76147	0.54334	1.40147
loglen	0.64961	0.15557	4.17581
loghp	0.13530	4.02494e-002	3.36161
d1990	0.72444	4.74763e-002	15.26824
d1991	0.82491	0.10048	8.20936
d1992	1.39253	8.04363e-002	17.31223
week26	-0.43441	0.24876	-1.74630
week27	2.43454	0.22941	10.61222
week28	-3.34909	0.72958	-4.63947
week29	4.10232	0.88898	4.61464
week30	-5.51851	0.81932	-6.73544
week31	-7.75566	0.49906	-14.61548
week32	-2.09473	0.43342	-4.83403
week33	0.96159	0.19231	5.00021
week35	-0.34527	0.27217	-1.26856
hours28	3.33978	0.77316	4.32300
hours29	-1.22137	0.20225	-6.03896
hours30	0.94180	9.38302e-002	10.03733
hours31	3.98022	0.55500	7.17159
hoursi28	0.98297	0.30036	3.27267
hoursi29	1.09995	0.23634	4.65414
hoursi30	1.63447	0.16165	10.11095
hoursi31	4.28141	0.27456	15.59378
hoursi32	0.95065	8.67119e-002	10.96336

Number of Observations	2291
R-squared	0.80892
Corrected R-squared	0.80698
Sum of Squared Residuals	1.40409e+003
Standard Error of the Regression	0.78700
Durbin-Watson Statistic	1.91678
Mean of Dependent Variable	6.22344

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: [illegible] value(area=[illegible])

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	[illegible]	[illegible]	[illegible]2.91867
logien	[illegible].40409	[illegible].[illegible]844e-002	[illegible].19501
loghp	[illegible]	[illegible].11466e-002	[illegible].59804
d1990	[illegible]	[illegible].14945e-002	[illegible].42746
d1991	[illegible]	[illegible].55940e-002	[illegible].70575
d1992	[illegible]	4.[illegible]9546e-002	[illegible].75615
week26	[illegible]	[illegible]	-[illegible].05234
week27	[illegible]	[illegible].10672	[illegible].75403
week28	[illegible]	[illegible]	-1[illegible].95213
week29	[illegible]	[illegible].30002	-[illegible].18507
week30	[illegible]	[illegible]	[illegible].39270
week31	[illegible]	[illegible]	-[illegible].[illegible]846
week32	[illegible]	[illegible]	-[illegible].[illegible]1256
week33	[illegible]e-002	[illegible]	[illegible].44131
week35	[illegible]	[illegible].68615	-[illegible].79821
hours28	[illegible].29485	[illegible].[illegible]886e-002	[illegible].49242
hours29	[illegible]	[illegible].[illegible]4741e-002	[illegible].62377
hours30	0.94405	5.69201e-002	16.58557
hours31	12.09577	0.44210	27.36009
hoursi28	-0.37669	9.00325e-002	-4.18394
hoursi29	0.74927	5.23622e-002	14.30934
hoursi30	-0.11030	9.18290e-002	-1.20111
hoursi31	-1.55971	0.11346	-13.74692
hoursi32	0.95452	4.16876e-002	22.89688

Number of Observations	6597
R-squared	0.82400
Corrected R-squared	0.82338
Sum of Squared Residuals	3.02001e+003
Standard Error of the Regression	0.67783
Durbin-Watson Statistic	1.89041
Mean of Dependent Variable	9.41629

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(lbs), area=14460

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	[illegible]	[illegible]	15.41759
logien	0.39315	7.78171e-002	5.05228
lognp	0.12050	2.11555e-002	5.69685
d1990	0.41202	3.05273e-002	13.53512
d1991	0.31647	3.86103e-002	8.19659
d1992	7.27315e-003	4.69744e-002	0.15483
week26	-1.26285	0.11061	-11.41736
week27	0.52810	0.10676	4.94639
week28	-6.75786	0.36134	-18.70208
week29	-2.14520	0.30015	-7.14713
week30	-0.57209	0.28833	-1.98410
week31	[illegible]	[illegible]	-14.94298
week32	[illegible]	0.10328	-10.97054
week33	-3.41327e-002	0.10738	-0.31806
week35	-1.94061	0.68644	-2.82705
hours28	3.38538	9.03265e-002	37.47941
hours29	0.53269	5.84987e-002	9.10603
hours30	0.99199	5.69441e-002	17.42051
hours31	11.42479	0.44228	25.83149
hoursi28	-0.38126	9.00703e-002	-4.23291
hoursi29	0.88507	5.23842e-002	16.89566
hoursi30	5.81865e-002	9.18676e-002	0.63337
hoursi31	-1.30269	0.11351	-11.47673
hoursi32	0.82120	4.17052e-002	19.69062

Number of Observations	6597
R-squared	0.78022
Corrected R-squared	0.77945
Sum of Squared Residuals	3.02255e+003
Standard Error of the Regression	0.67812
Durbin-Watson Statistic	1.86701
Mean of Dependent Variable	[illegible].33769

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: [illegible] lbs), area=14470

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	[illegible]	0.64850	7.09150
loglen	[illegible]	0.16981	1.35309
loghp	[illegible]	5.05963e-002	3.59997
d1990	[illegible]	6.18675e-002	3.49933
d1991	[illegible]	7.29306e-002	-1.55874
d1992	[illegible]	6.00245e-002	-4.15779
week26	[illegible]	0.29613	-3.65697
week27	[illegible]	0.23529	2.12956
week28	[illegible]	0.69524	-8.39717
week29	[illegible]	1.62586	-3.32904
week30	[illegible]	1.34866	-3.32983
week31	[illegible]	4.16219	3.08496
week32	[illegible]	1.21229	-1.74363
week33	[illegible]	0.31375	-0.43751
hours28	[illegible]	0.13890	14.99357
hours29	[illegible]	0.23751	2.40706
hours31	-6.46101	2.37315	-2.72255
hoursi28	-0.13331	0.16867	-0.79036
hoursi29	0.57085	0.41848	1.36409
hoursi30	3.19153	0.69921	4.56448
hoursi31	-0.84994	0.38128	-2.22915
hoursi32	0.62336	0.29502	2.11289

Number of Observations	1381
R-squared	0.73488
Corrected R-squared	0.73078
Sum of Squared Residuals	6.90080e+002
Standard Error of the Regression	0.71259
Durbin-Watson Statistic	1.77017
Mean of Dependent Variable	7.02510

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(value), area=24470

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	3.59617	0.65673	5.47570
logien	0.27613	0.17197	1.60569
loghp	0.18944	5.10387e-002	3.69713
d1990	0.50550	6.26530e-002	8.38780
d1991	-0.14287	7.38566e-002	-1.93444
d1992	0.16887	6.07966e-002	2.77800
week26	-0.30189	0.29989	-1.00670
week27	1.43466	0.29903	4.79764
week28	-4.94795	0.77407	-6.38544
week29	0.93335	1.64650	0.56687
week30	-6.61852	2.37848	-2.78267
week31	15.30503	4.26583	3.54536
week32	-1.72231	1.22768	-1.40371
week33	0.20753	0.31773	0.65316
hours28	2.85038	0.19130	14.89989
hours29	0.53174	0.24053	2.21074
hours31	-7.32091	2.40328	-3.04622
hoursi28	-0.20473	0.17081	-1.19857
hoursi29	0.39544	0.42380	0.93310
hoursi30	3.07562	0.70809	4.34356
hoursi31	-1.07020	0.38613	-2.77164
hoursi32	0.92169	0.29877	3.08494

Number of Observations	1381
R-squared	0.72745
Corrected R-squared	0.72324
Sum of Squared Residuals	7.07715e+002
Standard Error of the Regression	0.72164
Durbin-Watson Statistic	1.77231
Mean of Dependent Variable	7.18820

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(lbs), area=14570-24510

Independent Variable	Estimated Coefficient	Standard Error	t-Statistic
one	0.82627	2.27705	0.36287
logien	1.42025	0.70795	2.00614
loghp	-2.24563e-002	0.18650	-0.12041
d1990	-3.70024e-003	0.23419	-1.58000e-2
d1991	0.79868	0.24378	3.27618
d1992	0.42582	0.25900	1.64413
week26	0.75729	1.01535	0.74584
week27	0.62322	0.44381	1.40425
week28	-3.88169	3.35661	-1.15643
week29	3.60823	5.34207	0.67544
week30	0.28509	1.21494	0.23672
week31	-8.47777	4.26071	-1.98976
week32	1.53677	0.21219	7.24226
week33	0.96224	0.20819	4.62197
week35	9.07957e-002	0.21494	0.42243
week36	-2.03178e-002	0.51873	-3.91686e-2
hours28	2.06738	1.24338	1.66271
hours29	-0.10420	1.79986	-5.78913e-2
hours31	3.54840	1.49646	2.37120

Number of Observations	203
R-squared	0.46805
Corrected R-squared	0.41601
Sum of Squared Residuals	1.84758e+002
Standard Error of the Regression	1.00206
Durbin-Watson Statistic	1.76587
Mean of Dependent Variable	6.65248

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(value), area=24570-24510

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	0.30281	2.35868	0.12838
loglen	1.38605	0.73333	1.39280
loghp	7.53301e-004	0.19319	3.89929e-003
d1990	0.23541	0.24259	0.97043
d1991	0.76320	0.25252	3.02230
d1992	0.55281	0.26828	2.06058
week26	1.04699	1.05174	0.99548
week27	1.32747	0.45972	2.88756
week28	-4.95962	3.47694	-1.42644
week29	3.88822	5.53357	0.70266
week30	1.83255	1.05133	1.74056
week31	-4.39292	3.41344	-1.30167
week32	1.33353	0.21980	4.99963
week33	0.97287	0.21565	4.51133
week35	9.09448e-002	0.22264	0.40848
week36	-3.35353e-002	0.53732	-6.31066e-2
hours28	2.66782	1.28795	2.07137
hours29	5.91034e-004	1.86438	3.17014e-4
hours31	3.66844	1.55010	2.36658

Number of Observations	203
R-squared	0.48072
Corrected R-squared	0.42992
Sum of Squared Residuals	1.98242e+002
Standard Error of the Regression	1.03798
Durbin-Watson Statistic	1.74571
Mean of Dependent Variable	6.30690

******** ORDINARY LEAST SQUARES ESTIMATION ********

Dependent Variable: [illegible]

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
One	[illegible]	[illegible]	4.73656
loglen	[illegible]	[illegible]	1.17366
loggnp	[illegible]	[illegible]	-0.79015
d1990	[illegible]	[illegible]	[illegible].40863
d1991	[illegible]	[illegible]	4.59273
d1992	[illegible]	[illegible]	1.40055
week26	[illegible]	[illegible]	-[illegible].23843
week27	[illegible]	[illegible]	[illegible].73984
week28	[illegible]	[illegible]	-[illegible].72040
week29	[illegible]	[illegible]	4.25694
week30	[illegible]	[illegible]	[illegible].05642
week31	[illegible]	[illegible]	-[illegible].13307
week32	[illegible]	[illegible]	[illegible]
week33	[illegible]	[illegible]	[illegible].00617
hours28	[illegible]	[illegible]	[illegible].85895
hours29	[illegible]	[illegible]	-[illegible].20340
hours30	[illegible]	[illegible]	-[illegible].15860
hours31	1.43808	[illegible].35106	4.09634

Number of Observations	[illegible]05
R-squared	0.75589
Corrected R-squared	0.75062
Sum of Squared Residuals	4.[illegible]e+[illegible]
Standard Error of the Regression	0.[illegible]
Durbin-Watson Statistic	1.75598
Mean of Dependent Variable	7.49510

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(Value), Area=24580

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	0.85641	0.20092	4.25851
logien	0.58123	0.25913	2.24320
logmp	-5.41866e-002	6.91443e-002	-0.78367
d1990	0.97022	7.86626e-002	12.36831
d1991	0.39742	9.43875e-002	4.21479
d1992	0.55843	9.33997e-002	5.97957
week26	-1.10139	0.28578	-[illegible].67181
week27	1.25987	0.28527	4.41640
week28	-5.24514	0.67794	-7.73689
week29	4.87968	1.02295	4.77018
week30	7.32040	3.43613	2.13039
week31	-1.46182	1.02440	-1.40298
week32	[illegible]	0.29954	1.59941
week33	[illegible]	0.29833	1.46264
hours28	2.79759	0.24119	11.59918
hours29	-0.41304	0.32196	-1.28291
hours30	-1.19929	1.08679	-1.10351
hours31	1.63601	0.35491	4.60966

Number of Observations	305
R-squared	0.76062
Corrected R-squared	0.75545
Sum of Squared Residuals	4.19765e+002
Standard Error of the Regression	0.73032
Durbin-Watson Statistic	1.74792
Mean of Dependent Variable	7.58366

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(lbs), area=24590

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	5.28938	0.50327	10.51006
logien	0.21754	0.14715	1.47831
loghp	0.12238	4.38068e-002	2.79368
d1990	0.31914	4.45657e-002	7.16107
d1991	0.21811	7.77840e-002	2.80404
d1992	-0.32560	5.77173e-002	-5.64123
week26	-1.28214	0.13738	-9.33282
week27	0.37437	0.13572	2.75831
week28	-6.02645	0.53550	-11.25398
week29	-1.26442	0.76111	-1.66130
week30	7.72331	3.09391	2.49630
week31	-3.72496	2.01325	-1.85023
week32	0.66844	0.18569	3.59983
week33	-0.30647	0.21136	-1.44998
week35	0.95302	0.34587	2.75545
hours28	2.67637	0.20327	13.16647
hours29	1.17656	0.24928	4.71992
hours30	-1.90564	1.00103	-1.90367
hours31	1.79771	0.68420	2.62745

Number of Observations	1367
R-squared	0.71770
Corrected R-squared	0.71393
Sum of Squared Residuals	5.52148e+002
Standard Error of the Regression	0.64000
Durbin-Watson Statistic	1.77978
Mean of Dependent Variable	7.09249

********* ORDINARY LEAST SQUARES ESTIMATION *********

Dependent Variable: log(value), area=24590

Independent Variable	Estimated Coefficient	Standard Error	T-Statistic
one	1.53136	0.51547	5.79170
loglen	0.26036	0.15072	1.72745
loghp	0.11662	4.48689e-002	2.59916
d1990	0.65763	4.56462e-002	14.40720
d1991	0.18765	5.56699e-002	3.35531
d1992	8.24456e-002	5.27157e-002	1.56378
week26	-0.68915	0.14071	-4.89766
week27	1.02090	0.13901	7.34379
week28	-5.34865	0.54848	-9.75180
week29	-0.59775	0.77956	-0.76678
week30	0.30280	0.15892	2.62007
week31	-0.53450	0.16206	-1.71406
week32	0.77231	[illegible]	4.06337
week33	-0.42723	0.21648	-1.97371
week35	0.88939	0.35425	2.51061
hours28	2.67243	0.20820	12.83586
hours29	1.16429	0.25532	4.56013
hours30	-1.90747	1.02530	-1.86040
hours31	1.86803	0.70079	2.66560

Number of Observations	1367
R-squared	0.70721
Corrected R-squared	0.70330
Sum of Squared Residuals	5.79247e+002
Standard Error of the Regression	0.65552
Durbin-Watson Statistic	1.77212
Mean of Dependent Variable	7.28901

Job Ranking Method of Estimating Net Economic Value to Labor

This section provides documentation for the net economic value results presented in Chapter IX. To estimate the net economic value of crew labor in the Cook Inlet fishery, we built a data set with 479 observations representing data on Cook Inlet fishing jobs and the alternative jobs crew members described in the crew survey and how they ranked them in overall preference. (Three observations on each job, with variations in earnings assumptions and ranking, are included; the number of unique jobs in the data set is about 160.) A rank-order logit regression was used to estimate an equation predicting crew members' job preferences. The regression results appear in Table B-10. The variable definitions appear in Table B-11.

Table B-10. Crew Job Ranking Equation

Variable	Coeff.	Std. Error	t-ratio	Prob.	Minimum	Maximum	Mean	Std. Dev.	Coeff* Mean	Coeff* Std. Dev.
EARN	0.0788	0.0194	4.062	0.0000	0	38	4.45	4.586	0.3507	0.3614
SETCI	1.8721	0.9180	2.039	0.0414	0	1	0.2879	0.4533	0.5390	0.8486
WEEKSET	-0.1697	0.0885	-1.917	0.0552	0	20.14	2.408	4.177	-0.4085	-0.7086
HPWSET	0.0280	0.0165	1.697	0.0898	0	126	15.58	26.57	0.4356	0.7429
DRIFTCI	0.5506	0.4301	1.280	0.2005	0	1	0.141	0.3484	0.0776	0.1918
HPWDRFT	0.0163	0.0069	2.363	0.0182	0	147	8.461	24.39	0.1382	0.3984
CERTAIN	1.1490	0.1916	5.997	0.0000	0	1	0.2756	0.4473	0.3167	0.5139
OFFICE_S	1.1387	0.3315	3.435	0.0006	0	1	0.0080	0.2721	0.0915	0.3098

Maximum Likelihood Estimates
Log-Likelihood -152.69
Restricted (Slopes=0) Log-L. -201.45
Chi-Squared (8) 97.522
Significance Level 0.10000E-06
N(0,1) used for significance levels.

Table B-11. Definition of Variables

EARN	-	Earnings for the season or duration of the job; if the job is year-round, this is earnings for a period comparable to Cook Inlet fishing.
SETCI	-	1 indicating a Cook Inlet set net job; 0 otherwise.
WEEKSET	-	The number of weeks from the start of the set net fishing job to the end.
HPWSET	-	The number of hours per week worked set netting during the season
DRIFTCI	-	1 indicating a Cook Inlet drift net job; 0 otherwise.
HPWDRFT	-	The number of hours per week worked set netting during the season
CERTAIN	-	1 if the ex-ante expected earnings for the job were known with some certainty; 0 if the expected earnings were uncertain.
OFFICE_S	-	1 indicating an office job, for those who expressed a stong preference for working outdoors.

Calculation of NEV

This equation was used to calculate net economic value for three types of crew—drift crew, set net crew north of the Blanchard line, and set net crew south of the Blanchard line—across seven scenarios. Table B-12 displays the assumptions used in calculating the changes in variables across the scenarios. Table B-13 shows for Scenario A the mean value of each variable by type. Table B-14 shows for Scenario A the calculation of the change in net economic value to crew.

The formula for the change in NEV is:

(B-8) $$\Delta NEV = \sum_{i=1}^{6} ncrew_i * (inclu_{i1} - inclu_{i0})/\beta_1$$

where

(B-9) $$inclu_{ik} = \log \sum_{j=1}^{J} e^{X_{ijk}\beta}$$

$X_{ijk}\beta$ is the linear combination of variables and coefficients from the job ranking equation. For our present application it was evaluated at average values of the variables for Cook Inlet fishing (j=1) and for other jobs (j>1) for each of three groups of crew-- drift crew, set net crew north of the Blanchard line, and set net crew south of the Blanchard line-- with two cases for each: loss of fishing hours or loss of week (i=1 to 6). The "inclusive value" $inclu_{ik}$-- an index of value for the menu of job alternatives-- is calculated at a base value (k=0), and with scenario changes (k=1), then differenced to get the net change. Dividing by the coeficient on earnings β_1 converts it into dollar units. Multiplying by the projected number of resident crew affected in each case (i=1 to 6) and adding it all up produces an estimate of the total change in net economic value for resident crew. These calculations were performed in a spreadsheet model for which there is further documentation in Appendix B.

Table B-12 displays key assumptions used in calculating the changes in variables across the scenarios. The changes in fishing weeks and hours were derived from the observed choices model. The observed choices model has a weekly time horizon. We assume that the predicted numbers of permits holders who do not fish under a given scenario shut down just for the week, not for the season. Thus we model a few crew members losing a full week of fishing hours, and the vast majority losing only the hours that the fishery would be closed.

Table B-12. Assumptions for Calculating Net Economic Value for Crew

	Scenario Name and Code +200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	Low run, low price	Low run, high price
	A-C	D	E	A1	A2	A3	A5	
Setnet Crew								
Change in number of jobs	-1	-1	-1	-1	-1	-1	-1	-1
Hours lost, July 22-28, if whole week lost								
N. of Blanchard line	-79.8	-79.8	79.8	-79.8	-79.8	-79.8	-79.8	-79.8
S. of Blanchard line	-75.5	-75.5	75.5	-75.5	-75.5	-75.5	-75.5	-75.5
Crew who lose whole week	28	12	(10)	28	28	21	26	
Hours lost, July 22-28, only part of week lost								
N. of Blanchard line	-32.0	-16.0	17.0	-32.0	-32.0	-25.0	-28.0	-24.0
S. of Blanchard line	0	0	0	0	0	-12	-12	-12
Base Permits Fished	438	438	438	438	438	420	375	443
Scenario Permits Fished	424	432	443	424	424	404	355	429
Drift Crew								
Change in number of jobs	-1	-1	-1	-1	-1	-1	-1	-1
Hours lost, July 22-28, if whole week lost	-60.3	-60.3	60.3	-60.3	-60.3	-60.3	-60.3	-60.3
Hours lost, July 22-28, only part of week lost	-16.0	-8.0	7.0	-16.0	-16.0	-24.0	-28.0	-24.0
Base Permits Fished	542	542	542	542	542	476	347	536
Scenario Permits Fished	519	532	550	519	519	352	289	403
Calibration factors								
Average to marginal earnings	1.993	1.998	2.097	2.023	1.985	3.259	3.300	
Price factor	1.0	1.0	1.0	0.7	1.22	1.0	0.7	
Low run factor	1.0	1.0	1.0	1.0	1.0	0.61	1.61	
Crew Population Base	**Resident**		**Non-Resident**		**Total**		**Crew/Permit**	
	Number	% of Tot	Number	% of Tot				
Setnet - N of Blanchard Line	223	53.1%	197	46.9%	420		1.0	
Setnet - N of Blanchard Line	371	81.5%	84	18.5%	455		1.0	
Driftnet	401	76.5%	123	23.5%	524		.97	

The earnings data for all jobs comes from the crew survey. To calculate lost Cook Inlet earnings under each scenario, we converted total Cook Inlet earnings to an hourly average and multiplied by lost hours. Because proposed closures would be during the peak week of the sockeye run, this average calculation underestimates lost earnings. To correct for that underestimate, we scaled up estimated earnings changes to total 88 percent of the total income change estimated in Table VI-7. We benchmark our earnings to 88 percent of the total because crew income as reported by crew is about 88 percent of the crew income reported by permit holders. It is important to keep estimated changes in Cook Inlet earnings on the same relative scale as earnings reported by crew for other jobs. In this way we distribute the change in total earnings across individuals in proportion to their reported season earnings.

Table B-13. Mean Values of Variables and Vectors of Change for Scenario A and

Table B-14. Calculation of Crew Net Economic Value Using Mean Values by Type

Sample Calculation of Crew NEV using mean values by type: Scenario A

coefficient	0 078799	0 078799	0 078799	1 8721	-0 16965	0.02796	0 02796	0 55056	0 016333	0.016333	1.149	1 1387
variables	othearn	ciearn	dciearn	setci	weekset	hpwset	dhpwset	driftci	hpwdrft	dhpwdrft	certain	office_s
Scenario A												
set job - N	8 8875	3.28	-3.28	1	7.4114	0	0	0	0	0	0 3443	0 0164
set job - S	3 6036	4 4405	-4.4405	1	7.7143	0	0	0	0	0	0 2963	0 0741
set week -	8 8875	3.28	-1.30251	1	7.4114	54	0	0	0	0	0 3443	0 0164
set week -	3 6036	4 4405	-1 666624	1	7 7143	51 9655	0	0	0	0	0 2963	0.0741
set hours -	8 8875	3.28	-0 522637	1	7.4114	54	-4.317673	0	0	0	0.3443	0.0164
set hours -	3 6036	4.4405	0	1	7.7143	51.9655	0	0	0	0	0 2963	0 0741
drift job	4 5269	4 706	-4 7056	0	0	0	0	1	53.369	0	0.2694	0 0451
drift weeks	4 5269	4 7056	-1 516911	0	0	0	0	1	53 369	-8.863031	0 2694	0 0451
drift hours	4 5269	4 7056	-0 402831	0	0	0	0	1	53.369	-2 353668	0 2694	0 0451

												----- no earn change -----		
xboth	xbci	njobs	inclu	incluA	dnev	ncrew	tot. dnev	%resident	res dnev	tot dearn	tot.ciearn	xbci	dnev	totdnev
1 114601	0	2 0333	1 423075	1.7128	-3.676755	0	0	0 530952	0	0	0	0	-19.94372	
0 708786	0	2 1892	1 228438	1 590941	-4.600348	0	0	0 815385	0	0	0	0	-22.35892	
1 114601	2.45007	2 0333	2 690499	2 638189	0 663841	27.96804	18.56633	0 530952	9 857837	-36 42864	91 73516	2 552707	-16 86139	-471.[illegible]
0 708786	2 404553	2 1892	2 601902	2 570552	0 397843	0	0	0 815385	0	0	0	2 535881	-17 17078	
1 114601	2 221151	2 0333	2 515096	2 638189	-1 562105	392 032	-612.395	0 530952	-325 1526	-204 8904	1285 865	2 262335	-17 89729	-7016.3[illegible]
0 708786	2 366231	2 1892	2 570552	2 570552	0	455	0	0.815385	0	0	2020 428	2 366231	-17 82453	-8110.1[illegible]
0 717611	0	2 1491	1 210486	2 123788	-11.59027	0	0	0.76673	0	0	0	0 370797	-24.68692	
0 717611	1 528741	2 1491	1 941254	2 123788	-2 316452	22 23616	-51.50901	0 76673	-39.49352	-33 73029	104 6345	1.648273	-15 46219	-343.81[illegible]
0 717611	1 722847	2 1491	2 073872	2 123788	-0.633464	501.7638	-317.8492	0.76673	-243.7047	-202 1261	2361.1	1 75459	-14.92799	-7490.3[illegible]
					Total	1399	-963.187		-598 493	-477 1755	5863 762			-23432

Ave.drift	Ave.set	% dnev/ dearn	% dearn/ dnev
-0 704882	-0 678661	2.018517	0.495413

Documentation of Average Salmon Weight Assumptions

To calculate the average weight per fish for the Chapter IX analysis of changes in accounting income, we used the average harvest weights for the period 1990-95 (rounded to the nearest tenth of a pound). (Table B- 15) We assumed an average weight of 6.0 pounds for sockeye salmon harvested in Cook Inlet. Figure B-4 compares that assumed weight with actual average weights since 1980.

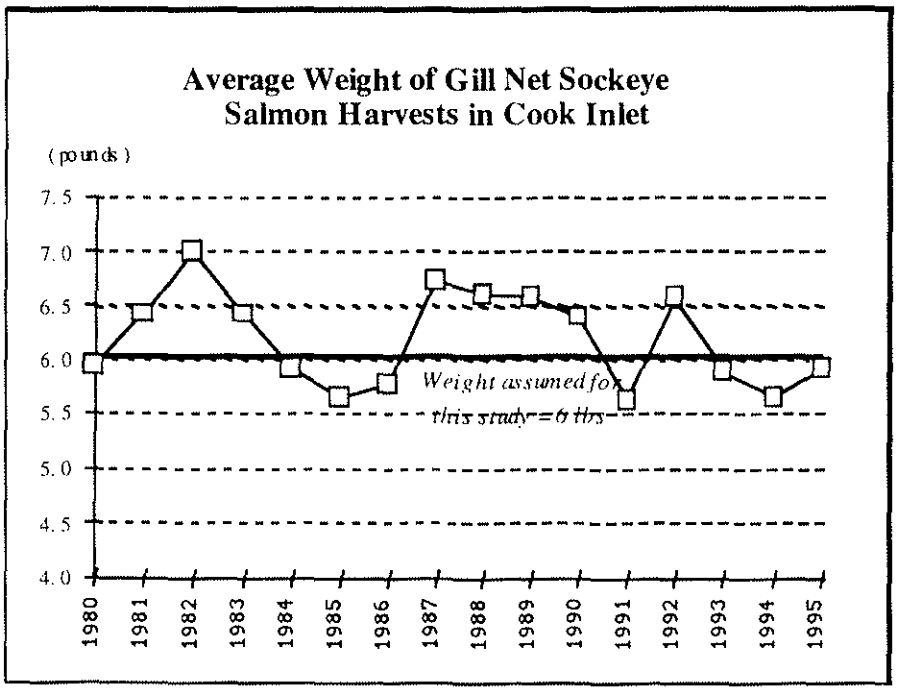
Table B-15

Average Weight of Salmon Harvested in Gill Nets in Cook Inlet (pounds)

	1980-1995	1985-1995	1990-1995
Chinook	26.63	26.40	25.84
Chum	6.61	7.01	6.69
Coho	6.41	6.57	6.42
Pink	3.30	3.78	3.32
Sockeye	6.19	6.13	6.01

ISER file: Gill Net Harvest Data.

Figure B-4



Market Effects of Reduced Commercial Harvests

Reduced commercial salmon harvests in Cook Inlet might—at least in theory—raise the price of salmon, not only in Cook Inlet but also in other parts of Alaska. A price increase would affect net economic value to Alaska commercial fishermen , as well as net economic value to Alaska salmon consumers. Below we detail how we reached our conclusions in Chapter VI about potential market effects of reduced commercial salmon harvests in Cook Inlet.

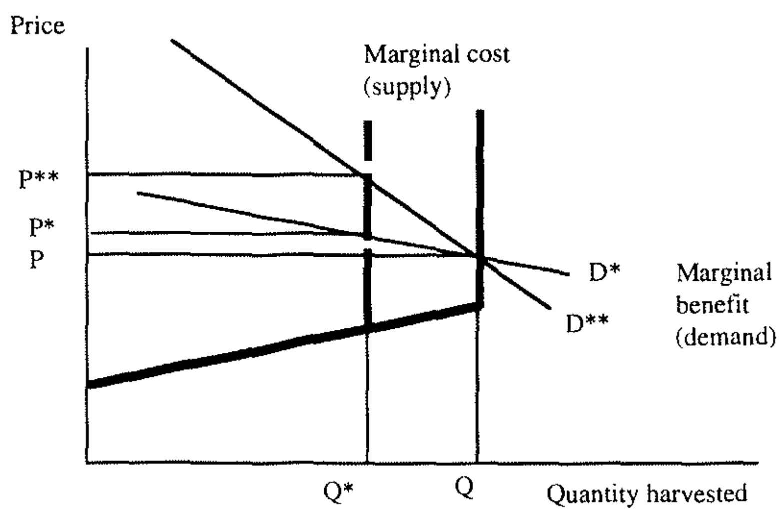
Effects on Cook Inlet Prices

As shown in Figure B-5, a reduction in harvests from Q would shift the supply curve for Cook Inlet salmon left to the dashed vertical curve Q*. As a result, the market price would rise. How much the price would rise depends on the shape of the demand curve. If the demand curve were steep (D**), a change in supply would have a large effect on price, increasing it from P to P**. If the demand curve were not steep (D*), a change in supply wold have only a small effect on price, increasing it from P to P*. Thus, to understand the potential effects of a reduction in Cook Inlet commercial harvests, we need to know the shape of the demand curve for Cook Inlet salmon.

The change in the price would also depend on the extent of the harvest reduction. For any shape of the demand curve, the larger the harvest reduction, the greater the price increase.

Since fishermen's total revenues are the harvest volume times the price, in theory a reduction in harvests could cause fishermen's total revenues to increase, if the price rose enough. If the demand curve is steep enough so that percentage increase in the price exceeds the percentage reduction in the harvest, leading to an increase in total revenue, economists refer to the demand curve as inelastic. If the demand curve is not steep enough for the rise in price to offset the reduction in quantity, economists refer to demand as elastic.

Figure B-5. Effects of a Reduced Commercial Harvest on Cook Inlet Ex-Vessel Prices



To examine how significant the change in price might be for Cook Inlet salmon, the first issue is the extent to which Cook Inlet salmon and other Alaska salmon are "substitutes" for which demand is interdependent. If Cook Inlet sockeye are not a close substitute for other sockeye, it is supply and demand for Cook Inlet sockeye that's relevant for determining the Cook Inlet price. But if Cook Inlet sockeye and other sockeye are close substitutes, then it is supply and demand for *all* sockeye that's relevant for determining the Cook Inlet price.

There is abundant evidence that Cook Inlet sockeye are very close substitutes for sockeye from other areas of Alaska. One indication of this is the strong correlation between the price of Cook Inlet sockeye and the price of sockeye from other areas, which is shown in Table B-16 and Figure B-6.

Among Japanese salmon importers—who buy almost all of Alaska's frozen sockeye salmon production—Alaska sockeye salmon from areas other than Bristol Bay (the largest producing area) is collectively referred to as "local" sockeye. Typically on the Japanese market "local" sockeye commands a price premium over Bristol Bay sockeye, but prices are very closely correlated at all levels, from ex-vessel prices through Japanese wholesale prices. This close correlation suggests that it is unlikely that a limited reduction in average Cook Inlet sockeye harvests would have much effect on average Cook Inlet prices.

A quantitative test of the degree to which Cook Inlet harvests may have an independent effect on Cook Inlet prices is provided by the regression results in Table B-17. This shows an ordinary least squares regression in which the dependent variable is the log of the ratio of the Cook Inlet ex-vessel price to the Bristol Bay ex-vessel price and the dependent variable is the log of the ratio of Cook Inlet harvest to total Alaska sockeye harvest. The estimated coefficient for the harvest ratio was statistically significant (t statistic = -3.18), but the coefficient was quite small (-0.16). The regression results suggest that on the average, a 10 percent increase in the Cook Inlet share of statewide sockeye harvests is associated with a 1.6 percent decline in Cook Inlet prices (relative to Bristol Bay prices). The regression explains about 40 percent of the variation in the Cook Inlet relative price.

As shown in Table B-16, between 1980 and 1995, total Alaska sockeye harvests averaged 260 million pounds, while Cook Inlet sockeye harvests averaged 28 million pounds, or 11 percent of total Alaska sockeye harvests. A reduction of 1.47 million pounds in the Cook Inlet sockeye harvest (the assumption for Scenario A) would represent about a 5.2 percent reduction in the average Cook Inlet sockeye harvest, but only a 0.6 percent reduction in the average statewide harvest volume. Evaluating the regression equation at our base-case price scenario (approximately equal to the average price prevailing over the past five years), a 5.2 percent reduction in Cook Inlet harvest would raise Cook Inlet sockeye prices by about one cent per pound. One cent per pound applied to an average harvest of 28 million pounds yields a change in revenue for the fishery of $280,000. Multiplying average harvest shares of the drift and set fisheries by their resident shares of the harvest, we expect 84.9 percent of this total would be harvested by residents. This would yield an increase in gross revenues of $238,000. This gain would partially offset the projected loss of revenue of $1.785 million from the harvest reduction.

The regression estimates the effects of year-to-year fluctuations in harvest levels on prices. The changes in management studied in this report, however, would reduce harvests permanently by a small amount. Over a longer period of time, capacity constraints that might affect Cook Inlet prices during years with especially large or small runs are not likely to be a factor if processors and shippers can anticipate smaller average harvests. For this reason, the estimate of a one cent gain in the price predicted by the regression is probably an upper bound. The change that would actually occur is undoubtedly much less, and may be trivial.

The average reduction in the statewide harvest volume would be so small that the effect on Cook Inlet ex-vessel prices would be very small—and therefore the effects of the price change on net economic value of the commercial fishery would be small relative to the effects of changes in harvest volumes. If we consider all Alaska fishermen, however, then even a small change in price might have an important effect on net economic value. If a reduction in Cook Inlet harvests led to a small increase in the average statewide price of sockeye, then net economic value to Alaska fishermen would rise by an amount equal to the statewide harvest volume times the price increase. Because the statewide harvest volume is large, even a small increase in price could result in a large increase in total value. In effect, fishermen in other parts of Alaska might benefit from a reduction in Cook Inlet harvests, to the extent that they got a slightly higher price.

Table B-16. Selected Data for Assessing Potential Market Impacts of a Reduction in Cook Inlet Sockeye Harvests

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	**Average**
Volume of sockeye salmon harvests (000 lbs) (a)																	
Cook Inlet	9,722	9,902	23,658	33,398	13,720	24,099	28,570	64,893	46,839	33,739	23,935	13,564	60,778	28,885	20,890	18,470	**28,446**
Alaska	186,700	225,956	188,550	305,641	222,699	221,508	194,557	224,831	188,553	260,671	305,969	255,519	345,810	379,119	294,160	352,649	**259,555**
Share of Cook Inlet in Alaska sockeye harvests	5.2%	4.4%	12.5%	10.9%	6.2%	10.9%	14.7%	28.9%	24.8%	12.9%	7.8%	5.3%	17.6%	7.6%	7.1%	5.2%	**11.0%**
Reduction in Cook Inlet sockeye harvest under Scenario A (1.47 million pounds) as a percentage of:																	
Cook Inlet sockeye harvest	15.1%	14.8%	6.2%	4.4%	10.7%	6.1%	5.1%	2.3%	3.1%	4.4%	6.1%	10.8%	2.4%	5.1%	7.0%	8.0%	**5.2%**
Total Alaska sockeye harvest	0.8%	0.7%	0.8%	0.5%	0.7%	0.7%	0.8%	0.7%	0.8%	0.6%	0.5%	0.6%	0.4%	0.4%	0.5%	0.4%	**0.6%**
Ex-vessel sockeye prices ($/lb) (b)																	
Cook Inlet	$0.85	$1.20	$1.10	$0.74	$0.97	$1.25	$1.44	$1.55	$2.55	$1.72	$1.71	$1.06	$1.59	$1.03	$1.46	$1.15	
Southeast	$0.86	$1.29	$1.08	$0.83	$1.12	$1.33	$1.49	$1.79	$3.16	$1.66	$1.60	$1.00	$1.72	$0.92	$1.36	$1.15	
Kodiak	$0.80	$1.11	$0.92	$0.78	$1.04	$1.13	$1.43	$1.73	$2.71	$1.79	$1.50	$0.91	$1.46	$0.87	$1.26	$1.15	
Bristol Bay	$0.57	$0.77	$0.69	$0.64	$0.66	$0.83	$1.42	$1.40	$2.10	$1.25	$1.09	$0.75	$1.12	$0.68	$0.97	$0.75	
World salmon supply (million lbs) (c)																	
Total Alaska harvests	511	612	562	621	661	670	609	509	534	698	692	719	687	846	866	973	
Other wild salmon								905	828	1138	1032	1296	887	1028	993	928	
Farmed salmon								183	320	492	655	725	712	842	1003	1208	

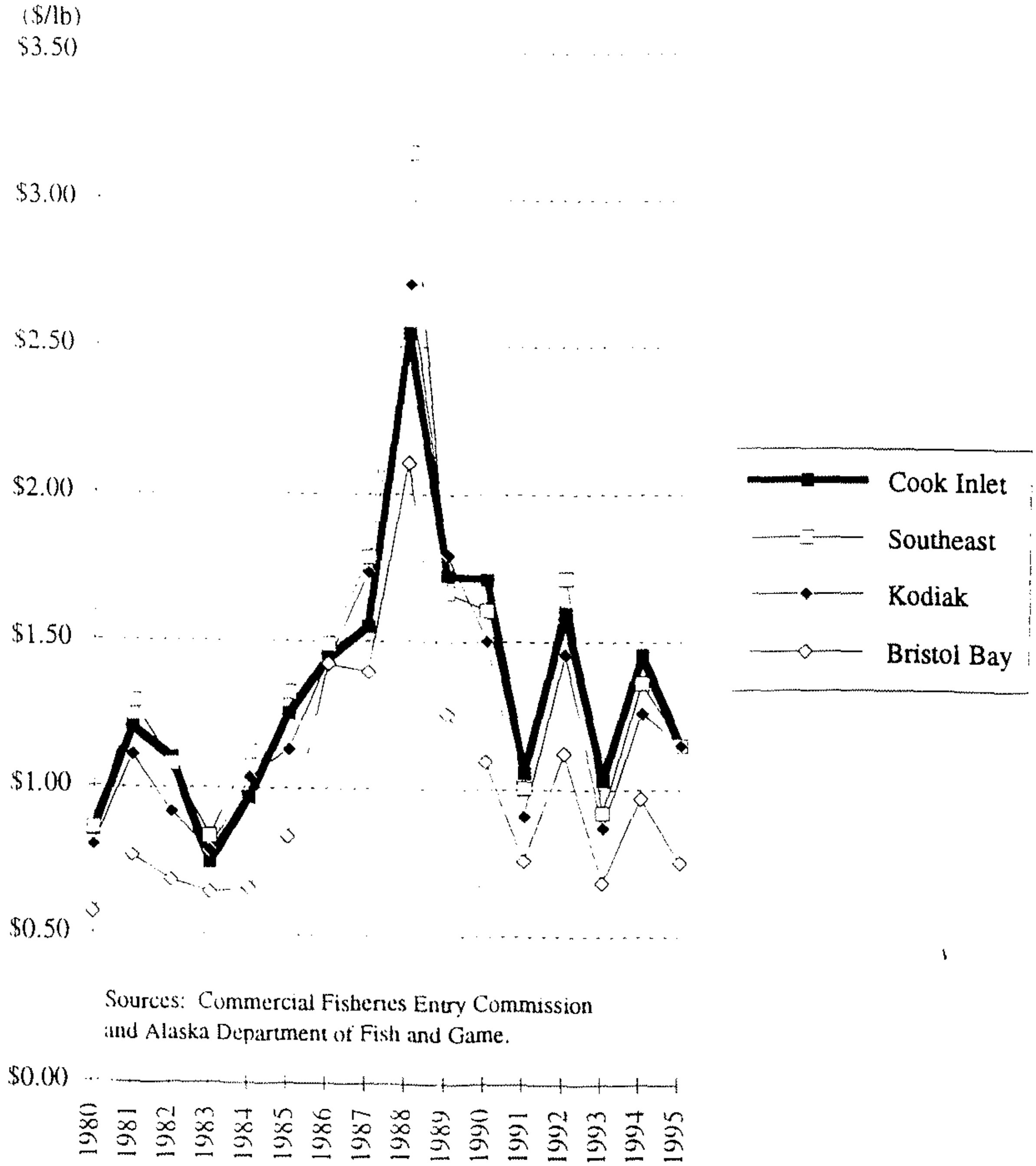
(a) 1980-1993: Commercial Fisheries Entry Commission. 1994 and 1995: Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, preliminary harvest data.

(b) Sources: Commercial Fisheries Entry Commission and Alaska Department of Fish and Game. For more Cook Inlet price data, see Appendix I, Table I-2.

(c) World supply data collected by the University of Alaska Anchorage Salmon Market Information Service, various sources.

ISER file: Market Effects Data.

Figure B-6. Ex-Vessel Sockeye Salmon Prices



Sources: Commercial Fisheries Entry Commission and Alaska Department of Fish and Game.

Table B-17. Regression Analysis of Sensitivity of Cook Inlet Ex-Vessel Price to Harvest Level

Dependent variable is the natural logarithm of the ratio of the Cook Inlet sockeye price to the Bristol Bay sockeye price. Independent variable is natural logarithm of the ratio of the Cook Inlet sockeye harvest to the total Alaska sockeye harvest.

Constant	-0.041
Standard Error of Regression	0.111
R Squared	0.419
No.of Observations	16
Degrees of Freedom	14

	ln(CI catch/ AKcatch)
Coefficient	-0.159
Std. Error	0.050
t statistic	-3.178

How significant this effect might be depends on the elasticity of demand for Alaska sockeye. The more inelastic the demand is, the greater the potential change in price. Various evidence—such as the great amount of attention paid to North American sockeye supply by Japanese importers—suggests that short-run changes in Alaska sockeye harvests do in fact affect short-run prices. However, for several reasons, we believe that long-run demand for Alaska sockeye is much more elastic than short-run demand, and the change in statewide average prices as a result of a long-run reduction in average harvests would be relatively small.

One reason is that the supply of substitutes for Alaska sockeye is growing. Canadian and Russian sockeye compete directly with Alaska sockeye on the Japanese market, and imports from Russia have grown substantially in recent years. Even more important, the last seven years have seen very rapid growth in production of farmed Chilean coho salmon, which also competes directly with Alaska sockeye on the Japanese market. Other species, including Japanese fall chum salmon and farmed Atlantic salmon, also compete less directly with Alaska sockeye. As the supply of these other species grows—and in particular the supply of farmed coho salmon—the relative effects of a given change in Alaska supply on sockeye prices will decline.

Figure B-7 shows the rapid growth in total world salmon supply in recent years, primarily as a result of growth in farmed salmon production. As the world supply grows, Alaska sockeye is becoming an ever-smaller share. To an ever greater extent in the future, the price of Alaska sockeye is likely to reflect the production costs of competing farmed salmon. As a result, the average supply of Alaska sockeye will have less and less of an effect on average Alaska prices—even though short-run fluctuations in supply might have short-run effects on sockeye prices in any given year.

Figure B-7

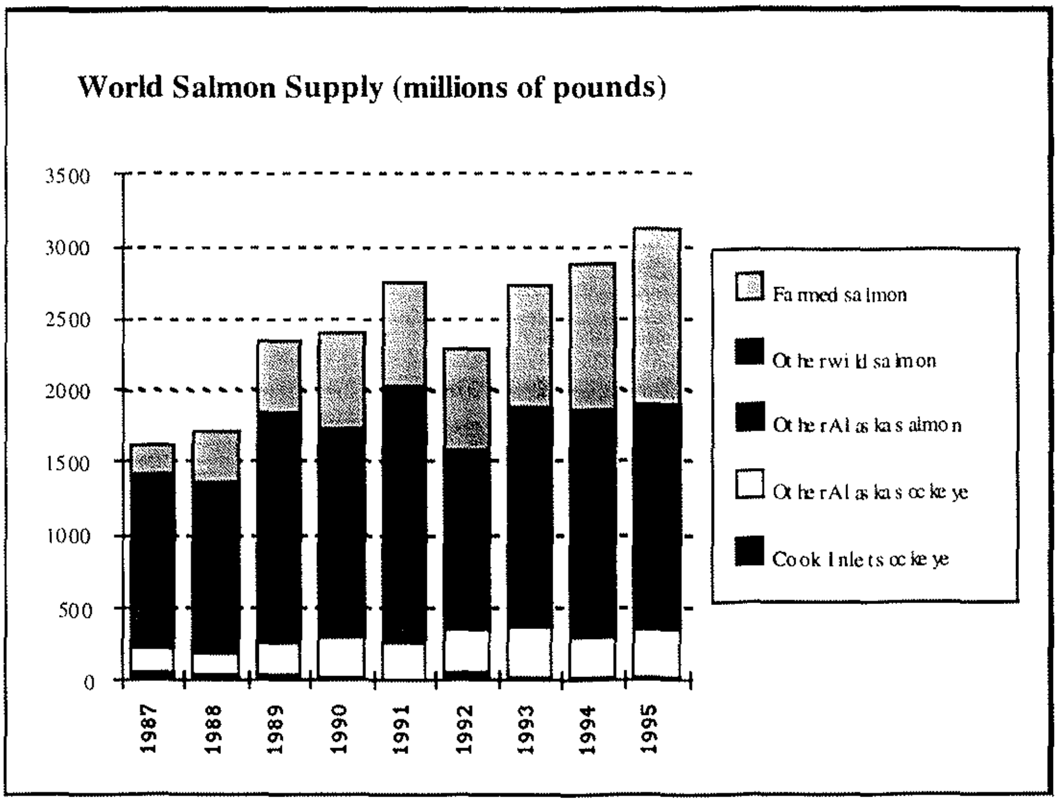


Table B-18 provides the results of a simple ordinary least squares regression of the ex-vessel price of Bristol Bay sockeye salmon against total Alaska sockeye harvests. The estimated coefficient for the total Alaska harvest is negative (as expected), but is significant only at the 7 percent level (t statistic = -1.95). The results suggest the obvious: more factors than sockeye harvests affect the price of sockeye salmon. These factors probably include—to name just a few—exchange rates, Japanese economic conditions, world supply of competing salmon species, and long-run trends in Japanese tastes and the Japanese distribution system.

Formal econometric measurement of the effects of these factors, and how Alaska sockeye prices might change in response to a reduction in average Cook Inlet sockeye harvests would require the specification of a system of equations modeling supply and demand in all the Kenai River red salmon markets as well as the markets for all substitutes. The complexity of the world salmon market, as well as the absence of data for many important variables, would complicate estimation of such a model.

Herrmann (1993) and Herrmann, Mittelhammer, and Lin (1992) attempted to estimate a full econometric model of Alaska salmon demand. In order to obtain enough observations to estimate their model, however, they estimate equations to explain quarterly price movements. Models estimated to explain monthly or quarterly price changes are likely to give biased and misleading results when applied to long-term changes in supplies. The reason is that the change in equilibrium prices that follows from a permanent reduction in Cook Inlet harvests is likely to be much smaller than the temporary fluctuations within the year. Over a longer period of time, wholesalers and consumers have more time to locate and acquire substitutes for Alaska sockeye. Increasingly, farmed salmon are emerging as such a substitute. In the long run, the price of farmed salmon will largely determine prices of all wild salmon species. Not enough data are yet available to estimate an econometric supply relationship for farmed salmon, but the abundance of potential sites and producing areas suggest that the long-run supply is likely to be highly elastic. Any long-term rise in salmon prices would be eliminated by an increase in farmed supply. Since the investment in farmed stock would take a few years to hit the market, the dampening effect on price fluctuations would not be visible in annual data.

This means that econometric models with high historical explanatory power probably give biased and misleading results when applied to the analysis of the effects of long-term changes in salmon supply on salmon prices. The world salmon industry is in a time of rapid change due to the very rapid growth of world farmed salmon supply. The change in equilibrium prices due to a permanent reduction in Cook Inlet harvests is certain to be much smaller than the price effects of temporary—even year-to-year--fluctuations.

In sum, then, if average Cook Inlet sockeye harvests were reduced, Alaska residents who fish commercially for sockeye in other parts of Alaska might enjoy a small increase in price. We did not estimate this potential increase in value to other Alaska resident fishermen, and we believe that it would be extremely difficult to do so with any degree of reliability. However, we believe that the supply response would be elastic,so that the additional value due to the higher price would be less—probably much less—than the loss in value to Cook Inlet fishermen. It would be further offset because a substantial share of the total Alaska sockeye harvest is caught by non-resident fishermen, in particular in Bristol Bay.

Table B-18. Regression Analysis of Factors Affecting Bristol Bay Ex-Vessel Price: Effects of Total Alaska Sockeye Harvest

	Data Used for Regression	
	Bristol Bay real ex-vessel price ($1994)	Total Alaska sockeye harvest
1980	$0.90	186,700
1981	$1.12	225,956
1982	$0.95	188,550
1983	$0.88	305,641
1984	$0.86	222,699
1985	$1.06	221,508
1986	$1.78	194,557
1987	$1.74	224,831
1988	$2.62	188,553
1989	$1.52	260,671
1990	$1.25	305,969
1991	$0.82	255,519
1992	$1.18	345,810
1993	$0.69	379,110
1994	$0.97	294,160
1995	$0.73	352,649

ISER file: Price regressions.

Dependent variable: Bristol Bay price
Independent variable: Total Alaska harvest

Regression Statistics

Multiple R	.46
R Square	.21
Adjusted R Square	.16
Standard Error	0
Observations	16

Analysis of Variance

	df	*Sum of Squares*	*Mean Square*	*F*
Regression	1.000	0.811	0.811	3.78674
Residual	14.000	2.997	0.214	
Total	15.000	3.807		

	Coefficients	*Standard Error*	*t Statistic*	*P-value*
Intercept	2.141	0.501	4.27	0.00067
Total Alaska harvest	-0.00000366	0.00000188	-1.95	0.07064

References for Market Effects Section

Herrmann, M. (1993). "Using an International Econometric Model to Forecast Alaska Salmon Revenues," *Marine Resource Economics* 8: 249-271.

Herrmann, M., R. Mittelhammer, and B.-H. Lin (1992). "Applying Almon-Type Polynomials in Modeling Seasonality of the Japanese Demand for Salmon," *Marine Resource Economics* 7: 3-14.

Appendix C

Documentation of Analysis of Changes in Economic Impacts of the Sport Fishery

Table C-1. Overview of Resident and Non-Resident Fishing Trips and Expenditures

	Alaska Residents (a)				Non-Residents (a)			
	All Southcentral Alaska trips	All Kenai River trips	All Kenai River July trips	Kenai July trips for "red salmon" or "salmon"	All Southcentral Alaska trips	All Kenai River trips	All Kenai River July trips	Kenai July trips for "red salmon" or "salmon"
Estimated number of households which took trips	60,678	24,464	14,071	7,603	57,985	32,074	13,022	7,872
Estimated total trips (b)	625,896	163,204	77,887	52,278	98,645	37,616	15,263	8,406
Sample size for detailed expenditure data	*823*	*168*	*61*	52	*3,688*	*1,403*	*572*	*315*
Estimated 95% conf. interval for total trips (b)	*+/-16.6%*	*+/-37%*	*+/-44%*	*+/-54.4%*	*+/-3.7%*	*+/-5.2%*	*+/-8.5%*	*+/-12.9%*
Average trips per household	10.3	6.7	5.5	6.9	1.7	1.2	1.2	1.1
Estimated total fishing days (c)	1,138,946	266,023	147,354	105,201	285,370	131,997	53,742	37,381
Average number of days per trip	1.8	1.6	1.9	2.0	2.9	3.5	3.5	4.4
Average number of days per household	18.8	10.9	10.5	13.8	4.9	4.1	4.1	4.7
Estimated expenditures (d)								
Food (e)	$20,016,367	$4,650,834	$2,117,121	$1,858,172	$5,015,227	$2,307,687	$772,143	$536,164
Lodging and camping	$3,358,807	$533,092	$198,966	$165,227	$4,439,637	$2,363,099	$980,164	$582,580
Tackle, bait and miscellaneous	$24,442,375	$3,035,472	$1,438,840	$1,018,132	$5,050,625	$2,488,969	$979,951	$634,663
Charter and guide services, total	$7,401,687	$793,938	$173,095	$86,548	$15,520,598	$6,005,653	$2,779,213	$1,089,339
Air charter	$1,893,289							
Boat charter	$4,660,811	$496,553	$173,095	$86,548				
Guide services (g)	$847,587	$297,385						
Fish processing (f)					$1,689,110	$666,518	$355,994	$161,932
Commercial transportation	$768,783	$156,881	$143,182		$1,394,276	$716,551	$292,512	$193,726
Boat maintenance and investment (h)	$8,939,473	$1,477,376	$649,509	$472,788	$1,879,662	$541,049	$272,526	$156,894
Vehicle maintenance and investment (h)	$15,027,271	$4,011,599	$1,934,150	$1,334,666	$4,509,683	$2,227,624	$966,448	$672,653
Fuel	$13,948,170	$2,066,464	$984,574	$759,811				
Other transportation expenditures (i)	$2,929,824	$311,206	$55,360	$2,911				
Plane maintenance	$582,799	$76,489	$76,489					
TOTAL	$97,415,556	$17,113,351	$7,771,286	$5,698,255	$39,498,818	$17,317,150	$7,398,951	$4,027,951
Estimated 95% conf. interval for total expend.	*+/-11.7%*	*+/-23.7%*	*+/-34.7%*	*+/-34.7%*	*+/-6.4%*	*+/-10.9%*	*+/-18.1%*	*+/-24.6%*
Estimated expenditures per trip								
Food (e)	$31.98	$28.50	$27.18	$35.54	$50.84	$61.35	$50.59	$63.78
Lodging and camping	$5.37	$3.27	$2.55	$3.16	$45.01	$62.82	$64.22	$69.31
Tackle, bait and miscellaneous	$39.05	$18.60	$18.47	$19.48	$51.20	$66.17	$64.20	$75.50
Charter and guide services, total	$11.83	$4.86	$2.22	$1.66	$157.34	$159.66	$182.09	$129.59
Air charter	$3.02							
Boat charter	$7.45	$3.04	$2.22	$1.66				
Guide services (g)	$1.35	$1.82						
Fish processing (f)					$17.12	$17.72	$23.32	$19.26
Commercial transportation	$1.23	$0.96	$1.84		$14.13	$19.05	$19.16	$23.05
Boat maintenance and investment (h)	$14.28	$9.05	$8.34	$9.04	$19.05	$14.38	$17.86	$18.66
Vehicle maintenance and investment (h)	$24.01	$24.58	$24.83	$25.53	$45.72	$59.22	$63.32	$80.02
Fuel	$22.29	$12.66	$12.64	$14.53				
Other transportation expenditures	$4.68	$1.91	$0.71	$0.06				
Plane maintenance	$0.93	$0.47	$0.98					
TOTAL	$155.64	$104.86	$99.78	$109.00	$400.41	$460.37	$484.76	$479.18
Estimated total expenditures per day	$85.53	$64.33	$52.74	$54.17	$138.41	$131.19	$137.68	$107.75

(a) Data for Alaska residents are for all trips originating from southcentral Alaska, May through October. Most of these trips are to southcentral Alaska sites. Thus, these data include a small number of trips to sites outside of southcentral Alaska, and exclude a small number of trips to southcentral Alaska sites originating in other parts of Alaska. Data for non-residents are for all trips, January through December, to southcentral Alaska sites. (b) Trips represent household trips, not angler trips. If three people from one household take a trip together, this counts as one trip. A percentage range for a 95% confidence interval for total trips was estimated as (1.96 x standard error of the mean)/mean trips per household. (c) Days represent household days, not angler days. If three people from one household take a one-day trip, this counts as one household day. (d) Expenditure categories differ between residents and non-residents, due to differences in the amount of detail in data collection and coding. There are also slight differences between residents and non-residents in what is included in each expenditure category. For this reason, comparisons of resident and non-resident expenditures are more accurate than totals than for individual categories. (e) Non-resident food expenditures were estimated based on resident food expenditures. (f) For residents, fish processing is included in "tackle, bait and miscellaneous." (g) Of the 1800 trips by Alaska residents in 1993 for which we collected detailed expenditure information, there were 3 July trips to Kenai River sites, by 2 households, which reported using guide services. For all three trips, the households reported zero expenditures for guides. There are several potential explanations, such as the possibility that the anglers were given guided trips as presents (resulting in no expenditures by the angling household) or that the guides were friends of the household and provided the guiding services for free. (h) For non-residents, category includes rentals (but not charters). Includes fuel expenditures for non-residents. (i) Includes rentals, fuel payments for friends vehicles and other miscellaneous expenditures on vehicles not owned by the household. (i) A percentage range for a 95% confidence interval for total expenditures was calculated by (first) summarizing all expenditures by trip, (second) calculating the mean and the standard error of the mean of total expenditures per trip, and (third) using the same formula as described in note (b) above. ISER file: Res & Non-Res. Profile.

Table C-2. Allocation of Estimated Non-Resident Expenditures for Kenai River July Trips to Cook Inlet Salmon Economic Impact Model Expenditure Categories

Table C-1 expenditure category	Expenditures	Cook Inlet Salmon Economic Impact Model category	% of Table VIII-1 category	Expenditures
Food	$536,164	Food	100.0%	$536,164
Lodging	$582,580	Lodging	100.0%	$582,580
Tackle, bait and miscellaneous	$634,663	All other trip-related expenditures	100.0%	$634,663
Charter and guide services, total	$1,089,339	Boat charter	33.0%	$359,482
		Guide services	67.0%	$729,857
Fish processing	$161,932	Guide services	100.0%	$161,932
Commercial transportation	$193,726	Commercial transport	100.0%	$193,726
Boat maintenance and investment	$156,894	Fuel	50.0%	$78,447
		Personal transportation, parts	25.0%	$39,224
		Personal transportation, repair	25.0%	$39,224
Vehicle maintenance and investment	$672,653	Fuel	50.0%	$336,327
		Personal transportation, parts	25.0%	$168,163
		Personal transportation, repair	25.0%	$168,163
TOTAL	$4,027,951	TOTAL		$4,027,951

Note: Data are for Kenai River July trips for "red salmon" or "salmon."
ISER file: Res & Non-Res Profile.

Table C-3. Estimation of Expenditures per $Million of Total Expenditures for Kenai River July Trips, by Cook Inlet Salmon Economic Impact Model Categories

Cook Inlet Salmon Economic Impact Model category	Estimated total non-resident expenditures (a)	Distribution of expenditures		Expenditures per $million	
		Residents (b)	Nonresidents	Residents	Nonresidents
Food	$536,164	27.2%	13.3%	$272,000	$133,111
Lodging	$582,580	2.6%	14.5%	$26,000	$144,634
All other trip-related expenditures	$634,663	18.5%	15.8%	$185,000	$157,565
Commercial transport	$193,726	1.8%	4.8%	$18,000	$48,095
Fuel	$414,774	12.7%	10.3%	$127,000	$102,974
Air charter	0	0.0%	0.0%	$0	$0
Boat charter	$359,482	2.2%	8.9%	$22,000	$89,247
Guide services	$891,789	0.0%	22.1%	$0	$221,400
Personal transportation, repair	$207,387	0.4%	5.1%	$4,000	$51,487
Personal transportation, parts	$207,387	0.4%	5.1%	$4,000	$51,487
Boats, new investment	0	4.1%	0.0%	$41,000	$0
Boat maintenance	0	4.3%	0.0%	$43,000	$0
Plane maintenance	0	1.0%	0.0%	$10,000	$0
Vehicles, new investment	0	14.6%	0.0%	$146,000	$0
Vehicle maintenance	0	10.3%	0.0%	$103,000	$0
TOTAL	$4,027,951	100.0%	100.0%	$1,000,000	$1,000,000

Note: Data are for Kenai River July trips for "red salmon" or "salmon."

(a) See Table C-2.

(b) See Table VII-2.

ISER file: Res & Non-Res Profile.

Table C-4. Assumed Share of Expenditures Made Within the Kenai Peninsula Borough

Type of Expenditure	Trips to the Kenai River	Trips to Other Sites	Changes in non-resident expenditures
Food (a)	75%	30%	75%
Lodging (a)	75%	30%	75%
All other trip-related expenditures (a)	100%	40%	100%
Commercial transport (a)	25%	10%	25%
Fuel (a)	30%	12%	30%
Air charter (a)	0%	0%	0%
Boat charter (a)	100%	40%	100%
Guide services (a)	100%	40%	100%
Personal transportation, repair (b)	15%	6%	0%
Personal transportation, parts (b)	15%	6%	0%
Boats, new investment (b)	2%	1%	0%
Boat maintenance (b)	15%	6%	0%
Plane maintenance (b)	15%	6%	0%
Vehicles, new investment (b)	5%	2%	0%
Vehicle maintenance (b)	15%	6%	0%

Note: We did not collect information in our surveys on where expenditures were made; estimates are our best judgment.
(a) Estimates are less than 100% for trips to the Kenai River because some trip-related expenditures occur outside the Borough. Estimates are greater than 0% for "Other Sites" because many of these sites are located within the Kenai Peninsula Borough.
(b) These expenditures are origin-dependent. Our assumptions reflect our best judgment as to the number of trips originating from the Kenai Peninsula, and where Kenai Peninsula residents make expenditures for repair, parts, investment and maintenance. ISER file: Sport Analysis.

Table C-5.
Estimated Change in Economic Impacts due to Changes in Sport Fishing Expenditures, by Type of Expenditure and Region

	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Estimated change in statewide economic impacts due to changes in expenditures for:									
Resident Kenai River trips	$259,620	$175,909	$435,535	$93,725	$44,662	$138,387	4.8	1.7	6.5
Resident trips to other sites	-$235,500	-$159,644	-$395,155	-$81,415	-$39,569	-$120,984	-4.2	-1.5	-5.7
All non-resident trips (a)	$1,732,300	$1,164,226	$2,896,855	$664,583	$310,342	$974,925	32.9	12.2	45.1
TOTAL	$1,756,420	$1,180,491	$2,937,234	$676,894	$315,435	$992,329	33.5	12.4	45.9
Estimated change in Kenai Peninsula Borough economic impacts due to changes in expenditures for:									
Resident Kenai River trips	$161,038	$105,525	$266,564	$58,393	$27,271	$85,664	3.1	1.1	4.2
Resident trips to other sites	-$56,273	-$36,470	-$92,743	-$19,613	-$9,279	-$28,892	-1.1	-0.4	-1.4
All non-resident trips (a)	$1,278,947	$839,538	$2,118,485	$506,171	$228,797	$734,968	25.5	9.1	34.6
TOTAL	$1,383,713	$908,593	$2,292,306	$544,951	$246,789	$791,740	27.6	9.7	37.3
Estimated change in economic impacts elsewhere in Alaska due to changes in expenditures for:									
Resident Kenai River trips	$98,582	$70,384	$168,971	$35,332	$17,391	$52,723	1.7	0.7	2.3
Resident trips to other sites	-$179,227	-$123,174	-$302,412	-$61,802	-$30,289	-$92,092	-3.1	-1.2	-4.3
All non-resident trips (a)	$453,353	$324,689	$778,369	$158,413	$81,545	$239,958	7.4	3.1	10.5
TOTAL	$372,707	$271,899	$644,929	$131,943	$68,646	$200,589	6.0	2.6	8.6
Regional distribution of changes in economic impacts:									
Kenai Peninsula Borough	79%	77%	78%	81%	78%	80%	82%	79%	81%
Elsewhere in Alaska	21%	23%	22%	19%	22%	20%	18%	21%	19%

Source: Statewide economic impacts from estimates presented in Chapter IX. Kenai Peninsula Borough economic impacts summarized from calculations in Tables C-5, C-6 and C-7. Economics impacts elsewhere in Alaska calculated as difference between statewide impacts and Kenai Peninsula Borough impacts. Note that regional estimates are only approximations, based on "best judgment" estimates of where expenditures are made.

(a) Economic impacts of changes in non-resident trips are for "medium estimate."

ISER file: Sport Analysis, regional.

Appendix D

Documentation of Commercial Fishery Economic Impact Analysis

Table D-1. Change in Commercial Harvest Volume, by Scenario

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price (e)
	A	D	E	A1	A2	A3	A4	A5
Change in drift-net harvest (lbs)								
Sockeye	-360,000	-180,000	180,000	-360,000	-360,000	-2,094,000	0	-2,094,000
Chinook	-2,580	-1,290	1,290	-2,580	-2,580	-7,740	0	-7,740
Coho	-6,400	-3,200	3,200	-6,400	-6,400	-214,400	0	-214,400
Chum	-40,200	-20,100	20,100	-40,200	-40,200	-314,900	0	-314,900
Pink	0	0	0	0	0	-46,200	0	-46,200
TOTAL	-409,180	-204,590	204,590	-409,180	-409,180	-2,677,240	0	-2,677,240
Change in set net harvest (lbs)								
Sockeye	-1,110,000	-555,000	555,000	-1,110,000	-1,110,000	-660,000	0	-660,000
Chinook	-38,700	-19,350	19,350	-38,700	-38,700	-38,700	0	-38,700
Coho	-19,200	-9,600	9,600	-19,200	-19,200	-19,200	0	-19,200
Chum	0	0	0	0	0	0	0	0
Pink	0	0	0	0	0	0	0	0
TOTAL	-1,167,900	-583,950	583,950	-1,167,900	-1,167,900	-717,900	0	-717,900
Change in total commercial harvest (lbs)								
Sockeye	-1,470,000	-735,000	735,000	-1,470,000	-1,470,000	-2,754,000	0	-2,754,000
Chinook	-41,280	-20,640	20,640	-41,280	-41,280	-46,440	0	-46,440
Coho	-25,600	-12,800	12,800	-25,600	-25,600	-233,600	0	-233,600
Chum	-40,200	-20,100	20,100	-40,200	-40,200	-314,900	0	-314,900
Pink	0	0	0	0	0	-46,200	0	-46,200
TOTAL	-1,577,080	-788,540	788,540	-1,577,080	-1,577,080	-3,395,140	0	-3,395,140

* Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

Source: Calculated from ADFG assumptions about changes in number of fish harvested and ISER assumptions about average fish weights, shown in Appendix B. Table B-15. ISER file: Net value changes.

Table D-2. Summary of Information Reported in Interviews with Cook Inlet Processors

	Processor size (lbs processed in 1994)		
	More than 3 million lbs	Less than 3 million lbs	Total
Number of processors interviewed	5	4	9
Pounds processed in 1994			
Kings	525,500	300,000	825,500
Reds	13,490,000	5,870,400	19,360,400
Pinks	1,101,500	197,700	1,299,200
Coho	1,815,500	241,000	2,056,500
Chum	1,667,500	184,000	1,851,500
Salmon (species not specified)	8,600,000	0	8,600,000
TOTAL	27,200,000	6,793,100	33,993,100
Number of employees			
Seasonal employees	885	877	1762
Alaska residents	538	413	952
From Kenai Peninsula	401	360	761
From other parts of Alaska	138	53	191
Non-Residents	347	464	810
Summer administrative employees			
Summer administrative employees	43	25	68
Alaska residents	43	13	56
From Kenai Peninsula	36	13	49
From other parts of Alaska	7	0	7
Non-residents	0	12	12
Estimated total salmon season employment			
Total	928	902	1,830
Resident	581	426	1,008
Non-resident	347	476	822
Employment reported to DEC (a)	850	645	1,495
Estimated employment months per million pounds processed (b)	51.2	199.2	80.8
Estimated residency shares as reported in interviews			
Resident	63%	47%	55%
Non-resident	37%	53%	45%
Estimated residency shares based on Department of Labor data (c)			
Resident	39%	24%	33%
Non-resident	61%	76%	67%
Ownership, by volume (d)			
Resident	78%	65%	75%
Non-resident	22%	35%	25%

Source: Interviews conducted with administrative personnel of Kenai Peninsula salmon processors in November and December of 1994. See Appendix J for interview questions and a summary of responses.
(a) Estimated maximum number of employees using fresh water, as reported on Seafood Processors Permit Applications on file at the Alaska Department of Environmental Conservation.
(b) Based on assumption that the salmon processing season lasts 1.5 months (July 1 through August 15).
(c) Calculated from residency share data reported in Kathryn Lizik and Jeff Hadland, Nonresidents Working in Alaska, 1993 (Alaska Department of Labor, January 1995), weighted by volume processed reported in processor interviews. Note that these data include workers in other plants owned by these companies in more remote regions of Alaska; thus they may understate the resident share on the Kenai Peninsula.
(d) Based on interview responses about processor ownership, weighted by reported volume processed.
ISER file: Processor survey employment.

Table D-3. Pacific Associates' Estimates of Employment and Alaska Expenditures of Kenai Peninsula Seafood Processors, Second and Third Quarters, 1992

	First quarter	Second quarter	Total
Employment			
Average employees/month	1.507	2.424	
Total employee months	4.521	7.272	11.793
EXPENDITURES (e)			
Non-Labor			
Consumables (a)	$501.376	$518.555	$1.019.931
Services (b)	$488.472	$351.543	$840.015
Utilities			
Electric	$357.283	$585.123	$942.406
Water	$70.545	$82.807	$153.352
Sewer	$5.474	$9.030	$14.504
Utilities, total	$433.302	$676.960	$1.110.262
Employee airfare	$193.641	$94.794	$288.435
Other	$3.097	$2.930	$6.027
Scholarships & donations	$11.658	$11.658	$23.316
Labor			
Payroll	$6.552.263	$13.125.597	$19.677.860
Employee benefits (c)	$1.965.679	$3.937.679	$5.903.358
Taxes			
State raw fish tax	$2.209.324	$1.793.639	$4.002.963
Round pounds processed			
Salmon			
Chinook	318.567	136.529	455.096
Sockeye	30.438.289	30.438.289	60.876.578
Coho	1.224.286	1.836.430	3.060.716
Pink	421.534	3.793.809	4.215.343
Chum	616.322	1.483.086	2.099.408
Total	33.018.998	37.688.143	70.707.141
Other species	22.695.730	4.301.625	26.997.355
Total	55.714.728	41.989.768	97.704.496
Payroll per employee month	$1.449	$1.805	$1.669
Employee months/million lbs (d)	81	173	121
Estimated expenditures/lb (d)			
Labor	$.118	$.313	$.201
Employee benefits	$.035	$.094	$.060
Consumables	$.009	$.012	$.010
Services	$.009	$.008	$.009
Utilities	$.008	$.016	$.011
Miscellaneous	$.004	$.003	$.003
State raw fish tax	$.040	$.043	$.041

(a) Consumables were defined for the survey as "those goods which are purchased within Alaska for consumption (such s food, fuel, paper products, household goods, etc.)."
(b) Services were defined for the survey as "those services of a non-consuming nature which are purchased or contracted locally (such as mechanical assistance and repair services)."
(c) Estimated by Pacific Associates at 30 percent of payroll.
(d) Based on total pounds of all species.
(e) Includes only expenditures within Alaska.
(f) Includes employee airfare, other, and scholarships and donations.
Source: Pacific Associates, "The Economic Impact of the Shoreside Processing Industry Upon Alaska During 1992," prepared for the Pacific Seafood Processors Association, March 1994. Tables 6-3, 6-4, 6-6. ISER file: Pacific Associates data.

Table D-4. Estimated Labor Cost per Pound, Based on Department of Labor Processing Employment Data and ADFG Salmon Production Data

	1992	1993	1994	Total
Kenai Peninsula Borough fish processing employment (a)				
July	3,404	3,063	2,620	6,467
August	2,239	2,011	1,888	4,250
Total employment months	5,643	5,074	4,508	10,717
Total Cook Inlet salmon production (lbs) (b)	62,419,022	37,889,158	41,550,673	100,308,180
Estimated employment months per million pounds				
Per processed pound	90	134	108	107
Per round pound, assuming 74% yield	67	99	80	79
Average monthly earnings in fish processing (c)	$1,800	$1,796	$1,954	
Estimated total earnings in fish processing, July & August	$10,157,400	$9,112,904	$8,808,632	
Average labor cost per pound	$0.163	$0.241	$0.212	
Estimated labor cost for analysis (d)				
Per processed pound				$0.209
Per round pound, assuming 74% yield				$0.154

(a) Total Kenai Peninsula fish processing employment, from Alaska Department of Labor, Research and Analysis Division. See Appendix G, Table G-16 for monthly data, 1992-94.
Monthly employment more accurately depicts the number of jobs as opposed to the number of individual workers. It represents the total number of employees during each employer's pay periods which includes the 12th of the month.
(b) Source: Alaska Department of Fish and Game. For more detailed data, see Appendix J, Table J-2.
(c) Source: Alaska Department of Labor, Research and Analysis Division, Employment & Earnings Reports, annual Summary Reports. Data are for annual average monthly earnings over the year in "food and kindred products manufacturing." Average monthly earnings are calculated by dividing yearly earnings by annual average monthly employment. Yearly earnings includes all remuneration paid to workers covering services performed during the year, including commissions, bonuses, and other gratuitites when furnished in connection with the job.
(d) Based on average employment months per million pounds over all three years and 1994 average monthly earnings.
ISER file: DOL employment analysis.

Table D-5. Estimated Changes in Commercial Fishing Annual Average Employment

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	D	E	A1	A2	A3	A4	A5
Estimated total employment, 1994 (a)								
Drift net crew	830	830	830	830	830	830	830	830
Drift net permit holders	621	621	621	621	621	621	621	621
Set net crew-north of Blanchard line	524	524	524	524	524	524	524	524
Set net permit holders-north of Blanch. line	211	211	211	211	211	211	211	211
Set net crew-south of Blanchard line	504	504	504	504	504	504	504	504
Set net permit holders-south of Blanch. line	202	202	202	202	202	202	202	202
Estimated change in hours fished (b)								
Drift net crew	-16	-8	7	-16	-16	-24	0	-28
Drift net permit holders	-16	-8	7	-16	-16	-24	0	-28
Set net crew-north of Blanchard line	-32	-16	17	-32	-32	-25	0	-28
Set net permit holders-north of Blanch. line	-32	-16	17	-32	-32	-25	0	-28
Set net crew-south of Blanchard line	0	0	0	0	0	-12	0	-12
Set net permit holders-south of Blanch. line	0	0	0	0	0	-12	0	-12
Estimated change in employment (c)								
Drift net crew	-6.6	-3.3	2.9	-6.6	-6.6	-10.0	0.0	-11.6
Drift net permit holders	-5.0	-2.5	2.2	-5.0	-5.0	-7.5	0.0	-8.7
Set net crew	-8.4	-4.2	4.5	-8.4	-8.4	-9.6	0.0	-10.4
Set net permit holders	-3.4	-1.7	1.8	-3.4	-3.4	-3.8	0.0	-4.2
Crew, total	-15.0	-7.5	7.4	-15.0	-15.0	-19.5	0.0	-22.0
Permit holders, total	-8.3	-4.2	4.0	-8.3	-8.3	-11.3	0.0	-12.9
Assumed resident shares (d)								
Drift net crew	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%
Drift net permit holders	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%
Set net crew	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%
Set net permit holders	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%
Estimated change in resident employment								
Drift net crew	-4.8	-2.4	2.1	-4.8	-4.8	-7.2	0.0	-8.4
Drift net permit holders	-3.6	-1.8	1.6	-3.6	-3.6	-5.4	0.0	-6.3
Set net crew	-7.4	-3.7	4.0	-7.4	-7.4	-8.5	0.0	-9.2
Set net permit holders	-3.0	-1.5	1.6	-3.0	-3.0	-3.4	0.0	-3.7
Crew, total	-12.3	-6.1	6.1	-12.3	-12.3	-15.7	0.0	-17.6
Permit holders, total	-6.6	-3.3	3.2	-6.6	-6.6	-8.8	0.0	-10.0

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) See estimates in Appendix H, Table H-8. Assumes that 51% of set net permit holders and crew are located north of the Blanchard line, based on estimates for operations shown in Appendix H, Table H-3.

(b) Changes in hours estimated using ISER landings model; see Chapter IX, Table IX-3.

(c) Calculated by multiplying total number of commercial fishermen by changes in hours fished, and dividing by assumed work year of 2000 hours.

(d) See residency assumptions in Chapter VIII, Table VIII-2.

ISER file: Commercial Analysis.

Table D-6. Estimated Wage Component of Changes in Permit Holder Earnings

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	D	E	A1	A2	A3	A4	A5
Estimated total employment, 1994 (a)								
Drift net crew	830	830	830	830	830	830	830	830
Drift net permit holders	621	621	621	621	621	621	621	621
Set net crew	1028	1028	1028	1028	1028	1028	1028	1028
Set net permit holders	413	413	413	413	413	413	413	413
Estimated change in payments to permit holders (b)								
Drift net	-$348,314	-$174,157	$174,157	-$215,031	-$447,501	-$2,156,634	$0	-$1,381,372
Set net	-$943,932	-$471,966	$471,966	-$606,003	-$1,195,413	-$578,334	$0	-$377,403
Total	-$1,292,246	-$646,123	$646,123	-$821,035	-$1,642,915	-$2,734,967	$0	-$1,758,775
Estimated change in payments to crew (b)								
Drift net	-$74,772	-$37,386	$37,386	-$53,255	-$90,785	-$456,007	$0	-$330,849
Set net	-$480,864	-$240,432	$240,432	-$341,493	-$584,583	-$292,962	$0	-$210,093
Estimated average change in payments to crew (per crew member)								
Drift net	-$90.1	-$45.0	$45.0	-$64.2	-$109.4	-$549.4	$0.0	-$398.6
Set net	-$467.8	-$233.9	$233.9	-$332.2	-$568.7	-$285.0	$0.0	-$204.4
Estimated wage component of changes in payments to permit holders (c)								
Drift net	-$55,944	-$27,972	$27,972	-$39,845	-$67,924	-$341,181	$0	-$247,539
Set net	-$193,188	-$96,594	$96,594	-$137,195	-$234,857	-$117,698	$0	-$84,405
Total	-$249,131	-$124,566	$124,566	-$177,040	-$302,781	-$458,879	$0	-$331,944
Assumed resident shares								
Drift net	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%	72.7%
Set net	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%	88.8%
Estimated wage component of changes in payments to permit holders								
Resident	-$212,222	-$106,111	$106,111	-$150,796	-$257,934	-$352,555	$0	-$254,912
Non-Resdent	-$36,910	-$18,455	$18,455	-$26,243	-$44,847	-$106,325	$0	-$77,031
Estimated non-wage component of change in payments to permit holders								
Drift net	-$292,371	-$146,185	$146,185	-$175,187	-$379,577	-$1,815,453	$0	-$1,133,834
Set net	-$750,744	-$375,372	$375,372	-$468,808	-$960,556	-$460,636	$0	-$292,998
Total	-$1,043,114	-$521,557	$521,557	-$643,995	-$1,340,134	-$2,276,088	$0	-$1,426,832
Estimated wage share of change in payments to permit holders								
Drift net	16%	16%	16%	19%	15%	16%		18%
Set net	20%	20%	20%	23%	20%	20%		22%
Total	19%	19%	19%	22%	18%	17%		19%

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) See estimates in Appendix H, Table H-8.

(b) See estimates in Chapter VIII, Table VIII-7.

(c) Assumes that permit holder wage component is the same as average crew payment. Calculated by multiplying number of permit holders by estimated average change in payments to crew.

(d) See residency assumptions in Chapter VIII, Table VIII-2.

ISER file: Commercial Analysis.

Table D-7. Estimated Processing Expenditures in Alaska per Round Pound

Expenditure category	Expenditure per processed pound (a)	Expenditure per round pound (a)	Allocation assumptions within categories	Share of expenditures made in Alaska	Expenditures in Alaska per round pound	Allocation to Cook Inlet Salmon Economic Impact Model expenditure categories: Share	Category
State raw fish tax (b)		$.043		100%	$.043	100%	Payments to resident workers (m)
ASMI assessment (c)		$.004		100%	$.004	100%	Payments to resident workers (m)
Tender services (o)		$.020		100%	$.020	100%	Tendering
Payments to workers (k)	$.209	$.155					
Residents (f)			40%	100%	$.062	100%	Payments to resident workers
Non-residents			60%	100%	$.093	100%	Payments to non-resident workers
Worker benefits (k)	$.052	$.039					
Residents (f)			40%	100%	$.015	100%	Payments to resident workers
Non-residents			60%	100%	$.023	100%	Payments to non-resident workers
Supplies (i)	$.051	$.038		10%	$.004	100%	Supplies
Instate trucking (d)	$.014	$.010		100%	$.010	100%	Instate shipping
Freight, outside Alaska (n)	$.080	$.059		0%	$.000		
Cold storage costs (j)	$.050	$.037		0%	$.000		
Other direct costs (i)	$.046	$.034		100%	$.034		
						50%	Maintenance
						50%	Utilities
Plant overhead (i)	$.200	$.148		75%	$.111		
						20%	Overhead
						20%	Services
						10%	Administration
						50%	Depreciation
Payments to owners (h)		$.213					
Resident (j)			75%	100%	$.160	100%	Payments to resident owners
Non-resident			25%	0%	$.000	100%	Payments to non-resident owners
Total = Average margin (g)		$.800					
Estimated value added/round lb (p)		$.454					

(a) Conversion from round pounds to processed pounds is based on assumed yield of 74%.
(b) Tax is 3.0% of ex-vessel value. Example based on ex-vessel price of $1.43/lb
(c) Assessment is 0.3% of ex-vessel value for on-shore processors producing frozen H&G salmon. Example based on ex-vessel price of $1.43/lb
(c) Examples assume yield of 74%.
(d) Based on assumed Kenai-Anchorage trucking cost of $525 for a 37,000 pound truckload, adjusted for 74 percent yield.
(e) Calculated by multiplying aveage roe wholesale price of $5.95/lb by assumed processing yield of 4%.
(f) Residency share assumed based on interviews with Kenai Peninsula processors and Alaska Department of Labor data, as reported in Appendix D, Table D-2. We assumed a resident share of 40%, which is between the two other estimates.
(g) See Chapter IX, Table IX-10 for estimation of average margin per round pound.
(h) Calculated by subtracting all other expenditures from average margin. This figure may be an overestimate, to the extent that other expenditures are underestimated.
(i) Cost estimate provided by Craig Wiese, University of Alaska Marine Advisory Program, based on interviews with Alaska processors.
(j) ISER estimate.
(k) We estimated average payment to workers of $.209/processed pound, based on Kenai Peninsula processing employment and Cook Inlet Salmon production (see Appendix D, Table D-4). We estimated employee benefits and employee taxes as 25% of payments to workers.
(m) The model does not estimate separate economic impacts of taxes; we assume taxes have the same economic impact as household income.
(n) Cost estimate based on Anchorage-Seattle shipping rates.
(o) Assumes 10% of harvest is tendered at a tender cost of $.20/lb.
(p) Calculated as taxes plus payments to workers and owners.
ISER file: Processor expenditure assumpt.

Table D-8. Estimated Changes in Commercial Harvesters' Expenditures

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	D	E	A1	A2	A3	A4	A5
Change in expenditures (a)								
Drift net	-$114,840	-$57,420	$57,420	-$114,840	-$114,840	-$667,986	$0	-$667,986
Set net	-$222,000	-$111,000	$111,000	-$222,000	-$222,000	-$132,000	$0	-$132,000
Share of change in expenditures: (b)								
Drift net								
Fuel	16.1%	16.1%	16.1%	16.1%	16.1%	16.1%	16.1%	16.1%
Food	22.6%	22.6%	22.6%	22.6%	22.6%	22.6%	22.6%	22.6%
Boat or camp supplies	13.6%	13.6%	13.6%	13.6%	13.6%	13.6%	13.6%	13.6%
Equipment repair	38.2%	38.2%	38.2%	38.2%	38.2%	38.2%	38.2%	38.2%
Other Supplies	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%
Set net:								
Fuel	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%
Food	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%
Boat or camp supplies	19.4%	19.4%	19.4%	19.4%	19.4%	19.4%	19.4%	19.4%
Equipment repair	24.8%	24.8%	24.8%	24.8%	24.8%	24.8%	24.8%	24.8%
Other Supplies	7.6%	7.6%	7.6%	7.6%	7.6%	7.6%	7.6%	7.6%
Estimated change in expenditures: (c)								
Drift net								
Fuel	-$18,522	-$9,261	$9,261	-$18,522	-$18,522	-$107,734	$0	-$107,734
Food (d)	-$13,000	-$6,500	$6,500	-$13,000	-$13,000	-$75,615	$0	-$75,615
Boat or camp supplies	-$15,648	-$7,824	$7,824	-$15,648	-$15,648	-$91,020	$0	-$91,020
Equipment repair	-$43,884	-$21,942	$21,942	-$43,884	-$43,884	-$255,258	$0	-$255,258
Other Supplies	-$10,787	-$5,393	$5,393	-$10,787	-$10,787	-$62,743	$0	-$62,743
Set net								
Fuel	-$65,397	-$32,698	$32,698	-$65,397	-$65,397	-$38,884	$0	-$38,884
Food (d)	-$20,812	-$10,406	$10,406	-$20,812	-$20,812	-$12,375	$0	-$12,375
Boat or camp supplies	-$42,964	-$21,482	$21,482	-$42,964	-$42,964	-$25,546	$0	-$25,546
Equipment repair	-$55,133	-$27,567	$27,567	-$55,133	-$55,133	-$32,782	$0	-$32,782
Other Supplies	-$16,881	-$8,441	$8,441	-$16,881	-$16,881	-$10,038	$0	-$10,038
Estimated total change in expenditures								
Fuel	-$83,918	-$41,959	$41,959	-$83,918	-$83,918	-$146,619	$0	-$146,619
Food	-$33,812	-$16,906	$16,906	-$33,812	-$33,812	-$87,990	$0	-$87,990
Boat or camp supplies	-$58,613	-$29,306	$29,306	-$58,613	-$58,613	-$116,566	$0	-$116,566
Equipment repair	-$99,017	-$49,509	$49,509	-$99,017	-$99,017	-$288,040	$0	-$288,040
Other Supplies	-$27,668	-$13,834	$13,834	-$27,668	-$27,668	-$72,781	$0	-$72,781

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) Based on estimates of change in harvest value, expenditures, and earnings, shown in Chapter VIII, Table VIII-7.

(b) Estimated shares of 1994 variable costs, calculated from data in Chapter VIII, Table VIII-4.

(c) Estimated by multiplying share of change in harvest cost by change in costs.

(d) We assume that food expenditures in Alaska change by only 50% of the change in food costs for fishing operations. See discussion in text.

ISER file: Commercial Analysis.

Table D-9. Assumptions Used to Estimate Changes in Processing Expenditures

	Scenario Name and Code*							
	+200K at sonar	+100K at sonar	-100K at sonar	Low price	High price	Low run	High run	Low run, low price
	A	D	E	A1	A2	A3	A4	A5
Change in total pounds harvested (a)	-1,577,080	-788,540	788,540	-1,577,080	-1,577,080	-3,395,140	0	-3,395,140
Change in Alaska processing expenditures per change in in round pounds processed (b)								
Utilities	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Supplies	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Services	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Tendering	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Instate shipping	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Maintenance	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Depreciation	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056
Administration	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Overhead	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Payments to resident workers	0.125	0.125	0.125	0.110	0.135	0.125	0.125	0.110
Payments to non-resident workers	0.116	0.116	0.116	0.116	0.116	0.116	0.116	0.116
Payments to resident owners	0.160	0.160	0.160	0.174	0.149	0.160	0.160	0.174
Payments to non-resident owners	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estimated total change in processor Alaska expenditures								
Utilities	-$26,842	-$13,421	$13,421	-$26,842	-$26,842	-$57,785	$0	-$57,785
Supplies	-$5,952	-$2,976	$2,976	-$5,952	-$5,952	-$12,813	$0	-$12,813
Services	-$35,011	-$17,506	$17,506	-$35,011	-$35,011	-$75,372	$0	-$75,372
Tendering	-$31,542	-$15,771	$15,771	-$31,542	-$31,542	-$67,903	$0	-$67,903
Instate shipping	-$16,339	-$8,169	$8,169	-$16,339	-$16,339	-$35,174	$0	-$35,174
Maintenance	-$26,842	-$13,421	$13,421	-$26,842	-$26,842	-$57,785	$0	-$57,785
Depreciation	-$87,528	-$43,764	$43,764	-$87,528	-$87,528	-$188,430	$0	-$188,430
Administration	-$17,506	-$8,753	$8,753	-$17,506	-$17,506	-$37,686	$0	-$37,686
Overhead	-$35,011	-$17,506	$17,506	-$35,011	-$35,011	-$75,372	$0	-$75,372
Payments to resident workers	-$196,378	-$98,189	$98,189	-$173,999	-$213,032	-$422,763	$0	-$374,586
Payments to non-resident workers	-$182,933	-$91,467	$91,467	-$182,933	-$182,933	-$393,819	$0	-$393,819
Payments to resident owners	-$252,110	-$126,055	$126,055	-$274,489	-$235,456	-$542,743	$0	-$590,920
Payments to non-resident owners	$0	$0	$0	$0	$0	$0	$0	$0

*Assumptions and analysis for Scenarios B and C are the same as for Scenario A.

(a) Estimated by multiplying change in number of fish harvested by average weight per fish. See Appendix D, Table D-1 for details of estimates.

(b) See Table Appendix D, Table D-7 for calculation of assumptions. Changes in fisheries business taxes and ASMI assessment are included in "payments to resident workers," because they are assumed to have the same economic impact. Slight differences between scenarios in payments to resident workers and payments to resident owners reflect differences in fisheries business taxes and aquaculture assessments, due to differences in ex-vessel prices.

ISER file: Commercial Analysis.

Table D-10. Estimated Changes in Commercial Fishing and Processing Expenditures in the Kenai Peninsula Borough

Type of Expenditure	Estimated change in expenditures, Scenario A (a)	Assumed share of Alaska expenditures made within the Kenai Peninsula Borough (b)	Estimated change in expenditures in the Kenai Peninsula Borough
HARVESTER EXPENDITURES			
Fuel	-$58,613	77%	-$45,132
Food	-$99,017	67%	-$66,342
Boat or camp supplies	-$27,668	75%	-$20,751
Equipment repair	-$481,367	71%	-$341,770
Other supplies	-$74,269	79%	-$58,673
Payments to resident crew	-$1,091,436	100%	-$1,091,436
Payments to non-resident crew	-$200,810	100%	-$200,810
Payments to resident permit holders	$0	100%	$0
Payments to non-resident permit holders	-$26,842	0%	$0
PROCESSOR EXPENDITURES			
Utilities	-$35,011	90%	-$31,510
Supplies	-$31,542	80%	-$25,233
Services	-$16,339	50%	-$8,169
Tendering	-$26,842	100%	-$26,842
Instate shipping	-$87,528	50%	-$43,764
Maintenance	-$17,506	100%	-$17,506
Depreciation	-$35,011	100%	-$35,011
Administration	-$196,378	100%	-$196,378
Overhead	-$182,933	100%	-$182,933
Payments to resident workers	-$252,110	90%	-$226,899
Payments to non-resident workers	$0	90%	$0
Payments to resident owners	$0	90%	$0
Payments to non-resident owners	$0	0%	$0

(a) See Chapter X, Table X-5. (b) Share is percentage of Alaska expenditures only; the Cook Inlet Salmon Economic Impact Model coefficients already reflect adjustments for expenditures made outside Alaska. Assumed shares for harvester expenditures are based on responses to Question A-13 of the permit holder survey. Assmptions for payments to crew, permit holders, processing workers and processor owners are by place of work rather than by place of residence. Assumed shares for processor expenditures are best judgments of ISER researchers. ISER file: Commercial Analysis, regional.

Table D-11. Approximate Kenai Peninsula Borough Share of Economic Impacts, Scenario A

Type of Economic Impact	Estimated impact, Scenario A (a)	Assumed Kenai Peninsula Borough Share (b)	Estimated impacts: Kenai Peninsula Borough	Estimated impacts: Elsewhere in Alaska
Change in Alaska Output				
Commercial fishing	-$1,847,882	100%	-$1,847,882	$0
Fish processing	-$715,458	90%	-$643,912	-$71,546
Other industries	-$2,562,919	86%	-$2,198,162	-$364,757
Total (c)	-$5,126,259	*91%*	-$4,689,956	-$436,302
Change in Alaska Payroll				
Commercial fishing	-$804,768	100%	-$804,768	$0
Fish processing	-$242,870	90%	-$218,583	-$24,287
Other industries	-$736,812	86%	-$636,536	-$100,276
Total (c)	-$1,784,450	*93%*	-$1,659,887	-$124,563
Change in Alaska Employment				
Commercial fishing	-23.4	100%	-23.4	0.0
Fish processing	-10.4	90%	-9.3	-1.0
Other industries	-30.2	87%	-26.4	-3.8
Total (c)	-63.9	*92%*	-59.1	-4.8

(a) Estimates presented in Table X-9.
(b) Note that the assumed Kenai Peninsula Borough share is by place of work, rather than place of residence. Thus for these estimates, an Anchorage resident fishing in Cook Inlet is assumed to be generating Kenai Peninsula Borough employment. Assumptions about the Kenai Peninsula Borough share for "other industries" are calculated based on the assumed Kenai Peninsula Borough share of expenditures presented in Table D-10. Impacts by place of residence would likely be lower.
(c) Kenai Peninsula Borough share estimated by dividing estimated impacts in the Kenai Peninsula Borough by total estimated impacts.
ISER file: Commercial Analysis, regional.

Appendix E

Survey Descriptions

Appendix E. Survey Descriptions

Resident Sport Angler Survey

Objective

The purpose of this survey was to collect information to calculate the economic benefits and economic impacts for resident Alaska sport anglers, including dip netters, of changing the allocation of late run Kenai River red salmon. Economic benefits are measured by "willingness to pay" and economic impacts are measured by the employment and income generated by sport angler expenditures. The survey provided information for calculating "willingness to pay" using both travel cost and contingent value methodologies. The data from the survey gave us sport fishing expenditure information and contingent behavior information for calculating economic impacts.

Design Considerations

Marginal Change

The contingent value and contingent behavior questions were difficult to construct. The purpose of these questions was to get respondents to tell us how their "willingness to pay" and behavior would change if the allocation of late run Kenai River red salmon were to change. Meaningful responses require that the respondent understand both the change which is proposed and the base from which the change is made. This study is concerned not with the overall or aggregate benefits and economic impact of the sport fishery, but rather with an incremental change in benefits and impact resulting from a change in the allocation of the resource among different users.

Respondents would naturally reference conditions in 1994 in thinking about their responses, so those conditions are the baseline for measuring change. Fortunately there were no major events during the short season which would suggest the responses would not be representative of an average year, but the responses cannot obviously be representative of all conditions in all years. Since the willingness to pay for a change in allocation is contingent upon exactly what changes (total catch, catch rates, timing of commercial closures, and other considerations) as well as the size and direction of the change, it is important to identify and describe the change as completely as possible. At the same time we had to be careful to not confuse or tire the respondent. Describing a change in allocation was complicated by the fact that there are a number of possible regulatory devices for implementing any change. For example, values and behavior might be contingent on the type of regulatory mechanism used to implement the change. A change in the allocation of red salmon would also change the amount of king salmon, a fish more valuable to sport fishermen than the red salmon. In addition, changing the allocation would change the catch rate and the number of anglers.

Payment Vehicle for Contingent Value

The contingent valuation payment vehicle, the technique where respondents state the amount they are willing to pay for the hypothetical change in allocation, posed two problems. First, it is important that the payment vehicle be as realistic as possible so respondents to think realistically about a payment amount. It was difficult to devise a realistic payment vehicle for a marginal change in allocation, rather than a payment vehicle for valuing the total allocation, both in terms of a mechanism and in terms of ease of understanding. For example, a special ticket to fish for late run Kenai red salmon would include the fishing that is already occurring as well as any additional fishing that might result from an increase in allocation. A second difficulty was that respondents might have strong feelings about how the new funds might be spent and, thus, influence their responses. For example a payment vehicle which collects funds to use for intensive management could be opposed by an individual who feels that management is inefficient.

USE OF PREVIOUSLY COLLECTED DATA

ISER conducted a statewide survey of sport fishermen for the Alaska Department of Fish and Game in 1993, that collected information on sport fishing expenditures and trip characteristics. ISER used the data from this survey to construct a travel cost model which has been used to measure sport anglers willingness to pay for sport fishing opportunities. The data has also been used to calculate the level of expenditures associated with sport fishing activity in the state.

By using the data from this 1993 survey, we were able to shorten the 1995 survey. As a result the 1995 survey did not include questions about detailed trip characteristics or expenditure information.

One problem with the 1993 data is that we believe that there was underreporting of the actual number of fishing trips taken by sport anglers, particularly by those who took many trips. We addressed this problem by weighting reported trips, with the trip weight based on reported 1992 summer and winter fishing trips, the number of trips respondents expected to take in 1993, and the number of fishing trips taken in 1994, gathered in the 1995 survey. We don't believe that underreporting of the number of trips produced a bias in the estimate of expenditures per trip or in the distribution of expenditures across categories.

1993 Sample Design

A sample of telephone numbers was selected using a procedure known a random digit dial. In this procedure the sample frame contains all residential telephone prefixes in the state, including residential prefixes on military bases. ISER has designed a computer program that selects a sample of phone numbers using two methods. In more populated areas, ones with more than 2,500 residential tie lines (i.e., assigned telephone numbers), random four digit numbers within each prefix were generated. Samples were drawn so that the number of households selected in each prefix was, within random error, proportional to the size of the prefix. Thus, a prefix with 5,000 residential ties had a sample size twice that of a prefix with 2,500 residential ties.

In areas where the prefix had fewer than 2,500 residential ties, the residential numbers contained in the most current telephone directories were entered directly into the computer. The samples were then drawn in proportion to the number of residential ties in the prefix.

A selected telephone number could not be replaced unless: (1) it was a non-working number; (2) it was a business number; (3) an adult in the household declined to participate in the survey on two separate phone calls; (4) repeated attempts over at least a four day period, including both daytime and evening hours, failed to reach anyone at the dialed number; (5) it was not an eligible household (e.g. a hospital room); or (6) no one in the household had sport fished within the past three years and did not anticipate fishing in the next year.

1993 Respondent Selection

Once the interviewer determined that the number reached was a residence, the respondent was asked if a member of the household had sport fished in Alaska within the past three years or anticipated fishing in the next year. If a member of the household had fished or anticipated fishing, the interviewer asked to speak with the person who knew the most about the household's fishing activities. If no one had fished and didn't anticipate fishing, no more questions were asked. To ensure that each household heard the same definition of sport fishing, all interviewers read the same description verbatim.

1993 Pre-Season Questionnaire

In June of 1993, 1355 Alaska residents were interviewed. These respondents were asked about the number of fishing trips the household took in 1992, about winter fishing trips (November 1992-April 1993), about the demographics of the household, and questions about the equipment used on fishing trips such as vehicles, boats, or planes. The questions about equipment went into detail about the age, purchase price, current value, fuel consumption, fixed and variable costs, and amount of use on fishing trips in the previous year for each piece of equipment. All of the above information was used in developing the travel cost model. In addition, respondents were asked about the reasons why they fish, their sources of information for fishing locations, and the importance of different reasons in the decision of where to fish.

These respondents were also asked if they would be willing to complete a diary of their fishing trips taken in the summer of 1993. Those respondents who said they would complete the diary were asked for their mailing address. Once a month trip diaries were mailed to these respondents and they were asked to complete a diary for a subset of their fishing trips and to return the diaries through the mail. Respondents gave detailed information about the location of trips, target species, and expenditures while on a fishing trip. Those respondents who didn't complete diaries were asked these questions when they were reinterviewed in the post-season survey.

1993 Post-Season Survey

In October of 1993, the Sport Fish Division of the Alaska Department of Fish and Game attempted to reinterview the respondents who had been interviewed the previous June. They were able to complete interviews with 918 of the previously interviewed 1,355 respondents. This post-season questionnaire asked if the household still owned the equipment described in the June interview and about any equipment purchased since June. Respondents were asked about different policy options for certain fisheries and if someone in the household had fished in one of these fisheries in the past three years. Finally, those respondents who had not completed diaries on their summer fishing trips, completed them over the phone. All respondents were asked about their autumn fishing trips. This detailed information about fishing trips was used in developing the travel cost model.

1995 Questionnaire

The household was the unit of analysis in this questionnaire, thus, questions were framed around the household's activities and expenditures rather than being framed around an individual's activities and expenditures. There were three sections in the questionnaire.

Section A included questions about fishing activities including characteristics of the trips taken and reasons for sport fishing.

Section B included contingent value and contingent behavior questions. For each of three possible sets of changes, we asked anglers how their fishing would change and how much they would be willing to pay for a fish stamp to allow them to fish, given the changes. We asked about:

1. A higher bag limit for the hook and line fishery. Anglers were asked how their fishing would change if they could keep six fish per day, rather than three, from the start of the season. We then asked about their willingness to pay for a fish stamp for the higher bag limit. When asking about their willingness to pay for a fish stamp, we said that the proceeds would finance either salmon habitat improvements, or would buy out some commercial permits to reduce the commercial allocation.

2. More fish in the river that would result in a shorter times to catch a fish. When asking how respondents' fishing would change, we varied the increase in escapement (either 100,000 or

200,000 more fish), reduced the average time to catch a fish (15%, 25%, or 35% less time), and increased crowding (5, 10, or 15% more anglers).

3. Changes in the dipnet fishery. Given increases in escapement, we asked whether the respondent preferred a higher bag limit or longer season in the dipnet fishery. Then, given their preferred option, we asked how their fishing behavior would change and about their willingness to pay for a fish stamp.

In the "willingness to pay" questions the respondents were asked if they would be willing to pay more than a specified bid amount for a fish stamp to finance the change. Depending on the response, a second bid price was presented and respondents again indicated if they would be willing to pay more than that second bid price (dichotomous choice contingent value). All the bid prices were varied randomly among respondents.

The section ended with a series of questions about changes in non-fishing activities given a change in the amount of time spent fishing.

Section C asked for general background information about the household including number of anglers in the household, annual income, and potential fishing related capital expenditures.

Instrument Development

Focus Group

Prior to development of the survey a focus group session was held in Soldotna including invited representative of sport fishing interest groups as well as the general public. There were several objectives for the focus group session. The first was to describe the project approach for the calculation of economic benefits and economic impacts. The second was to describe the types of information we would be collecting through the survey. The third was to get feedback from participants regarding how changes in allocation would impact characteristics of sport fish use of the river, what regulations would be most reasonable to implement an allocation change, and what factors influence sport fisherman behavior. This feedback was used to construct the questions used in the survey.

Peer Review and Study Team Review

Peer reviewers critiqued a preliminary version of the questionnaire. They suggested many changes in the questions to improve the quality of the responses, particularly the contingent value and contingent behavior questions where specification of the cases and payment vehicles is most important. The study team also reviewed versions of the questionnaire as it was being developed. Considerable time and effort went into making the survey as short and concise as possible since "respondent fatigue" was a concern.

Pretest

The questionnaire was pretested on 30 people to filter out confusing questions and terms, confirm that the cases described in the contingent value and behavior questions worked, determine the time required to administer the survey, and establish the distribution of bid prices for the contingent value questions.

In the questionnaire, we offered respondents bid prices to estimate their willingness to pay. In pretests, rather than offering bids, we simply asked the respondents how much they would be willing to pay. Based on the pretest responses, we estimated that the non-zero bids were distributed log-normally, with a mean of about \$7, and standard deviation of about \$2. We generated initial bid amounts randomly from this distribution. The second bid price was generated from the portion of the distribution which was higher than the initial bid for respondents who answered 'yes', and lower than the initial bid for respondents who answered 'no.' We asked respondents who answered 'no' to both bids if they would be willing to pay anything, and if not, why not. This was to screen out 'protest bids' of zero by anglers who did value the change but were unwilling to pay for it.

Sample Frame

(1) **Sample size:** The sample size for the sport survey was selected specifically for the dichotomous choice contingent value questions to yield estimates within +/-20% of the true population values 90% of the time. Confidence intervals in dichotomous choice models are discussed in the methodology appendix.

The confidence intervals for the contingent value questions using the dichotomous choice method depend upon how closely the bid amounts approximate the respondents' actual willingness to pay. Pretesting of the questions allowed us to adjust the bid values to approximate actual willingness to pay, but complete accuracy is of course not possible. However as the level of accuracy of the bid amount increases, the standard errors will fall and approach those achieved with any referendum question that has an expected positive response of 50%. We used the variance for the contingent value questions from the Jones and Stokes Southeast Sport Fish study as an estimate of the variance to expect in our study.

(2) **Region sampled:** Analysis of the 1993 statewide sport fish survey indicated that about 90% of the resident sport fishermen fishing for Red Salmon on the Kenai River resided in Southcentral Alaska. Three to four percent come from Fairbanks and the remainder from other locations in the state. By excluding some of the groups who currently fish for Kenai River red salmon or who might do so if the sport fishery became more attractive, there is a potential for bias in the analysis. However, the willingness to pay of these groups (residents outside Southcentral Alaska) is difficult and expensive to estimate, because so few of them make trips to the Kenai, and is small anyway, relative to that of the Southcentral anglers. Therefore we have focused our efforts on Southcentral anglers only.

(3) **Sample frame split:** The sample was drawn from two frames: the panel sample and the random digit dial sample. The panel sample consists of a subset of the respondents to the 1993 sport fish survey. These are known to be fishing households. The random digit dial sample is drawn from all Southcentral households with telephones, excluding those in the sport fish survey. A screening question identified sport fishing households. Both frames were administered the same survey instrument.

One reason for splitting the sample in this way was to minimize the cost of survey implementation. Since respondent households from the 1993 survey had already been identified as angler households, there was no screening time associated with this part of the sample. The second reason was to compare the answers of this sample to the two questionnaires administered about a year apart. In particular the questions on the number of trips taken were important for interpretation of the information from the two surveys.

(4) **Sample stratification:** The 1993 sport angler survey indicates that of the 291 Southcentral respondents (at the end of the season), 42% indicated they fished for Kenai reds between 1991 and 1993; 20% fished the Kenai for reds in 1993. Looking more broadly at 1993 fishing trips, 40% of south central respondents fished somewhere in the Kenai drainage (although not necessarily for reds) and 30% fished for reds (although not necessarily in the Kenai). 5% dipnetted for reds in the Kenai river. Kenai Peninsula residents had higher participation rates than Southcentral anglers in general.

It is appropriate to sample both those who fished for Kenai River red salmon in the last 3 years (either with rod and reel or dipnet) and those who did not. Households which did fish, but not for Kenai reds, are the most likely group to become Kenai River red salmon fishermen if the red salmon fishery were liberalized. Consequently it is important that this group be asked the contingent value and contingent behavior questions to estimate their behavior and net willingness to pay for an increase in allocation of red salmon to the sport fishery.

Unfortunately it was not possible to know a priori how the sample should be split between "fished for Kenai reds" and "did not fish for Kenai reds" households in order to get the best results for the contingent value questions. On the one hand the "did not fish" people are important since they form a pool of potential beneficiaries of a liberalization policy for the fishery. On the other hand many of them probably would never fish the river.

These problems are magnified for dipnetters, because they are small in number but a large share of an increased allocation into the river might go to these harvesters. A random sample of households would only catch about 30 dipnet harvesters. Because of their low incidence in the population (only 5% of angler households) it would be extremely costly to search for them using random digit dialing. There was a partial list of dip netters for 1993 available from ADF&G which could have been used as the basis for a sample. A sample from such a list would contain bias because the respondents were a self-selected group. Additionally, this wasn't in the project budget.

We considered several possible stratifications. All started with the panel sample of known fishing households from 1993. We considered trying to sample equal numbers of "did fish" and "did not fish" the Kenai River households, and drawing a sample with a specific target for dip net fishermen. Both of these would have increased the cost of the survey beyond our budget limitations, since it would have increased the number of households we would need to contact in order to obtain the specified target amounts. We decided to stratify the sample to over-represent the Kenai Peninsula residents because this group had higher participation rates of angling in general, fishing for Kenai reds, and dipnetting for Kenai reds. Thus, for no increase in screening costs we increased the number of households which did fish (and dipnet) for Kenai reds.

Sampling Protocols

The random sample was drawn from a statewide telephone sample frame developed by ISER in cooperation with the Alaska Department of Health and Social Services. The sample frame is designed to meet probability sampling requirements and to minimize the number of non-working and commercial numbers called. The frame includes all possible residential telephone numbers for large exchanges, and listed residential numbers for small exchanges. It is easily stratified by region.

Survey Protocols

The survey was administered by telephone to maximize the response rate and assure a random and unbiased sample. It was conducted by ISER employees specifically hired and trained for this purpose. The interviewers are screened for their ability to read aloud clearly and precisely from questionnaires, to follow interview procedures exactly, to record verbatim all responses, and to quickly establish a professional rapport with strangers. About half have previous interviewing experience at ISER.

Interviews were conducted out of the ISER offices in Anchorage under the supervision of the field director or supervisor. Calls are monitored and interviews are edited immediately after completion to ensure quality.

A random sample is ensured through a prescribed callback protocol, identification of the disposition of all calls, and protocol for replacement of phone numbers.

Response Rate

The panel sample started with 281 respondents to the 1993 sport fish interview. We completed 160 interviews from these 281 known fishing households; this is a 57% response rate.

We completed 491 interviews from the random digit dial sample frame. 292 households told us they did not fish, or about a 63% fishing participation rate. This is about 10% lower than the fishing participation rate we found in the statewide sport fish survey, where we counted as fishing households those that expected to fish in the summer of 1993 (they were interviewed in June) as well as those that had fished in the previous three years.

Based on the 63% fishing participation rate, we failed to get interviews from about 154 fishing households that we contacted, for a response rate of about 76%.

Sample Weighting Summary

The panel sample was weighted to total Anchorage fishing households (Sport fish survey definition) in 1993 (62,138 households). These weights were adjusted to reflect the demographic differences (and possible bias, therefore) between households which did answer the panel survey, and those who dropped out. The random digit dial sample was weighted to the total 1994 estimated fishing households (Cook Inlet survey definition) counts in Anchorage (51,399), the relevant portion of the Mat-Su borough (8,526), and the Kenai Peninsula borough (10,741). The total number of Anchorage households changed little between 1993 and 1994; the 10,000 household difference in the total Anchorage fishing households results from the difference in the definition of a fishing household in the two surveys. When the samples are combined, the total Anchorage surveys are weighted to a number between the two estimates of Anchorage fishing households. Mat-Su and Kenai households are not affected by this, since they occur only in the random digit dial sample.

Sample Weighting Background

The resident angler survey was constructed from two different samples. One sample consisted of interviews with respondents to a previous survey, the 1993 Statewide Sport Fish Survey (160 interviews), and the other sample used a random digit dial program which excluded all the phone numbers that were in the sport fish survey (490 interviews). Interviews were completed in two regions: Kenai (246) and Anchorage/Mat-Su (404).

The panel sample started with 280 telephone numbers of respondents who had completed the 1993 pre-season Sport Fish interview and were still believed to be at the same telephone number during the post-season Sport Fish interview. The 280 were a subset of 311 Anchorage numbers from the original survey.

We believe the panel sample will be biased towards those households that a) do not change their residence often, and b) are willing to participate in surveys. Households that move and those that refuse were more likely to drop out of the sample. We adjust for this bias by constructing a binomial probit model which projects the probability that a given household, of the 280 we attempted to contact, would actually complete a Cook Inlet survey, based on demographic data we had on all 280 households from the Sport Fish survey. This model assumes a standard normal distribution of probability. The result was:

Binomial Probit Model
Maximum Likelihood Estimates

Log-Likelihood	-187.88
Restricted (Slopes=0) Log-L	-191.21
Chi-Squared (2)	6.6655
Significance Level	.035695

N(0,1) used for significance levels

Variable	Coefficient	Std Error	t-ratio	Prob	Mean & S.D. of Var.	
Constant	0.11990	0.1369	0.876	0.3813		
C10	0.012103	0.006059	1.998	.0458	17.5071	13.4745
ADLTONLY	-0.30658	.1557	-1.968	0.0490	0.4786	0.5004

This equation produces a z-score, which corresponds to a given probability. The bias adjustment weight is:

$$\frac{\text{(the fraction of 280 which completed CI surveys)}}{\text{(the predicted probability that a given HH would complete a CI survey)}}$$

The weighted responses still total 160. The households still have to be weighted to the total number Anchorage HH they represent. First, all the HH are weighted by (311/160), so they represent the entire Anchorage pre-season sample. Then they are weighted by the pre-season Anchorage household weight of 199.8. This brings the weighted total to our estimate of total fishing households in Anchorage (Sport Fish Survey definition) in 1993.

All the weighting steps are:

	Weight	Weighted total
Respondents in Panel Sample		160
Weighted by their likelihood of having answered:	varies	160
Weighted to total Anchorage HH respondents in Pre-season survey	311/160	311
Weighted to total Anchorage fishing HH, Sport Fish survey definition	199.8	62,138

The random digit dial sample was drawn from telephone exchanges in the Municipality of Anchorage, the Kenai Peninsula Borough (excluding Tyonek) and the Palmer, Wasilla and Big Lake exchanges of the Mat-Su Borough. We screened out non-fishing households at the start of each interview.

We derived household estimates from several different sources. For Anchorage, we will use the municipality's 1994 estimate of 87,227 plus 3,448 HH on Elmendorf and Ft Richardson for a total of 90,675.

For the Mat-Su Borough we use household estimates from the borough's 1993 census, taking all households in Houston, Wasilla, Palmer, and the suburban area and 75 percent of households in the Big Lake/Willow area, for a total of 14,210.

For the Kenai Peninsula Borough, we used the ratio of the 1993 to the 1990 population estimates (44,411/40,802), times the 1990 household number (excluding Tyonek) (14,200) for a total of 15,456.

The weight is simply:

(est total HH) / (total sample of fishing and non-fishing households)

Respondents were distributed as follows:

	Fishing HH	Non-Fishing HH	Est Total HH	Weight (RDDWGT)	Est Fishing HH
Kenai	246	108	15,456	43.66	10,741
Anchorage	212	162	90,675	242.45	51,399
Mat-Su	33	22	14,210	258.36	8,526

So, the weighted total for the random digit dial sample is an estimate of the total number of fishing households (Cook Inlet Survey definition) in 1994 in Anchorage, Wasilla-Palmer-Big Lake, and the Kenai Peninsula.

Combined Panel and RDD Sample

We want to be able to analyze the survey as a single sample, since many of the questions are identical. To do this we must adjust the separate sample weights of Anchorage households only so that they add to some estimate of total Anchorage fishing households. There were two problems we had to resolve:

1) The samples were drawn one year apart, and therefore total households changed. As it happens, our estimate of total Anchorage households for 1993, based on a population estimate and 1990 census household size, is 90,725; the 1994 estimate based on data from the Municipality, is 90,675. Thus, we can assume that there was little change in the total number of households in Anchorage from 1993 to 1994.

2) The definition of a fishing household changed from the Sport Fish survey to the Cook Inlet survey. The Sport Fish pre-season survey, was conducted of 1993, asked respondents whether they had fished in the previous three years **or anticipated fishing in 1993.** The Cook Inlet survey, conducted in January 1995, asked only if respondents had fished in the last three years. The percent of sampled households that qualified as fishing households was about 10% higher under the Sport Fish definition than under the Cook Inlet definition. We don't know how much of the difference was due to differing definitions, how much to sampling error, and how much due to changing participation in sport fishing. When combining the two samples, we weight the respondents to an average population, about halfway between the 52,399 sport fishing households of the 1994 Cook Inlet estimate and the 62,138 sport fishing households of the 1993 Sport Fish estimate.

   To reflect the differing probabilities of being in the RDD or the panel sample, we calculate an adjustment weight for each sample which is the proportion of contacted households to the total sample.

Anchorage Area HH	Known Fishing HH	Known Non-Fishing HH	Total Known HH	Weight Adjustment
Sport Fish Pre-season	314	149	463	463/(463+374)=.553166
Cook Inlet Random Dial	212	162	374	374/(463+374)=.446834

Applicability of Data Collected in 1993 and 1994

Because the conditions surrounding the fishery change from year to year the data collected must be in a form that is applicable to other years. The contingent value and contingent behavior questions in the survey specifically reference 1994 since there is no other consistent frame of reference for respondents. The travel cost model was built and calibrated based upon the data collected in the 1993 survey. However. it is designed to be applicable to conditions in other years with respect to regulations, size of harvest, etc. The travel cost method estimates how anglers value various aspects of the fishing experience based on the choices they make. As long as the menu of site choices includes enough variation in types of fishing, fishing quality, regulations, and so forth, it does not matter whether the reference year is typical or atypical at a particular site. Consequently, we feel that the travel cost analysis based on 1993 data will be valid when appropriately applied to other years.

We assume that the pattern of trip expenditures reported by sport fishermen in the 1993 survey is applicable to 1994 trip expenditures.

Commercial Fishing Survey

Objective

The purpose of this survey was to collect information for calculating the economic benefits and economic impacts for Alaska commercial fishermen—both permit holders and crew members—of changing the allocation of late run Kenai River red salmon. Economic benefits are measured by "willingness to pay," and economic impacts are measured by the employment and income generated in Alaska by commercial fisherman expenditures. The surveys provide information for calculating the two components of commercial fisherman "willingness to pay"—change in net profits and worker satisfaction bonus—using contingent value, direct elicitation, and comparative analysis methodologies. The surveys provided commercial fishing related expenditure and income information for calculating the economic impacts.

Design Considerations

Marginal Change

The contingent value and contingent behavior questions were difficult to construct. The purpose of these questions was to get respondents to tell us how their "willingness to pay" and behavior would change if the allocation of later run Kenai River red salmon were to change. Meaningful responses require that the respondent understand both the change which is proposed in the question and the base from which the change is made. This study is concerned not with the overall or aggregate benefits and economic impact of the commercial fishery, but rather with an incremental change in the way that the resource is allocated among users.

The baseline for measuring change had to be conditions in 1994 since that is the year that respondents would naturally reference in thinking about questions of costs, etc. Fortunately there were no major events during the short season which would suggest the response would not be representative of an average year, but the responses cannot be representative of all conditions in all years. We did attempt to obtain responses over a variety of run sizes and market price conditions—the most important factors which might influence how a fisherman might respond to a change in allocation.

Contingent Value Payment Vehicle and Means for Implementing Change

Two problems were associated with the contingent valuation method -the device by which respondents would pay the amount they are "willing to pay" for the hypothetical change in allocation. It is important that the payment vehicle be as realistic as possible in order for respondents to think realistically about a payment amount. It was difficult to devise a realistic payment vehicle for a marginal change in allocation, rather than a payment vehicle for valuing the total allocation. In the end we used the idea of a payment for improved management of the fishery which would effect the change in harvestable surplus, but not all fishermen would interpret this as a realistic possibility or one which they might feel is appropriate. For example a payment vehicle which collects funds to use for instream management could be opposed by an individual who feels that management is inefficient.

Since the measure of the willingness to pay for a change in allocation is contingent upon both how and what changes in response to a change in allocation, it is important to identify and describe the change as completely as possible, while at the same time not confusing or tiring the respondent. Describing a change in allocation was complicated by the fact that there are a number of possible regulatory devices for implementing any change. In other words, values and behavior are likely to be contingent on the type of regulatory devices used to implement any change in the allocation of the harvest. In this however we were restricted to changes in the number of openings of the commercial fishery as a mechanism for implementation.

Short vs. Long Run Change

Changes in the allocation of fish will cause a change in commercial harvester behavior both in terms of time spent fishing and fish harvesting related expenditures. The response may vary between the short and long run. If the allocation were reduced the harvester might simply spend less on fuel in the short run because the number of openings is fewer. However if the reduction in allocation were to persist in subsequent years the harvester might change the level of his investment in the fishery or change the portion of the season that he participated in the fishery. The study is primarily interested in these long run adjustments by the commercial fleet to permanent changes in allocation, but the short term adjustments are easier for the fishermen to respond to. In the survey we attempted to identify both the short and long run responses to changes in allocation.

Change in Economic Rents

Once the season has begun and the decision to fish has been made, most of the expenses associated with the fishing season have been committed to. Variable costs will be associated with food, fuel, and associated operating costs which are a small part of the total. A change in the number of openings or in the allocation will consequently have only a marginal effect on the level of total costs, and in the short run, the level of fixed costs, of the fishery. Most of the change in revenues from a change in harvest will be a change in economic rent—profit to the fisherman and crew. The economic impact of this change in profit will be determined by where and how the permit holder and crew spend their fishing profits. A detailed survey of fixed and operating costs is therefore not necessary for this purpose and can be avoided with great savings in time and complexity in the survey instrument.

Crew Information

Collecting information on crew members was complicated by the lack of a simple, inexpensive method for developing a sample frame for crew members. Our method for sampling crew members required that we contact them through the permit holder who assisted us by obtaining the permission of the crew member to allow us to contact them and by providing us with addresses and phone contact information. It was still difficult and time consuming to track down many crew members because of the transient nature of their activities.

Job Satisfaction Data

Framing questions for estimation of the marginal willingness to pay of commercial harvesters—both permit holders and crew members—for the loss of a small portion of their harvest proved to be challenging and a large number of survey questions was necessary to collect the information. We had to ask respondents about their other employment experiences, how they value those other opportunities, and the extent to which those other opportunities could substitute for commercial harvesting. This required a long set of questions about each of several alternative employment opportunities.

Questionnaire

There were three separate questionnaires.

The first was a short PRE-SEASON SURVEY designed to locate the permit holder and determine if several permits would be combined into a single operation. This was to develop the sample frame for the post-season permit holder survey. We also requested permission to contact the crew members of the operation for the post-season crew survey and to get the cooperation of the permit holder in contacting the crew members.

The second survey was the was the permit holder survey. Because multiple permits are sometimes combined into a single operation, the unit of analysis became the operation. The questionnaire was divided into 4 sections.

Section A contained questions about the operational characteristics of the fishing operation. This included information first about fixed costs of operation in Cook Inlet as well as other locations and the equipment owned and used in the operation. This was followed by questions about the size of crew and how the individual crew members were compensated, including crew expenses paid by the permit holder such as food, and transportation. This was summarized for each crew member on a crew data sheet. This was followed by questions about other expenses directly related to the Cook Inlet salmon fishery including the portions spent in Alaska and other locations. Finally a series of questions asked about the openings fished, gross revenues from Cook Inlet salmon fishing, and catch.

Section B contained questions to determine how the permit holder would change his operation if fishing conditions changed, as well as questions about willingness to pay for these changes. Permit holders were first asked what they did on a specific day during the height of the season when the fishery was closed and if they made up for the loss in income due to the closure, how they did it. Next they were asked what their additional costs of operation would have been if the fishery had been open on that day. The permit holder was also asked what the additional costs would have been if it were a low run year and the catch rate were half what it was in 1994 as well as what the additional costs would have been if it were a low price year.

This was followed by a question about how the permit holder would change his operation if he knew that the escapement target for late run Cook Inlet red salmon were to be permanently changed by an amount that varied among respondents. This was combined with a description of the regulatory method by which the change in allocation would be implemented. This was augmented by a question of how the permit holder might restructure his operation in response to a change in the escapement target in a low run year.

The section closed with a series of three dichotomous choice contingent value questions to determine the value the permit holder places on various management changes. Each question posed a hypothetical situation which was an annual change in the harvest for the individual permit holder combined with a payment vehicle to serve as a means for the respondent to indicate a "willingness to pay" for the annual change in harvest. An initial bid price was included in the question and depending on the answer the respondent was given a second higher or lower amount. In this way the "willingness to pay" was approximated.

The first was a question about the "willingness to pay" for an increase in the harvest resulting from more intensive management of the resource. The size of the increase varied among respondents for this question as well as those that followed. The second was a question about "willingness to pay" to prevent a decline in the annual harvest, again through more intensive management of the resource. The last question asked about the amount that the permit holder would be "willing to accept" to compensate for the loss of a certain number of fish annually from the harvest of Cook Inlet red salmon.

At the end of the section was a question about how the level of enjoyment derived from the commercial harvest of fish varied with the number of openings independent of the catch. This served as a transition into the next section which was concerned with the benefits derived from fishing and alternative jobs.

Section C began with questions about the time spent fishing and other fisheries worked during recent years. Questions then asked about the experiences of the permit holder in at least 2 other fishing jobs in terms of time spent, earnings, type of job, overlap with fishing for Cook Inlet red salmon, certainty of the job in the future, etc. Since many fishermen also work in non-commercial fishing jobs the same information was collected about at least 2 of these jobs including wages, time spent on the job, certainty of the job in the future, etc. Finally many fishermen have the opportunity to work at other jobs during the time they are commercial fishing or would look for other work if they were not commercial fishing. A series of questions were asked to determine the types of jobs and the characteristics of the jobs that might substitute for commercial fishing.

The next part of this section asked the permit holder to rate the importance of different job characteristics such as high earnings, job security, and being ones own boss. Finally the permit holder was asked to rank the overall desirability of each of the jobs described earlier in Section C. Then the respondents were asked to rerank the overall desirability of these jobs if the money they earned changed by a specified amount. This information was summarized on a job ranking sheet for each permit holder.

The final section, Section D, contained a series of questions for background information. Several questions were designed to ascertain residence of the permit holder including where the permit holder lived and whether he received a Permanent Fund dividend check in 1993. Several questions probed for income from fishing, other sources, and total income. Another series of questions asked about age, race, size of household, how long the permit holder had been fishing, and how the permit was obtained.

The third survey was the CREW MEMBER SURVEY. This survey was designed to discover how crew members valued their Cook Inlet fishing compared to their other jobs.

Section A asked about the crew member's work during the 1994 Cook Inlet red salmon fishing season. A question asked what the crew member would have done if there had been no opening on a certain day during the season and what he might have done to recover the income lost from not working that day. The crew member was next asked about income and expenses from working as a crew member during the season as well as the method of payment—crew share, by the pick, by the hour, etc. The section closed with a series of questions about how much the crew member had expected to earn prior to the start of the 1994 season and about future employment as a Cook Inlet crew member.

Section B contained questions about the benefits the crew member could obtain from various jobs. The questions in this section paralleled those of Section C of the permit holder survey. Information on three categories of jobs was obtained—other fishing jobs, other non-fishing jobs, and possible jobs. For each category the survey asked about the type of job, conditions of employment, when the job was held, whether it was a substitute for commercial fishing for Cook Inlet red salmon, remuneration, and expectations about pay and future availability. Next a series of questions about job attributes was asked similar to the permit holder survey. Finally the crew member was asked to rank the overall desirability of each of the jobs described earlier in section B. Then the crew member reranked these jobs given specified changes in earnings. This information was summarized on a job ranking sheet.

The final section, Section C, contained a series of questions for background information. Several questions were designed to ascertain residence of the permit holder including where the permit holder lived and whether he received a Permanent Fund dividend check in 1993. Several questions probed for income from fishing, other sources, and total income. Another series of questions asked about age, race, size of household, and how long the crew member had been fishing.

Instrument Development

Focus Group

Prior to development of the permit holder questionnaire, a focus group session was held in Soldotna. Representative of commercial fishing interest groups, as well as the general public, were invited. There were several objectives for the focus group session. The first was to describe the project approach for the calculation of economic benefits and economic impacts. The second was to describe the types of information we would be collecting through the survey. The third was to get feedback from participants regarding how changes in allocation would impact characteristics of commercial fishing activity, what regulations would be most reasonable from their perspective as a means to implement an allocation change, and what factors influence commercial fisherman behavior. This feedback was used to construct the questions used in the survey.

Peer Review and Study Team Review

A preliminary version of the questionnaire was examined by the Peer Reviewers. They suggested many changes in the questions to improve the quality of the responses, particularly in the contingent value and contingent behavior questions. The study team also reviewed versions of the questionnaire as it was being developed. Considerable time and effort went into making the survey as short and concise as possible since "respondent fatigue" could compromise the results. To shorten the survey we decided not to ask for detailed harvest cost information. Instead, we asked only about how costs would change in response to a change in fishing effort.

Pretest

The permit holder questionnaire was pretested to filter out confusing questions and terms, confirm that the cases described in the contingent value and behavior questions worked, determine the time required to administer the survey, and establish the distribution of bid prices for the contingent value questions.

The contingent value questions asked if a respondent would be willing to pay more than a certain amount, the bid price, for a change in allocation. Depending on the response, a second amount was presented to the respondent. The respondent was then asked about willingness to pay more than this second amount. The pretest was used to develop the distribution of values for bid prices. The distribution of the bid prices was derived from the pretest by asking respondents how much they would be willing to pay for a the described changes in allocation. The responses were roughly log normal and we assumed that distribution in formulating the bid prices for the survey itself. The bid prices and iterations were randomized in the final survey.

Sample Frame

(1) Sample Size

The sample size for the sport survey was selected specifically for the dichotomous choice contingent value questions to yield estimates within +/-20% of the true population values 90% of the time.

The confidence intervals for the contingent value questions using the dichotomous choice method depend upon how closely the bid amounts approximate the respondents' actual willingness to pay. Pretesting of the questions will allow us to adjust the bid values to approximate actual willingness to pay, but complete accuracy is of course not possible. However as the level of accuracy of the bid amount increases, the standard errors will fall and approach those achieved with any referendum question that has an expected positive response of 50%. We used the variance for the contingent value questions from the Jones and Stokes Southeast Sport Fish study as an estimate of the variance to expect in our study.

(2) Region Sampled

The pre-season survey of permit holders was conducted on a random sample of 600 cook inlet salmon gill net and set net harvesters using the permit file. Subsequent to this survey the decision was made to exclude the Northern district set net fishermen and the western Central district set net fishermen from the survey. Consequently the post-season permit holder survey and the crew member survey were administered to a sample of operations which included all drift fishermen and the Upper Central District set net fishermen.

The exclusion of the Northern District and the Western (Western, Kalgin, Chinitna, and Kustatan) fishermen means that the survey results are only directly applicable to the drift fleet and the east side set net fishery. The other set netters would be less directly affected by the regulatory changes addressed in this study, therefore, they were not studied as a cost saving measure. This does not mean that these fishermen would not be affected from changing the regulations. However, this study concentrates on the most directly affected groups.

(3) Permits vs. Operations

The sample was drawn from the population of Cook Inlet salmon set net and drift net permits. For the drift fleet almost all operations have a just one permit holder. For set netters, however, there may be several permits consolidated into a single operation. The unit of observation for the survey was the operation so each permit holder was asked how many permits the operation included. Thus, the number of permits represented by the sample was actually larger than the original sample size because of multiple permits in an operation. Because the original sample included numerous permits in the same operation there were fewer interviews than originally anticipated, however, the final sample included a large share of permits and operations.

(4) Non-English Speaking Respondents

During the pre-season survey several Russian speaking permit holders were encountered. An interpreter was used to conduct a number of permit holder and crew member interviews in Russian.

(5) Crew Member Interviews

The name of one crew member was drawn at random from the list of crew members provided by the permit holder. Crew members who were themselves permit holders or under the age of 18 were culled from the list and one crew member was chosen at random from each operation to be interviewed. The crew members were extremely difficult to contact because many were transient and permit holders did not have current phone numbers. If we were unable to contact the first crew member chosen at random from a permit holder survey, we replaced that individual with a second crew member taken from the same permit holder listing.

(6) Job Satisfaction Data

The information collected in Section C of the post-season permit holder survey was essentially the same as the information collected in Section B of the crew survey. This was information on other fishing jobs, non-fishing jobs, and a potential job. This information was collected to estimate net economic value to permit holders and crew.

Sampling Protocols

The sampling frames for both the permit holder and crew surveys were both designed to be random samples of their underlying populations.

Survey Protocols

The surveys were administered by telephone to maximize the response rate and assure a random and unbiased sample.

The survey was conducted by ISER employees specifically hired and trained for this purpose. They are specially screened for their ability to read aloud clearly and precisely from questionnaires, to follow interview procedures exactly, to record verbatim all responses, and to quickly establish a professional rapport with strangers. About half have previous interviewing experience at ISER.

Interviews were conducted out of the offices of ISER in Anchorage under the supervision of the field director or supervisor. Calls are monitored and interviews are edited immediately after completion to ensure quality.

A random sample is ensured through a prescribed callback protocol, identification of the disposition of all calls, and protocol for replacement of phone numbers.

Response Rates

An analysis of the sample, permits, and operations is attached. The sample drawn in May included 266 drift permits and 334 set permits from a population of approximately 1214. Twenty-five of these permits were duplicates because of emergency transfers and sales

In the pre-season survey 487 of the selected 600 permit holders were contacted. Considerable time and effort was required to locate the selected permit holders. Methods included searching telephone books, use of directory assistance, attempts to contact by mail, and the use of a toll free telephone response number. As a result of these efforts the response rate was 85 percent, representing 403 operations—225 drift operations and 178 set net operations. In addition, it represented 37 percent of all Cook Inlet salmon permits because some set net operations included permits not in our sample.

After the pre-season survey the decision was made to exclude the western and northern set netters from the post-season survey. This reduced the number of permits in the sample by 68 and the number of operations by 48. The sample going into the post-season permit holder survey was 419, representing 355 operations. This was 40 percent of the 1017 permits (excluding the Northern and western permits) and 43 percent of total operations. The number of permits represented by these operations was 48 percent of the total 1,017.

Weights for Commercial Fishing Surveys

Tables E-1 and E-2 show the development of the weights for the Cook Inlet salmon permit holders data. To develop these weights we had to estimate the total for the populations we wish to project to; these calculations are in Table E-1. The Commercial Fisheries Entry Commission (CFEC) has recorded 745 set net and 583 drift net salmon permits in 1993. After removing the permits not fished and Northern and Western District set netters, we estimated that the number of permits fished by the drift fleet was 580 and by East side set netters was 514. These were the numbers we used for our projections.

The next table, Table E-2, shows the actual calculation of the weights. The upper portion of the table shows how we arrived at the sampling fractions of approximately one-fourth for set netters and one-third for drifters. The middle portion of the table shows the breakdown of the weights for set net operations with varying numbers of permit holders in the operation. The last row of this section shows the projected number of permits fished for each size operation. The lower portion of this table shows the breakdown of the weights for drift operations.

Table E-1: Estimated Permits Fished East Side

	Sample		Population	
	Set	Drift	Set	Drift
Total pemits ('93)	274	227	745	583
Not planning to fish pre-season	-4.4%	-0.4%	-33	-2
North and West: first screen	-26.0%		-185	
Permits not fished in '94	-2.6%	-0.2%	-13	-1
North and West: second screen	-2.9%		-15	
Total permits fished E side			514	580

Table E-2: Revised Commerical Survey Weights

Sampling Fraction:	**Set**	**Drift**	
completed pre-season	262	225	
plus permit won't be fished	12	2	
not completed post season	-10	-24	(excluding didn't fish) (not adjusted for multiple permits)
completed sample	264	203	(including N, W and didn't fish)
total permits	745	583	
sampling fraction	0.3544	0.3482	
raw weight	2.822	2.8719	
adjustment factor	0.719	1.005	
adjusted sampling fraction	0.2548	0.3499	

Set Net

Permits per Operation	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**11**	**Total**
no. operations surveyed	34	27	21	8	4	7	1	1	1	104
no. permits represented	34	54	63	32	20	42	7	8	11	271
Pr(not selected)^n	0.6456	0.4168	0.2691	0.1738	0.1122	0.0724	0.0468	0.0302	0.0081	
Adjusted Pr(not selected)^n	0.7452	0.5553	0.4138	0.3084	0.2298	0.1713	0.1276	0.0951	0.0394	
weight	3.9249	2.2489	1.7060	1.4459	1.2984	1.2067	1.1463	1.1051	1.0410	
weighted permits	133	121	107	46	26	51	8	9	11	514
							Control Total			514

Drift Net

Permits per Operation	**1**	**2**	**3**	**Total**
no. operations surveyed	195	3	3	201
number of permits	195	6	9	210
Pr(not selected)^n	0.6518	0.4248	0.2769	
Adjusted Pr(not selected)^n	0.6501	0.4226	0.2747	
weight	2.8576	1.7318	1.3787	
weighted permits	557	10	12	580
		Control Total		580

Notes: The formula for the weight is 1/(1-P^n) where P is the probability of one permit not being selected ^n raises it to the nth power, and n is the number of permits in the operation. The probability has been adjusted so that the projected total number of permits matches the control total. For drift, the number of permits fished in 1993 is a better total estimate than the projection from the survey. The adjustment accounts for the multiple permits lost due to refusal or no contact during the post-season survey, as well as systematic differences between drift and set in didn't fish and non-response.

Non-Resident Sport Fish Survey

Objective

The purpose of this survey was to quantify the changes in non-resident sport anglers expenditures in Alaska resulting from changes in Kenai River red salmon regulations. Since data on non-resident sport fishing expenditures were collected in the 1994 survey, this survey only needed to generate information on the number of visits and their length. We assume that average expenditures per day do not change with changing regulations or with length of stay in Alaska by non-residents. The sources of changing expenditures are consequently due to changes in the number of visits to Alaska and changes in the length of the average visit. Ideally the survey sample would be the entire population of potential Alaska visitors, but the limited budget for this project prevented a survey of the entire population of the U.S.

Use of Previously Collected Data

1994 Questionnaire

In the winter of 1994 a questionnaire was mailed to 7,000 people who purchased a non-resident fishing license in 1993. This questionnaire asked respondents to provide us with information about their most recent trip to Alaska that included sport fishing. Respondents were asked about why they fish, sources of information for where to fish, preferences for fishing locations, and general demographic questions. The majority of the questionnaire asked about specific fishing trips and expenditures in Alaska. The information from these questions was used to calculate non-resident participation in Kenai red salmon fishing, to estimate in-state expenditures, and to draw the sample for the Cook Inlet non-resident survey.

1995 Questionnaire

We mailed questionnaires to visitors to Alaska who fished either the Kenai River drainage or Southcentral Alaska in 1993. We asked a slightly different questions of the two groups.

Questionnaire A was mailed to anglers who reported fishing for red or king salmon in the Kenai River System. It asked anglers how their behavior would have changed for some combination of change in the bag limit and in the CPUE (catch per unit of effort). Half were asked to consider a reduced bag limit and half an increased bag limit. CPUE was either held constant or varied with the change in the bag limit.

A second question asked if the respondent would have been willing to pay a particular amount to change the bag limit.

Questionnaire B was sent to anglers who did not fish for Kenai River red salmon, but did fish in Southcentral Alaska. The questionnaire began by asking for reasons why they did not fish for Kenai River reds. A second question was similar to the contingent behavior question for those who did fish. If asked whether the respondents behavior would have changed if the bag limit or the CPUE were liberalized. These fishermen were not asked the contingent value question.

The remaining questions were the same for both versions of the questionnaire:

- how important Kenai River salmon fishing was to the decision to visit Alaska
- how much information the angler had about Kenai River regulations before visiting Alaska
- number of trips to Alaska
- importance of Kenai River salmon in trip decisions in 1994

- plans to visit Alaska again
- likelihood of visiting Alaska again, given an increase in the red salmon bag limit
- whether they would recommend a trip to Alaska to friends
- whether their recommendation to visit Alaska would change if the red salmon bag limit changed
- number of visits to Alaska

Sample Frame

Questionnaires were mailed to all respondents to the 1994 Sport Fish Non-Resident Survey who had fished in the Kenai River drainage for salmon or fished in Southcentral Alaska in 1993. Respondents who had fished in both locations did not receive both questionnaires; they were mailed the Kenai River drainage questionnaire. The Kenai River drainage questionnaire was mailed to 780 anglers and the Southcentral questionnaire to 1,394 anglers.

Response Rate

We received 972 questionnaire from the 2,174 we mailed. After subtracting the undeliverable questionnaires, we have a response rate of 45%.

Appendix F

Survey Questionnaires

1994 Cook Inlet Salmon Survey
Institute of Social & Economic Research
[illegible] Interview

June 17, 1994

Respondent's Name:	Permit No.:	Study No:

1. INTERVIEWER ID__________ 2. INTERVIEWER'S INTV. NO.________

3. R'S PHONE NO.__________

Contact Record		
Preferred Contact Name: Contact Role: Contact Information: Tel. Fax Address	Second Contact Name: Contact Role: Contact Information: Tel. Fax Address	Third Contact Name: Contact Role Contact Information: Tel. Fax Address

START TIME: _______

My name is ________ I am with the Institute of Social and Economic Research at the University of Alaska. As I'm sure you know, there has been much discussion about the importance of Cook Inlet salmon to the commercial, sport, and personal-use fisheries. We have a contract from the Alaska Department of Fish and Game to do an independent study. This study will measure how alternative Cook Inlet salmon management strategies impact the economy and the value of the fishery to different user groups. We randomly selected a permit registered to your name for this research. This interview should take less than five minutes. Everything you say is confidential. Do you have any questions before I begin?

1. Do you presently own Cook Inlet commercial salmon (set/drift) net permit number _______?

☐ YES ☐ NO → Could you tell me who the owner is?

☐ (YES, BUT SOMEONE ELSE KNOWS MORE ABOUT THIS PERMIT)

NAME OF PERSON: ______________________ SWITCH TO NEW PERSON

2. Are you going to fish under this permit this season?

☐ YES ☐ No ☐ DON'T KNOW—(Who would know?)

2a. What will you do with this permit? Will you

1. not use it this year?
2. obtain an emergency transfer?
3. sell the permit?
4. or do something else? ____________________

Thank you for your help. That's all we need to know.

INTERVIEWER CHECKPOINT: IF R HAS A SETNET PERMIT - GO TO Q.3
IF R HAS A DRIFTNET PERMIT - GO TO Q.6 PAGE 3

3. Will you be working together with other set net permit holders as one operation?

☐ YES ☐ NO → SKIP TO Q.6, PAGE 3

4. How many other permits holders? ☐

5. In the fall we will call you to ask questions about your fishing season. To help us interpret the information we collect, could you please tell us the name of each permit holder, their home town, and their permit number, if you have it handy?

NAME	HOME TOWN	PERMIT #

5a. Who is the head of the operation? ____________________

6. As I mentioned, the purpose of this study is to estimate the economic effects of Cook Inlet salmon. To do this, we would like to interview you in the fall, after the fishing season. We would also like to interview crew members fishing on these permits. To do so, we need your help in contacting them. We would like to send letters for you to give to your crew members, explaining the study and requesting permission for us to contact them in the fall through you. We will ask you how best to contact each crew member when we interview you in the fall.

How many crew members do you expect will work with you this season? ☐

(IF NONE, SKIP TO Q.8)

7. Is (READ ADDRESS FROM STRATA SHEET) the address we should use in July to send you the crew letters?

☐ YES ☐ NO → 7a. What is the best address?

8. Is (THIS/READ ADDRESS FROM STRATA SHEET) the best address to use to contact you in the fall?

☐ YES ☐ NO → 8a. What is the best address?

9. Is this the best telephone number to use to call you in the fall?

☐ YES ☐ NO → 9a. What is the best number ? ____________

That is the last of my questions. Thank you for your help. I'll look forward to talking with you in the fall. Have a good season.

END TIME______

UNIVERSITY OF ALASKA ANCHORAGE

3211 Providence Drive
Anchorage, Alaska 99508

SCHOOL OF PUBLIC AFFAIRS

INSTITUTE OF SOCIAL AND
ECONOMIC RESEARCH
(907) 786-7710 FAX (907) 786-7739

July 15, 1994

PRMTHLDR ~
ADDRESS1 ~
ADDRESS2? ~
CITY ~ STATE ~ ZIP ~

Thank you for your help on the economic study of the Cook Inlet salmon fishery. We have completed the pre-season interviews with permit holders. In the interview we mentioned that we would send you a letter to give to each of your crew members to let them know that we want to interview them in the fall. I have included one copy of the letter for each of the crew members you thought would be working with you this season.

I would appreciate it if you give one copy to each crew member and collect the information on how to contact them. We will be calling you in the fall to ask for that information and to interview you. Thank you for your help; have a safe season.

Sincerely,

Scott Goldsmith
Professor of Economics

Enclosures — P6 ~ Crew Letters

UNIVERSITY OF ALASKA ANCHORAGE

3211 Providence Drive
Anchorage, Alaska 99508

SCHOOL OF PUBLIC AFFAIRS

INSTITUTE OF SOCIAL AND
ECONOMIC RESEARCH
(907) 786-7710 FAX (907) 786-7739

July 15, 1994

Dear Crew Member:

The Institute of Social and Economic Research (ISER) at the University of Alaska was selected by the Alaska Department of Fish and Game to conduct an economic study of the salmon fishery in Cook Inlet. This study was requested by the Alaska Legislature to measure how fishery management changes affect the economy and the value of the fishery. As part of the study, we need to know how much money the commercial salmon fishery puts into the Alaskan economy as well as how permit holders and crew members would respond to changes in regulations.

Information from crew members, like you, is an important part of a complete and successful analysis. We would like to interview you in the fall, after the fishing season.

In June we interviewed the permit holder you fish with. We would like you to give permission to that person to release your name, address, and phone number to us. To interview you we need you to:

1. Tell the permit holder that you've said it is okay for them to give ISER your name, address, and phone number.

2. At the bottom of this letter, write in your name and the address where you will receive mail in September.

3. Write in the phone number where you can be reached in September and October.

4. Give this letter back to the permit holder who gave it to you.

Or you may call us collect at 786-7710. Please ask for the crew survey coordinator and give her your name, address, and phone number.

When we call you in the fall, we will ask questions like:
What community do you live in?
How many people do your wages help to support?
When you aren't fishing, do you have another job?
How many years have you been a crew member?

We hope you will be willing to help us document the value of the commercial salmon fishery in Cook Inlet. Thank you.

Sincerely,

Scott Goldsmith

Scott Goldsmith
Professor of Economics

NAME ______________________________ PHONE ________________

ADDRESS ______________________________

1994 Cook Inlet Salmon Survey
Institute of Social & Economic Research
Post-season Interview of Commercial Fishermen

October 4, 1994

Respondent's Name:	Permit No.:

1. INTERVIEWER ID__________ 2. INTERVIEWER'S INTV. NO.________

3. R'S PHONE NO.____________ 4 STUDY NUMBER ____________

Contact Record		
Preferred Contact Name: Contact Role: Contact Information: Tel. Fax Address	Second Contact Name: Contact Role: Contact Information: Tel. Fax Address	Third Contact Name: Contact Role Contact Information: Tel. Fax Address

My name is ________. I am with the Institute of Social and Economic Research at the University of Alaska. I am calling for (NAME).

CONFIRM R IS (NAME) OR ARRANGE TO SPEAK WITH (NAME).

I believe one of our interviewers may have talked with you or another member of your fishing operation last June. I am calling to arrange to interview you about your fishing this season and about future fishing. As we mentioned in June, there has been much discussion about the importance of Cook Inlet salmon to the commercial, sport, and personal-use fisheries.

We have a contract from the Alaska Department of Fish and Game to study how alternative Cook Inlet salmon management strategies impact the economy and the value of the fishery to different user groups. We randomly selected your name from a list of Cook Inlet permit holders for this research. This interview should take about 40 minutes. Everything you say is confidential. Do you have any questions before I begin?

STUDY NUMBER _______ PERMIT NUMBER _______________

RESPONDENT NAME ______________________________________

START TIME__________

SECTION A: OPERATIONAL CHARACTERISTICS (SEPTEMBER 30, 1994)

1994 OPERATIONS IN COOK INLET

A1. Did you fish under your Cook Inlet permit this year?

❒ 1. YES
❒ 9. NO ANSWER
❒ 2. NO → A1a. Why didn't you fish under your permit this year?

SKIP TO SECTION C

SETNET PERMIT HOLDERS - SO4	DRIFTNET PERMIT HOLDERS - SO3
A2. Who headed your operation? ❒ Respondent ❒ Other:____________________ A3. Where was your setnet site this year? ❒ 1. CENTRAL DIST. **EAST** SIDE ❒ 2. CENTRAL DIST. **WEST** SIDE ❒ 3. NORTHERN DISTRICT ❒ 4. OTHER____________ → SKIP TO ALTERNATE ENDING AT THE END OF THE LAST PAGE **A3a. EAST SIDE**: Was your site north or south of the Blanchard line? ❒ North ❒ South	A4. Were you the boat captain? ❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER A4a. Where is your boat homeported? ______________________________

ALL RESPONDENTS

COSTS OF OPERATION

Thinking about your Cook Inlet salmon fishing operations for 1994. I would like to ask you about the equipment and property you used. What is the current market value of all equipment and property that you or a relative owned and used in your operations? (Do not include the value of your permit.)

EITHER GET A TOTAL VALUE OR PROMPT WITH THE CATEGORIES ON THE TABLE: **boats and motors, tractors, trucks, trailers and other vehicles, fishing gear, cabins, trailers, buildings or groups of buildings, or land;** AND **fishing sites.**

TYPE OF EQUIP. / PROPERTY	CURRENT MARKET VALUE (OWNED)
A5.TOTAL	
OR	
A5a. BOATS & MOTORS	
A5b. VEHICLES	
A5c. FISHING GEAR	
A5d. LAND, BUILDINGS OR GROUPS OF BUILDINGS	
A5e. FISHING SITES	
A5f. OTHER	

A6. About what percent of your fishing equipment do you buy in the Kenai Peninsula Borough?

____________________% (IF 100%, SKIP TO A9)

A7. And about what percent do you buy elsewhere in Alaska?

____________________%

A8. And about what percent do you buy outside Alaska?

____________________%

A9. I would like to ask you about "fixed" expenses of your total fishing operations for the year, both in Cook Inlet and elsewhere. These are annual costs that don't vary with how many openings or fisheries you fish. They also don't include any new equipment you might buy. How much did you spend in 1994 on:

Expenditure Category	Total Dollars
a. MOORING & STORAGE	
b. INSURANCE	
c. SERVICES LIKE ACCOUNTANTS OR LAWYERS	
d. LICENSES, FEES & ASSOCIATION DUES	
e. PROPERTY TAXES	
f. INTEREST EXPENSES	
g. COOK INLET PERMIT PRINCIPAL PAID (exclude interest)	
h. OTHER PERMIT PURCHASE (PRINCIPAL PAID)	
i. OTHER____________	

A10. Could you list for me the names of the people who worked on your Cook Inlet salmon fishing operation this year, including crew members, other permit holders, and anyone else who was a part of your operation or who was paid from the revenues of the operation?
(PROBE FOR ADDRESS AND PHONE CONTACT INFORMATION. MINIMALLY, LIST PEOPLE BY POSITION OR FIRST NAME.)

PERSON #	NAME	COMMUNITY OF RESIDENCE	CURRENT MAILING ADDRESS	PHONE #	IF SET PERMIT HLDR, PMT #?
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

1994 COSTS OF OPERATIONS: CREW

In order to understand the cost of your fishing operations, I would like to ask a few questions about each of the people you listed.

COMPLETE CREW DATA SHEETS, THEN RETURN TO Q. A11

A11. IF ONE OR MORE PERSONS PAID WITH A CREW SHARE:

What expenses were deducted from gross receipts before calculating crew shares?

❒ 0. NONE→ SKIP TO A13
❒ 1. FOOD
❒ 2. FUEL
❒ 3. CREW SUPPLIES
❒ 4. CREW TRANSPORTATION.
❒ 5. OTHER (list)

A12. How many dollars of expenses did you deduct from your total gross revenues before calculating crew shares?

$ ______

❒ 9998. Don't Know ❒ 9999. No Answer

A13. Next, I'd like to know how much you spent on any other types of expenses you may have had in the Cook Inlet salmon fishery. How much did you spend in 1994 on:

Expenditure Category	Amount Spent			
	Total Dollars	% Spent in Kenai Penin.	% Spent elsewhere in Alaska.	9998. Don't Know 9999. No Answer
a. Food				DK NA
b. Fuel				DK NA
c. Boat or Camp Supplies other than food				DK NA
d. Equipment Repair				DK NA
e. Other Supplies				DK NA

A14. Are there any other operating expenses in Cook Inlet that we haven't talked about?

Type	Amount

OTHER OPERATING CHARACTERISTICS

A15. What was the date of the first opening you fished for Cook Inlet Salmon this year?

____
MONTH/DAY (E.G. 07/04)

A16. What was the date of the last opening you fished?

____
MONTH/DAY (E.G. 08/21)

A17. How many openings did you miss during the peak of the season?

________ ❐ 98 Don't Know ❐ 99 No Answer

A18. What do you think the gross revenues from your Cook Inlet salmon fishing operation will be in 1994?

$ ________ ❐ 998 Don't Know ❐ 999 No Answer

A19. What percent of that was from red salmon?

______ % ❐ 998 Don't Know ❐ 999 No Answer

A20. What was your sockeye catch in 1994?

______ lbs ❐ 999,998 Don't Know ❐ 999,999 No Answer

OR

______ fish

SECTION B: OPERATIONAL RESPONSES TO CHANGING CONDITIONS (REVISED 9/30/94)

B1. The commercial fishery was closed this year on Saturday, July 30 to allow escapement into the Kenai River. Think about your catch during that period. What do you think your catch of sockeye salmon would have been if there had been an emergency opening that day?

________ lbs

<<Expected Catch>>

❒ 9998 Don't Know
❒ 9999 No Answer

B1a. What did you do on that day when the fishery was closed?

❒ 1. FISHING RELATED WORK
❒ 2. OTHER WORK FOR PAY→SKIP TO B1b&c
❒ 3. OTHER: ________
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

B1b. What was the other work ?

____

B1c. How much did you make that day?

$________ ❒ 998. DON'T KNOW ❒ 999. NO ANSWER

SKIP TO B2

→ B1d. How did you make up the income lost from not fishing that day?

❒ 0. DIDN'T LOSE ANY INCOME
❒ 1. COULDN'T MAKE UP LOST INCOME
❒ 2. WORK MORE IN OTHER JOB
❒ 3. OTHER________

B2. Now I would like you to think about what your extra costs would have been for just that one additional opening, beyond what you actually spent in 1994.

B2a. What do you think your extra expenses for food, fuel, and (BOAT/CAMP) supplies would have been for that opening?

$________________

❐ 0. None → B2b. [IF NONE] Is that because you would not have fished?

- ❐ I would not have fished that day. → SKIP TO B5
- ❐ Other reason ______________________________

❐ 8. Don't Know
❐ 9. No Answer

B2c. Would you have had other expenses, such as additional equipment repair, additional people, or other items?

$________________ DESCRIBE __________________________

❐ 000. None ❐ 998. Don't Know ❐ 999. No Answer

B3. Now, suppose that the extra opening occurred in a low-run year, with, say, half the catch rate at the peak as in 1994. Would it still cost you $__________ to fish that extra day in a low run year?

❐ 1. Yes. Same costs as QB2 →**SKIP TO B4**
❐ 2. Different costs
❐ 8.DON'T KNOW → **SKIP TO B4**
❐ 9. NO ANSWER → **SKIP TO B4**

B3a. What would the extra costs be in this case? (RELATIVE TO NOT FISHING)

$__________________ food fuel and boat /camp expenses

$__________________ other (specify)___________________________

❐ 000. None, would cost the same as not fishing

B3b. [IF NONE] Is that because you would not have fished that day?

- ❐ I would not have fished in that case.
- ❐ Other reason ______________________________

B4. Now suppose the price was half of what it was this year. Would it still cost you $__________ to fish that extra day in a low price year?

❒ 1. Yes. Same costs as QB2 →**SKIP TO B5**
❒ 2. Different costs
❒ 8.DON'T KNOW → **SKIP TO B5**
❒ 9. NO ANSWER → **SKIP TO B5**

B4a. What would the extra costs be in this case? (RELATIVE TO NOT FISHING)

$________________ food fuel and boat /camp expenses

$________________ other (specify)________________________

❒ 000. None, would cost the same as not fishing

B4b. [IF NONE] Is that because you would not have fished that day?

❒ I would not have fished in that case.

❒ Other reason ________________________

CHANGE IN COST IN RESPONSE TO POLICY CHANGE

Now I would like to ask you about changes in the escapement target for late run Kenai river sockeye. By escapement, we mean the number of sockeye passing the sonar counter located 19 miles upstream from the mouth of the Kenai River. Suppose the escapement target for Kenai River sockeye were permanently **increased** by **200 Thousand** starting next year. Although it is difficult to predict exactly how your operation would be affected, the management change would in most years result in a reduction of the commercial harvest of Cook Inlet sockeye salmon by **200 Thousand.**

SETNETTERS	DRIFTNETTERS
B5. In an average run year of 3 to 4 million Kenai sockeye this policy might be implemented by the loss of **2 or 3** setnet periods from mid-Kalifonsky north at the peak of the run.	**B5**. In an average run year of 3 to 4 million Kenai sockeye this policy might be implemented by the loss of **2 or 3** corridor openings from mid-Kalifonsky north at the peak of the run.

If this happened, how do you think you would restructure your operation and what changes in your cost would result?

YES	NO	TYPE OF CHANGE	Direction and Amount of Change
		NO CHANGE	
		CHANGE IN EQUIPMENT	
		CHANGE IN OPENINGS FISHED	
		CHANGE IN CREW SIZE	
		OTHER One time costs:	
		OTHER costs incurred each year:	
		OTHER:	

B6. In a <u>low</u> run year, increased escapement might require the loss of a regular drift and setnet period, as well. If that happened, would you restructure your operation any differently than you described above?

❐ 1. YES (CONTINUE WITH NEXT QUESTION)
❐ 2. NO → SKIP TO Q.B7, NEXT PAGE

❐ 8. DON'T KNOW → SKIP TO Q.B7, NEXT PAGE
❐ 9. NO ANSWER → SKIP TO Q.B7, NEXT PAGE

B6a. (IF YES, ABOVE) How do you think you would restructure your operation and what changes in your cost would result?

RESTRUCTURE IS FROM CURRENT BASE, AND NOT FROM THE RESTUCTURED OPERATION DECSRIBED IN Q.B5.

YES	NO	TYPE OF CHANGE	AMOUNT OF CHANGE
		NO CHANGE	
		CHANGE IN EQUIPMENT	
		CHANGE IN OPENINGS FISHED	
		CHANGE IN CREW SIZE	
		OTHER ONE TIME COSTS	
		OTHER COSTS INCURRED EACH YEAR:	

B7. Suppose that intensive management could result in an increase in your commercial harvest of Cook Inlet reds by 200 in most years. Would you be willing to pay **$600** annually if the funds were used to pay for such intensive management?

- ❒ 1.YES → CONTINUE WITH Q.B8a
- ❒ 2. NO →SKIP TO Q.B8b
- ❒ 8. DON'T KNOW → SKIP TO Q.B8b
- ❒ 9. NO ANSWER→SKIP TO Q.B9

B8a. Would you be willing to pay more than **$900** annually?

- ❒ 1.YES →SKIP TO Q.B9
- ❒ 2. NO → SKIP TO Q.B9

B8b. Would you be willing to pay more than **$400** annually?

- ❒ 1.YES → SKIP TO Q.B9
- ❒ 2. NO →SKIP TO Q.B9

B9. Now suppose that in future years runs were expected to decline, but that intensive management could offset any decline in the commercial harvest. If your catch would otherwise declineby **200** fish, would you pay **$600** annually if the funds were used to pay for intensive management which succeeded in keeping the harvest from declining?

❒ 1 YES → CONTINUE WITH Q.B9a

❒ 2. NO →SKIP TO Q.B9b
❒ 8. DON'T KNOW → SKIP TO Q.B9b

❒ 9. NO ANSWER→SKIP TO Q.B10

B9a. Would you be willing to pay more than **$900** annually?
❒ 1.YES → SKIP TO Q.B10
❒ 2. NO →SKIP TO Q.B10

B9b. Would you be willing to pay more than **$400** annually?
❒ 1.YES → SKIP TO Q.B10
❒ 2. NO →SKIP TO Q.B10

B10. Now suppose that the State of Alaska wanted to compensate Cook Inlet for a reallocation of a portion of the Kenai River sockeye harvest to other users. Suppose that as a result of the reallocation, you expected to catch 200 fewer sockeye salmon over the whole season. Would you be willing to accept less than **$200** annually to decrease your harvest by this amount?

❑ 1. YES →SKIP TO Q.B10b

❑ 2. NO → CONTINUE WITH Q.B10a
❑ 8. DON'T KNOW → CONTINUE WITH Q.B10a

❑ 9. NO ANSWER→SKIP TO Q.B11

B10a. Would you be willing to accept less than **$300** annually??
❑ 1.YES → SKIP TO Q.~~B25~~ B11
❑ 2. NO → SKIP TO Q.~~B25~~ B11

B10b. Would you be willing to accept less than **$130** annually?
❑ 1.YES
❑ 2. NO

B11. If your income for the season didn't change, would your enjoyment of fishing be greater, the same, or less if you had one less opening during the peak of the season?

❑ 1. GREATER
❑ 2. THE SAME
❑ 3. LESS
❑ 4. DEPENDS (explain?:)________________
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

SECTION C: WORK BENEFITS

R FISHED C. I. SALMON THIS YEAR	R DID NOT FISH C.I. IN 1994
This next section of the interview is about benefits you get from working in commercial fishing and other jobs.	**C1.** What was the most recent year you did fish for Cook Inlet salmon? ❒ 93. 1993 ❒ 92. 1992 ❒ 91. 1991 ❒ 98. DON'T KNOW ❒ 99. NO ANSWER **C2a.** About what date did you start fishing in that year? START ____________ **C2b.** And when did you stop? END ________________

IF R HASN'T FISHED COOK INLET SINCE 1990, SKIP TO SECTION D

C3. About how many hours would you say you worked per week during the Cook Inlet salmon season?

______________ HOURS/WEEK

❒ 998. DON'T KNOW
❒ 999. NO ANSWER

C4. Before the season started, how much did you think you would earn [THIS/THAT] year?

❒ 1. ABOUT $__________
❒ 2. BETWEEN $________ AND__________
❒ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN

❒ 8. DON'T REMEMBER WHAT I EXPECTED
❒ 9. NO ANSWER

C5. When you fish for Cook Inlet salmon, are some of the people you work with:

C5a. FAMILY MEMBERS? ❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

C5b. FRIENDS? ❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

OTHER FISHING JOBS

C6. Over the past four summers, did you fish commercially in any other fisheries besides Cook Inlet salmon?

❐ 1. YES

❐ 2. NO ——→ SKIP TO Q.C27.
❐ 8. DON'T KNOW
❐ 9. NO ANSWER ——

What were the two most recent fisheries you fished other than Cook Inlet?

	AREA	TARGET SPECIES	GEAR
C6a. FISHING JOB 1:			
C6b. FISHING JOB 2:			

ALSO RECORD ON JOB SHEET FOR LATER REFERENCE

CONTINUE ON NEXT PAGE

C7. What year did you most recently fish in [FISHING JOB 1]?

YEAR________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

C7a. About what date did you start fishing that year?

START DATE__________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

C7b. And when did you finish?

END DATE___________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

C8. Did you fish in (FISHING JOB 1) instead of fishing in Cook Inlet that year, or could you have done both?

- ❒ 1. INSTEAD OF
- ❒ 2. DID BOTH
- ❒ 3. COULD HAVE DONE BOTH, BUT DIDN'T
- ❒ 4. COOK INLET WAS NOT AN OPTION THAT YEAR
- ❒ 5. OTHER ______________________

- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C9. Were you a permit holder in that fishery?

❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

C10. In (FISHING JOB 1) were you paid as an owner, with a crew share, with wages, or did you work without pay?

- ❒ 1. CAPTAIN (PERMIT HOLDER)
- ❒ 2. CREW MEMBER RECEIVING A SHARE OF GROSS REVENUES
- ❒ 3. CREW MEMBER RECEIVING A WAGE
- ❒ 4. UNPAID WORKER → SKIP TO Q.C14
- ❒ 5. OWNER
- 6. OTHER ______________________

- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C11. How much did you earn in this fishery in (THE MOST RECENT YEAR)?

$ _______ over the entire season ❒ 99998. DON'T KNOW
❒ 99999. NO ANSWER

C12. Before the season started, how much did you think you would earn?

- ❐ 1. $__________
- ❐ 2. BETWEEN $________ AND ________
- ❐ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN

- ❐ 8. DON'T REMEMBER WHAT I EXPECTED
- ❐ 9. NO ANSWER

C13. What fringe benefits did you earn on this job?

- ❐ 0. NONE
- ❐ 1. HEALTH INSURANCE
- ❐ 2. PENSION OR RETIREMENT BENEFITS
- ❐ 3. OTHER ____________________
- ❐ 4. OTHER ____________________
- ❐ 8. DON'T KNOW
- ❐ 9. NO ANSWER

C14. About how many hours would you say you worked per week during the season?

[ ] HOURS

C15. When you worked in (FISHING JOB 1), are some of the people you work with:

C15a. FAMILY MEMBERS? ❐ 1. YES ❐ 2. NO ❐ 8. DON'T KNOW ❐ 9. NO ANSWER

C15b. FRIENDS? ❐ 1. YES ❐ 2. NO ❐ 8. DON'T KNOW ❐ 9. NO ANSWER

C16. If you want to work in (FISHING JOB 1) next year, are you very certain you can have the job, almost certain, somewhat uncertain, very uncertain, or certain that you won't have it?

- ❐ 1. CERTAIN I WILL HAVE IT
- ❐ 2. ALMOST CERTAIN
- ❐ 3. SOMEWHAT UNCERTAIN
- ❐ 4. VERY UNCERTAIN
- ❐ 5. CERTAIN I WON'T HAVE IT
- ❐ 8. DON'T KNOW
- ❐ 9. NO ANSWER

IF NO FISHING JOB 2 LISTED SKIP TO QUESTION C27, PAGE C-21

OTHERWISE, CONTINUE ON NEXT PAGE

C17. What year did you most recently fish in [FISHING JOB 2]?

YEAR ________ ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C17a. About what date did you start fishing that year?

START DATE ________ ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C17b. And when did you finish?

END DATE ________ ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C18. Did you fish in (FISHING JOB 2) instead of fishing in Cook Inlet that year, or could you have done both?

❐ 1. INSTEAD OF
❐ 2. DID BOTH
❐ 3. COULD HAVE DONE BOTH, BUT DIDN'T
❐ 4. COOK INLET WAS NOT AN OPTION THAT YEAR
❐ 5. OTHER ________________
❐ 8. DON'T KNOW
❐ 9. NO ANSWER

C19. Were you a permit holder in that fishery?

❐ 1. YES ❐ 2. NO ❐ 8. DON'T KNOW ❐ 9. NO ANSWER

C20. In (FISHING JOB 2) were you paid as an owner, with a crew share, with wages, or did you work without pay?

❐ 1. CAPTAIN (PERMIT HOLDER)
❐ 2. CREW MEMBER RECEIVING A SHARE OF GROSS REVENUES
❐ 3. CREW MEMBER RECEIVING A WAGE
❐ 4. UNPAID WORKER → SKIP TO Q.C24
❐ 5. OWNER
6. OTHER ________________

❐ 8. DON'T KNOW
❐ 9. NO ANSWER

C21. How much did you earn in this fishery in (THE MOST RECENT YEAR)?

$ ________ over the entire season ❐ 99998. DON'T KNOW
❐ 99999. NO ANSWER

C22. Before the season started, how much did you think you would earn?

- ❐ 1. ABOUT $__________
- ❐ 2. BETWEEN $________ AND _________
- ❐ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN

- ❐ 8. DON'T REMEMBER WHAT I EXPECTED
- ❐ 9. NO ANSWER

C23. What fringe benefits did you earn on this job?

- ❐ 0. NONE
- ❐ 1. HEALTH INSURANCE
- ❐ 2. PENSION OR RETIREMENT BENEFITS
- ❐ 3. OTHER ______________________
- ❐ 4. OTHER ______________________

- ❐ 8. DON'T KNOW
- ❐ 9. NO ANSWER

C24. About how many hours would you say you worked per week during the season?

[________]
HOURS

C25. When you worked in (FISHING JOB 2), were some of the people you work with:

C25a. FAMILY MEMBERS? ❐ 1. YES ❐ 2. NO ❐ 8. DON'T KNOW ❐ 9. NO ANSWER

C25b. FRIENDS? ❐ 1. YES ❐ 2. NO ❐ 8. DON'T KNOW ❐ 9. NO ANSWER

C26. If you want to work in (FISHING JOB 2) next year, are you very certain you can have the job, almost certain, somewhat uncertain, very uncertain, or certain that you won't have it?

- ❐ 1. CERTAIN I WILL HAVE IT
- ❐ 2. ALMOST CERTAIN
- ❐ 3. SOMEWHAT UNCERTAIN
- ❐ 4. VERY UNCERTAIN
- ❐ 5. CERTAIN I WON'T HAVE IT

- ❐ 8. DON'T KNOW
- ❐ 9. NO ANSWER

OTHER JOBS

C27. Over the past four summers, did you do any work besides commercial fishing?

- ❒ 1. YES
- ❒ 2. NO ——→ SKIP TO Q.C50
- ❒ 8. DON'T KNOW — POSSIBLE JOB
- ❒ 9. NO ANSWER ——

IF YES, LIST MOST RECENT TWO NON-FISHING JOBS. *WE WILL ELABORATE ON THIS JOB ON THE NEXT PAGE*

C27a. OTHER JOB 1: What kind of work?______________________________

C27b. OTHER JOB 2: What kind of work?______________________________

ALSO RECORD ON JOB SHEET FOR LATER REFERENCE

CONTINUE ON NEXT PAGE

OTHER JOB 1

C28. What summer did you most recently work in [OTHER JOB 1]?

YEAR ________ GO TO Q. C28b ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

❐ 97. YEAR-ROUND EMPLOYMENT

> **C28a.** If you fished Cook Inlet (THIS/THAT) year, were you on paid vacation, leave without pay, or some other status in (OTHER JOB 1)?
>
> ❐ 1. PAID
> ❐ 2. LEAVE WITHOUT PAY
> ❐ 3. OTHER ______________
> ❐ 8. DON'T KNOW
> ❐ 9. NO ANSWER
>
> SKIP TO Q. C30

C28b. About what date did you start that year?

START DATE __________ ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C28c. And when did you finish?

END DATE __________ ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C29. Did you work in (OTHER JOB 1) instead of fishing in Cook Inlet (this/that) year, or could you have done both?

❐ 1. INSTEAD OF
❐ 2. DID BOTH
❐ 3. COULD HAVE DONE BOTH, BUT DIDN'T
❐ 4. COOK INLET WAS NOT AN OPTION
❐ 5. OTHER ____________________
❐ 8. DON'T KNOW
❐ 9. NO ANSWER

C30. Tell me a little about this job...

C30a. What kind of work (do/did) you do?

____

C30b. What (are/were) your usual duties or activities at this job?

____

C31. Was this work located on the Kenai Peninsula, somewhere else in Alaska, or outside Alaska?

- ❒ 1. KENAI PENINSULA
- ❒ 2. ELSEWHERE IN AK
- ❒ 3. OUTSIDE AK
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C32. On (OTHER JOB 1), were you working for wages, self-employed, or working without pay (such as for family)?

- ❒ 1. WAGE AND SALARY WORKER
- ❒ 2. SELF EMPLOYED
- ❒ 3. UNPAID WORKER → SKIP TO Q.C36
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C33. What was your rate of pay?

C33a. $__________ **C33b.** per

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C33c. How much did you earn over the entire summer?

$______________ ❒ 9998. DON'T KNOW ❒ 9999. NO ANSWER

C34. Before (OTHER JOB 1) started, how much did you think you would earn?

C34a. Dollars **per** **C34b.**

- ❒ 1. $__________
- ❒ 2. BETWEEN $________ AND _________
- ❒ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN
- ❒ 8. DON'T REMEMBER WHAT I EXPECTED
- ❒ 9. NO ANSWER

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

C35. What fringe benefits did you earn on (OTHER JOB 1)?

- ❒ 0. NONE
- ❒ 1. HEALTH INSURANCE
- ❒ 2. PENSION OR RETIREMENT BENEFITS
- ❒ 3. OTHER ______________________
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C36. How many hours per week did you usually work?

____

____
HOURS ❐ 98. DON'T KNOW ❐ 99. NO ANSWER

C37. If you wanted to work again in (OTHER JOB 1) next year. are you very certain you could have the job. almost certain. somewhat uncertain. very uncertain. or certain you wouldn't have it?

❐ 1. CERTAIN I WILL HAVE IT
❐ 2. ALMOST CERTAIN
❐ 3. SOMEWHAT UNCERTAIN
❐ 4. VERY UNCERTAIN
❐ 5. CERTAIN I WON'T HAVE IT
❐ 8. DON'T KNOW
❐ 9. NO ANSWER

C38. When you work in (OTHER JOB 1), are some of the people you work with:

C38a.	FAMILY MEMBERS?	❐ 1. YES	❐ 2. NO	❐ 8. DON'T KNOW	❐ 9. NO ANSWER
C38b.	FRIENDS?	❐ 1. YES	❐ 2. NO	❐ 8. DON'T KNOW	❐ 9. NO ANSWER

OTHER JOB 2. IF NO OTHER JOB 2. SKIP TO QUESTION C50

C38. What year did you most recently work in [OTHER JOB 2]?

YEAR________ GO TO Q. C38b ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

❒ 97. YEAR-ROUND EMPLOYMENT

C38a. If you fished Cook Inlet (THIS/THAT) year, were you on paid vacation, leave without pay, or some other status in (OTHER JOB 2)?

❒ 1. PAID
❒ 2. LEAVE WITHOUT PAY
❒ 3. OTHER ________________
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

SKIP TO Q. C40

C38b. About what date did you start that year?

START DATE__________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

C38c. And when did you finish?

END DATE__________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

C39. Did you work in (OTHER JOB 2) instead of fishing in Cook Inlet (this/that) year, or could you have done both?

❒ 1. INSTEAD OF
❒ 2. DID BOTH
❒ 3. COULD HAVE DONE BOTH, BUT DIDN'T
❒ 4. COOK INLET WAS NOT AN OPTION
❒ 5. OTHER ____________________
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

C40. Tell me a little about this job...

C40a. What kind of work (do/did) you do?

____

C40b. What (are/were) your usual duties or activities at this job?

____

C41. Was this work located on the Kenai Peninsula, somewhere else in Alaska, or outside Alaska?

- ❒ 1. KENAI PENINSULA
- ❒ 2. ELSEWHERE IN AK BOTH
- ❒ 3. OUTSIDE AK
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C42. On (OTHER JOB 2), were you working for wages, self-employed, or working without pay (such as for family)?

- ❒ 1. WAGE AND SALARY WORKER
- ❒ 2. SELF EMPLOYED
- ❒ 3. UNPAID WORKER → SKIP TO Q.C47
- ❒ 4. OTHER ____________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C43. What was your rate of pay?

C43a. $________

- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C43b. per

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

C44c. How much did you earn over the entire summer?

$______________ ❒ 9998. DON'T KNOW ❒ 9999. NO ANSWER

C45. Before (OTHER JOB 2) started, how much did you think you would earn per month?

C45a. Dollars

- ❒ 1. $_________
- ❒ 2. BETWEEN $_______ AND________
- ❒ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN
- ❒ 8. DON'T REMEMBER WHAT I EXPECTED
- ❒ 9. NO ANSWER

per **C45b.**

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

C46. What fringe benefits did you earn on (OTHER JOB 2)?

- ❒ 0. NONE
- ❒ 1. HEALTH INSURANCE
- ❒ 2. PENSION OR RETIREMENT BENEFITS
- ❒ 3. OTHER ____________________
- ❒ 4. OTHER ____________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C47. How many hours per week did you usually work?

____
HOURS ❑ 98. DON'T KNOW ❑ 99. NO ANSWER

C48. If you wanted to work again in (OTHER JOB 2) next year, are you very certain you could have the job, almost certain, somewhat uncertain, very uncertain, or certain you wouldn't have it?

❑ 1. CERTAIN I WILL HAVE IT
❑ 2. ALMOST CERTAIN
❑ 3. SOMEWHAT UNCERTAIN
❑ 4. VERY UNCERTAIN
❑ 5. CERTAIN I WON'T HAVE IT
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

C49. When you work in (OTHER JOB 2), are some of the people you work with:

C49a. FAMILY MEMBERS? ❑ 1. YES ❑ 2. NO ❑ 8. DON'T KNOW ❑ 9. NO ANSWER

C49b. FRIENDS? ❑ 1. YES ❑ 2. NO ❑ 8. DON'T KNOW ❑ 9. NO ANSWER

POSSIBLE JOB

C50. In the next three summers, do you think you will try to get work other than commercial fishing for salmon in Cook Inlet?

❒ 1. YES → CONTINUE WITH Q.C51
❒ 2. NO → SKIP TO Q.C53. BOX
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

C51. What kind of work would you look for?

____
(PROBE FOR POSSIBLE JOB IF UNCERTAIN)

❒ 1. POSSIBLE JOB IS FISHING JOB 1 → SKIP TO C70 JOB ATTITUDES
❒ 2. POSSIBLE JOB IS FISHING JOB 2
❒ 3. POSSIBLE JOB IS OTHER JOB 1
❒ 4. POSSIBLE JOB IS OTHER JOB 2

C52. Would (possible job) mean you couldn't fish in Cook Inlet or could you do both?

❒ 1. INSTEAD OF
❒ 2. DID BOTH
❒ 3. COULD HAVE DONE BOTH, BUT DIDN'T
❒ 4. COOK INLET WAS NOT AN OPTION
❒ 5. OTHER ________________
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

SKIP TO Q. C55

C53. If you couldn't commercial fish for salmon in Cook Inlet in future years, would you try to get other work?

❒ 1. YES
❒ 2. NO → CONTINUE WITH Q.C70
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

C54. What kind of work would you look for?

____
(PROBE FOR POSSIBLE JOB IF UNCERTAIN)

❒ 1. POSSIBLE JOB IS FISHING JOB 1 → SKIP TO C70 JOB ATTITUDES
❒ 2. POSSIBLE JOB IS FISHING JOB 2
❒ 3. POSSIBLE JOB IS OTHER JOB 1
❒ 4. POSSIBLE JOB IS OTHER JOB 2

ALL RESPONDENTS

C55. Tell me a little about this job...

C55a. What kind of work (would/do) you do?

____

C55b. What (would be/are) your usual duties or activities at this job?

____

C56. Would this work most likely be located on the Kenai Peninsula, somewhere else in Alaska, or outside Alaska?

- ❒ 1. KENAI PENINSULA
- ❒ 2. ELSEWHERE IN AK
- ❒ 3. OUTSIDE AK
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C57. On (POSSIBLE JOB) would you be working for wages, self-employed, or working without pay (such as for family)?

- ❒ 1. WAGE AND SALARY WORKER
- ❒ 2. SELF EMPLOYED
- ❒ 3. UNPAID FAMILY WORKER → SKIP TO Q.C61
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C58. If you worked in (POSSIBLE JOB), how much do you think you would earn?

C58. Dollars **per** **C59.**

- ❒ 1. $__________
- ❒ 2. BETWEEN $________ AND ________
- ❒ 3. I DON'T KNOW HOW MUCH I WOULD EARN
- ❒ 9. NO ANSWER

C59.

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

C60. What fringe benefits do you think you would earn on (POSSIBLE JOB)?

- ☐ 0. NONE
- ☐ 1. HEALTH INSURANCE
- ☐ 2. PENSION OR RETIREMENT BENEFITS
- ☐ 3. OTHER ____________________
- ☐ 4. OTHER ____________________
- ☐ 8. DON'T KNOW
- ☐ 9. NO ANSWER

C61. How many hours per week do you think you would work on (POSSIBLE JOB)?

______________ HOURS ☐ 98. DON'T KNOW ☐ 99. NO ANSWER

C62. If you worked in (POSSIBLE JOB) and want to continue, are you very certain you would be able to continue, almost certain, somewhat uncertain, very uncertain, or certain you couldn't continue?

- ☐ 1. CERTAIN COULD CONTINUE
- ☐ 2. ALMOST CERTAIN
- ☐ 3. SOMEWHAT UNCERTAIN
- ☐ 4. VERY UNCERTAIN
- ☐ 5. CERTAIN COULDN'T CONTINUE
- ☐ 8. DON'T KNOW
- ☐ 9. NO ANSWER

C63. If you work in (POSSIBLE JOB 1), would some of the people you would work with be:

C63a. FAMILY MEMBERS? ☐ 1. YES ☐ 2. NO ☐ 8. DON'T KNOW ☐ 9. NO ANSWER

C63b. FRIENDS? ☐ 1. YES ☐ 2. NO ☐ 8. DON'T KNOW ☐ 9. NO ANSWER

JOB ATTITUDES

C70. I'd like you to think for a minute about things that you look for and avoid in choosing a job. For each job characteristic that I mention, please tell me whether you strongly prefer the characteristic, mildly prefer it, are neutral, mildly avoid, or strongly avoid that characteristic. So, how about... (PROBE: DO YOU STRONGLY PREFER, MILDLY PREFER, NEUTRAL, MILDLY AVOID, OR STRONGLY AVOID JOBS WITH [CHARACTERISTIC]?)

1 STRONGLY PREFER 2 MILDLY PREFER 3 NEUTRAL 4 MILDLY AVOID 5 STRONGLY AVOID

CHARACTERISTIC					
a. high earnings?	1	2	3	4	5
b. certainty of earnings?	1	2	3	4	5
c. job security?	1	2	3	4	5
d. benefits like health insurance and a pension plan?	1	2	3	4	5
e. having time to do other things?	1	2	3	4	5
f. the opportunity the job gives to live where you want?	1	2	3	4	5
g. the excitement of the job?	1	2	3	4	5
h. the job's physical surroundings?	1	2	3	4	5
i. lots of responsibility?	1	2	3	4	5
j. being your own boss?	1	2	3	4	5
k. job safety?	1	2	3	4	5
l. working with family members?	1	2	3	4	5
m. working with friends?	1	2	3	4	5

C71. Thinking about what is particularly important to you in a job, is there a characteristic I haven't mentioned? (What is that? How would you rate?

C71a. CHARACTERISTIC: ______________________________

C71b. 1 STRONGLY PREFER 2 MILDLY PREFER 3 NEUTRAL 4 MILDLY AVOID 5 STRONGLY AVOID

IF R DIDN'T HAVE ANY OTHER FISHING JOBS, DIDN'T HAVE ANY OTHER JOBS, AND DIDN'T HAVE A POSSIBLE JOB, SKIP TO SECTION D.

C72. Now, thinking about Cook Inlet salmon fishing and all the jobs you have mentioned (REPEAT FISHING JOB 1, FISHING JOB 2, OTHER JOB 1, OTHER JOB 2, POSSIBLE JOB, RECORDED ON RANDOM NUMBERS SHEET), in what order would you rank them in overall desirability, from best job to worst job?
RECORD ON RANDOM NUMBERS SHEET

IF COOK INLET SALMON IS RANKED LOWER THAN ALL OTHER JOBS, SKIP TO SECTION D.

C73. If you expected your earnings from Cook Inlet Salmon fishing to decline by 10 percent, would your rankings of job preference change?

- ❒ 1. YES
- ❒ 2. NO → SKIP TO Q.C74
- ❒ 8. DON'T KNOW → SKIP TO Q.C74
- ❒ 9. NO ANSWER → SKIP TO Q.C74

C73a. Please rank the jobs again from most desirable to least desirable.
RECORD ON JOB SHEET
IF (POSSIBLE JOB) IS RANKED HIGHER THAN ALL OTHER JOBS, SKIP TO SECTION D

C74. If you found out you could earn 20 percent more in (POSSIBLE JOB/IF NO POSSIBLE JOB, ASK ABOUT NEXT ONE RANKED BELOW COOK INLET) than you currently expect, would your rankings of job preference change?

- ❒ 1. YES
- ❒ 2. NO
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

C74a. Please rank the jobs again from most desirable to least desirable.
RECORD ON JOB SHEET

SECTION D: BACKGROUND INFORMATION

D1. I just have a few background questions and we're done. First of all, how did you get your Cook Inlet salmon permit, did the state issue it when the program first began, did you inherit it, did you purchase it, or did you get it in some other way?

❒ 1. ISSUED BY STATE
❒ 2. INHERITED
❒ 3. PURCHASED
❒ 4. OTHER ______________________________

D2. How many years have you fished commercially?

______________years ❒ 98 . DON'T KNOW ❒ 99. NO ANSWER

D3. In what community were you living last January? ______________

D4. How many months did you live there in 1994?

[ ] MONTHS (IF 8 OR MORE MONTHS, GO TO Q.D7)

D5. Where else did you live for a month or more? ____________

D6. How many months did you live there?

[ ] MONTHS

D7. How old are you?

____ YEARS

D8. What race do you consider yourself to be?

- ☐ 1. WHITE
- ☐ 2. ALASKA NATIVE
- ☐ 3. OTHER ______________________________

D9. How many people live in your household?

____ PEOPLE

D10. How many people in your household contribute to the household's income?

____ PEOPLE

D11. How many children are there in your household under age 6?

____ PEOPLE

D12. How many people in your household are ages 6 to 18?

____ PEOPLE

D13. Did you receive a permanent fund dividend check in 1993?

- ☐ 1. YES
- ☐ 2. NO

D14. In 1994 before the fishing season began, did you do any work where you:

D14a. were self-employed?

❒ 1. YES ❒ 8. DON'T KNOW
❒ 2. NO ❒ 9. NO ANSWER

D14b. worked for wages or a salary?

❒ 1. YES ❒ 8. DON'T KNOW
❒ 2. NO ❒ 9. NO ANSWER

D15. What do you estimate your household's total 1994 income will be before taxes, but after taking out commercial fishing expenses and other business expenses?

[ ]
DOLLARS

D16. What do you estimate your household's total 1994 income will be from sources other than fishing? (AGAIN BEFORE TAXES, BUT AFTER TAKING OUT BUSINESS EXPENSES)

[ ]
DOLLARS

Thank you! I appreciate your time and the information you've given me. Those are all the questions I have.

END TIME: ______

ALTERNATE ENDING FOR NORTHERN AND WESTERN SETNETTERS
Thank you! That is all the questions I have.
(IF R WANTS MORE INFORMATION, SAY THAT WE WILL SEND THEM A LETTER OF EXPLANATION. ASK FOR MAILING ADDRESS)

MAILING ADDRESS (IF SENDING LETTER)

____

CREW DATA SHEET

RESPONDENT'S NAME: STUDY NUMBER:	PERSON NUMBER: ______	PERSON NUMBER: ______	PERSON NUMBER: ______
CD1. Did (PERSON #) get paid as an owner of the operation, with a crew share, by the pick, or by the hour or some other way?	❐ 1. OWNER ❐ 2. SHARE OF EARNINGS ❐ 3. PICK ❐ 4. HOURLY ❐ 5. OTHER: ______	❐ 1. OWNER ❐ 2. SHARE OF EARNINGS ❐ 3. PICK ❐ 4 HOURLY ❐ 5. OTHER: ______	❐ 1. OWNER ❐ 2. SHARE OF EARNINGS ❐ 3. PICK ❐ 4. HOURLY ❐ 5. OTHER: ______
CD2A. SHARE OF EARNINGS What was (PERSON #)'s % crew share?	______%	______%	______%
CD2b. PICK PERSON What was (PERSON#) paid for each pick?	$	$	$
CD2c. HOURLY PERSON What was (PERSON#) paid per hour?			
CD2d. OTHER PAYMENT What was (PERSON#') paid per (OTHER)t?	$	$	$
ALL RESPONDENTS **CD3.** How much money did (PERSON#) earn over the whole season?	$	$	$
CD5. Not counting any costs deducted before calculating crew shares, did (PERSON #) cover any of the costs of the operation, such as paying for food, fuel, or lost gear?	❐ 1.YES ❐ 2. NO	❐ 1.YES ❐ 2. NO	❐ 1.YES ❐ 2. NO
IF YES, CD5A. About how much did they pay to cover these expenses?	$	$	$

JOB SHEET

Study No. ____________________

Permit No. ____________________

Respondent Name ____________________

C72. INITIAL RANKING: LIST JOB NAMES HERE:

job	**C72.** Initial Ranking	**C73**: Cook Inlet earns 20% less	**C74. Possible Job earns 20% more**
	Ranking 1=most desirable to 5 = least desirable		
Cook Inlet salmon fishing			
FISHING JOB 1:			
FISHING JOB 2:			
OTHER JOB 1:			
OTHER JOB 2:			
POSSIBLE JOB:			

1994 Cook Inlet Salmon Survey
Institute of Social & Economic Research
Post-season Interview of Crew Members

October 12, 1994

Respondent's Name:	Link to Permit No.:

1. INTERVIEWER ID____________ 2. INTERVIEWER'S INTV. NO.__________

3. R'S PHONE NO.______________ 4. STUDY NUMBER ____________

Contact Record		
Preferred Contact Name: Contact Information: Tel. Fax Address		

My name is ________. I am with the Institute of Social and Economic Research at the University of Alaska. I am calling for (NAME).

CONFIRM R IS (NAME) OR ARRANGE TO SPEAK WITH (NAME).

We have a contract from the Alaska Department of Fish and Game to study how alternative Cook Inlet salmon management strategies impact the economy and the value of the fishery to different user groups. We randomly selected (NAME OF PERMIT HOLDER/ ______________________) from a list of Cook Inlet permit holders for this research, and HE/SHE gave us your name as someone to interview who worked on HIS/HER operation. This interview should take about 20 minutes. Everything you say is confidential. Do you have any questions before I begin?

CS1. Are you at least 18 years old?

❑ 1. YES → CONTINUE ❑ 2. NO ↓ Thank you, we are only interviewing crew members over 18

CS2. Do you own a Cook Inlet salmon permit?

❑ 1. YES → Thank you; we are only interviewing crew members who don't hold a permit. ❑ 2. NO→CONTINUE

STUDY NUMBER ______ **START TIME**________

RESPONDENT NAME________________________________

SECTION A: COOK INLET SALMON FISHING (OCTOBER 7, 1994)

A1. When did you start working for (PERMIT HOLDER) this year?

[ ] MONTH/DAY (E.G. 07/04)

A2. And when did you finish?

[ ] MONTH/DAY (E.G. 08/21)

A3. During the season, did you work regularly, frequently, or occasionally for (PERMIT HOLDER)?

❑ 1. OCCASIONALLY
❑ 2. FREQUENTLY
SKIP TO A5

❑3. REGULARLY

❑ 8 DON'T KNOW
❑ 9 NO ANSWER

A4. About how many hours would you say you worked per week during the Cook Inlet salmon season?

[ ] HOURS/WEEK

❑ 998. DON'T KNOW
❑ 999. NO ANSWER
GO TO INTERVIEWER CHECKPOINT

A5. Please describe how often and how much you worked for (PERMIT HOLDER):

INTERVIEWER CHECKPOINT:
IF R WAS EMPLOYED DURING THE PERIOD THAT INCLUDED JULY 30TH, **CONTINUE WITH Q. A6.**

IF R WASN'T EMPLOYED IN THAT PERIOD, **SKIP TO Q.A8.**

A6. The commercial fishery was closed this year on Saturday, July 30 to allow escapement into the Kenai River. What did you do on that day when the fishery was closed?

❒ 1. FISHING RELATED WORK
❒ 2. OTHER WORK FOR PAY→SKIP TO A6a & A6b, BOX
❒ 3. OTHER: ______________________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

A6a. What was the other work ?

____

A6b. How much did you make that day?

$______________ ❒ 998. DON'T KNOW ❒ 999. NO ANSWER

SKIP TO A8

A7. How did you make up the income lost from not fishing that day?

❒ 0. DIDN'T LOSE ANY INCOME
❒ 1. COULDN'T MAKE UP LOST INCOME
❒ 2. WORK MORE IN OTHER JOB
❒ 3. OTHER______________________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

1994 COOK INLET SALMON INCOME AND EXPENSES

Now, I would like to talk about your income from Cook Inlet salmon fishing.

A8. Did you get paid as an owner of the operation, with a crew share, by the pick, by the hour or some other way? ❒ 1. OWNER ❒ 2. SHARE OF EARNINGS ❒ 3. PICK ❒ 4. HOURLY ❒ 5. OTHER ______________	
A8a. SHARE OF EARNINGS What % was your crew share?	______%
A8b. PICK PERSON What were you paid for each pick?	$
A8c. HOURLY PERSON What were you paid per hour?	$
A8d. OTHER PAYMENT What were you paid per (OTHER)?	$
ALL RESPONDENTS **A9.** How much money did you earn over the whole season?	$
A10. Did you get or do you expect any post-season adjustments to that amount? ❒ NO ❒ YES(IF YES) How much?	❒ 0. NONE ❒ $______
A11. How much did you have to spend on gear or equipment for Cook Inlet salmon fishing?	❒ 0. NONE ❒ $______
A12. How much money did you spend looking for your Cook Inlet crew position?	❒ 0. NONE ❒ $______
A13. How much did you spend traveling to the Kenai area? (THAT IS, TO WHERE YOU LIVED WHILE WORKING THIS JOB)	❒ 0. NONE ❒ $______
A14. How much did you spend for a crew license?	❒ 0. NONE ❒ $______

A15. What fringe benefits did you earn on this job?

- ❒ 0. NONE
- ❒ 1. HEALTH INSURANCE
- ❒ 2. PENSION OR RETIREMENT BENEFITS
- ❒ 3. OTHER ______________
- ❒ 4. OTHER ______________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

SECTION B: WORK BENEFITS

This next section of the interview is about benefits you get from working in commercial fishing and other jobs.

B1. Over the past four summers, did you fish commercially in any other fisheries besides Cook Inlet salmon?

❒ 1. YES ❒ 8. DON'T KNOW
❒ 2. NO → SKIP TO B4 ❒ 9. NO ANSWER

B2,3. What were the two most recent fisheries you fished other than Cook Inlet? (LIST ON JOB RANK SHEET)

B4. Over the past four summers, did you do any work besides commercial fishing?

❒ 1. YES ❒ 8. DON'T KNOW
❒ 2. NO SKIP TO B7 ❒ 9. NO ANSWER

B5, 6. What were your two most recent non-fishing jobs? (LIST ON JOB RANK SHEET)

B7. In the next three summers, do you think you will you try to get work other than commercial fishing?

❒ 1. YES → SKIP TO Q.B9
❒ 2. NO
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

B8. If you couldn't commercial fish for salmon in Cook Inlet in future years, would you try to get other work?

❒ 1. YES→ CONTINUE WITH B9 ❒ 8. DON'T KNOW
❒ 2. NO → SKIP TO B10 ❒ 9. NO ANSWER

B9. What kind of work would you look for? (PROBE FOR POSSIBLE JOB IF UNCERTAIN)

❒ 1. OTHER(**LIST ON JOB RANK SHEET**)

❒ 2. POSSIBLE JOB IS FISHING JOB 1
❒ 3. POSSIBLE JOB IS FISHING JOB 2
❒ 4. POSSIBLE JOB IS OTHER JOB 1
❒ 5. POSSIBLE JOB IS OTHER JOB 2

IF POSSIBLE JOB IS THE SAME AS A FISHING JOB OR OTHER JOB ALREADY LISTED, DON'T ASK ABOUT POSSIBLE JOB ON NEXT PAGE, AND DON'T FILL OUT A PJ FORM.

IF R DIDN'T HAVE ANY OTHER FISHING JOBS, DIDN'T HAVE ANY OTHER JOBS, AND DIDN'T HAVE A POSSIBLE JOB, SKIP TO JOB ATTITUDES, B13.

B10. Now, thinking about Cook Inlet salmon fishing and all the jobs you have mentioned (REPEAT COOK INLET SALMON, FISHING JOB 1, FISHING JOB 2, OTHER JOB 1, OTHER JOB 2, POSSIBLE JOB), in what order would you rank them in overall desirability, from best job to worst job?

IF COOK INLET SALMON IS RANKED LOWER THAN ALL OTHER JOBS, SKIP TO JOB ATTITUDES, B13.

B11. If you expected your earnings from Cook Inlet Salmon fishing to decline by 10 percent, would your rankings of job preference change?

❒ 1. YES

❒ 2. NO → SKIP TO Q.B12
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

B11a. Please rank the jobs again from most to least desirable (RECORD ON TABLE)
IF (POSSIBLE JOB) IS RANKED HIGHER THAN ALL OTHER JOBS,
SKIP TO JOB ATTITUDES, B13

B12. If you found out you could earn 20 percent more in (POSSIBLE JOB) [IF NO POSSIBLE JOB, ASK ABOUT JOB RANKED ONE BELOW COOK INLET] than you currently expect, would your rankings of job preference change?

❒ 1. YES

❒ 2. NO → GO TO JOB DETAIL SHEET
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

B12a. Please rank the jobs again from most desirable to least desirable.
RECORD ON TABLE

COMPLETE JOB DETAIL SHEETS FOR TWO MOST PREFERRED JOBS, OTHER THAN COOK INLET, ON INITIAL RANKING, THEN RETURN TO Q'AIRE.

JOB ATTITUDES

B13. I'd like you to think for a minute about things that you look for and avoid in choosing one job over another. For each job characteristic that I mention, please tell me whether you strongly prefer the characteristic, mildly prefer it, are neutral, mildly avoid, or strongly avoid that characteristic. So, how about... (PROBE: DO YOU STRONGLY PREFER, MILDLY PREFER, NEUTRAL, MILDLY AVOID, OR STRONGLY AVOID JOBS WITH [CHARACTERISTIC]?)

1 STRONGLY PREFER | 2 MILDLY PREFER | 3 NEUTRAL | 4 MILDLY AVOID | 5 STRONGLY AVOID

CHARACTERISTIC					
a. high earnings?	1	2	3	4	5
b. certainty of earnings?	1	2	3	4	5
c. job security?	1	2	3	4	5
d. benefits like health insurance and a pension plan?	1	2	3	4	5
e. having time to do other things?	1	2	3	4	5
f. the opportunity the job gives to live where you want?	1	2	3	4	5
g. the excitement of the job?	1	2	3	4	5
h. working outdoors?	1	2	3	4	5
i. lots of responsibility?	1	2	3	4	5
j. being your own boss?	1	2	3	4	5
k. job safety?	1	2	3	4	5
l. working with family members?	1	2	3	4	5
m. working with friends?	1	2	3	4	5

B14. Thinking about what is particularly important to you in a job, is there a characteristic I haven't mentioned? ❒ YES ❒ NO (What is that? How would you rate it?)

B14a. CHARACTERISTIC: ______________________________

B14b. 1 STRONGLY PREFER | 2 MILDLY PREFER | 3 NEUTRAL | 4 MILDLY AVOID | 5 STRONGLY AVOID

SECTION C: BACKGROUND INFORMATION

C1. How many years have you fished commercially? (INCLUDE ALL COMMERCIAL FISHING EXPERIENCE, NOT JUST COOK INLET)

_______________ years ❒ 98 . DON'T KNOW ❒ 99. NO ANSWER

C2. In what community were you living last January? _______________

C3. How many months did you live there in 1994?

[ ]
MONTHS (IF 9 OR MORE MONTHS, GO TO Q.C6)

C4. Where else did you live for a month or more? ______________

C5. How many months did you live there?

[ ]
MONTHS

C6. How old are you?

[ ]
YEARS

C7. What race do you consider yourself to be?

❒ 1. WHITE
❒ 2. ALASKA NATIVE
❒ 3. OTHER ______________________________

C8. How many people live in your household?

[ ] PEOPLE — IF ONLY ONE PERSON IN HH, SKIP TO C12

C9. How many people in your household contribute to the household's income?

[ ] PEOPLE

C10. How many children are there in your household under age 6? [ ] PEOPLE UNDER 6

C11. How many people in your household are ages 6 to 18? [ ] PEOPLE 6 TO 18

C12. Did you receive a permanent fund dividend check in 1993?

❐ 1. YES ❐ 2. NO

C13. Thinking about the part of your income that **doesn't** come from fishing, what do you estimate your household's 1994 non-fishing income will be before taxes, but after taking out business expenses?

[ ] DOLLARS

C14. Now, including fishing income, what do you estimate your household's **total** 1994 income will be? (AGAIN BEFORE TAXES, BUT AFTER TAKING OUT COMMERCIAL FISHING EXPENSES AND OTHER BUSINESS EXPENSES)

[ ] DOLLARS

Thank you! I appreciate your time and the information you've given me. Those are all the questions I have.

END TIME: ________

JOB RANKINGS

JOB	**B10**. Initial Ranking	**B11**: Cook Inlet earns 10% less	**B12**. Possible Job earns 20% more
	Ranking 1=most desirable to 6 = least desirable		
B1A. COOK INLET SALMON FISHING			
B2. FISHING JOB 1: AREA, TGT SPECIES, GEAR			
B3. FISHING JOB 2: AREA, TGT SPECIES, GEAR			
B5. OTHER JOB 1: KIND OF WORK			
B6. OTHER JOB 2: KIND OF WORK			
B9. POSSIBLE JOB: KIND OF WORK			

OTHER FISHING JOB #: ______________________________

FJ1. What year did you most recently fish in [FISHING JOB]?

YEAR__________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

FJ2. About what date did you start fishing THIS/THAT year?

START DATE____________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

FJ3. And when did you finish?

END DATE_____________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

FJ4. Did you fish in (FISHING JOB) instead of fishing in Cook Inlet THIS/THAT year, did you do both, or could you have done both but didn't?

❒ 1. INSTEAD OF
❒ 2. DID BOTH
❒ 3. COULD HAVE DONE BOTH, BUT DIDN'T
❒ 4. COOK INLET WAS NOT AN OPTION THAT YEAR
❒ 5. OTHER ____________________________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

FJ5. ARE/WERE you a permit holder in that fishery?

❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

FJ6. In (FISHING JOB) were you paid as an owner, a captain, with a crew share, with wages, or did you work without pay?

❒ 1. CAPTAIN (PERMIT HOLDER)
❒ 2. CREW MEMBER RECEIVING A SHARE OF GROSS REVENUES
❒ 3. CREW MEMBER RECEIVING A WAGE
❒ 4. UNPAID WORKER → SKIP TO FJ10
❒ 5. OWNER
❒ 6. OTHER ____________________________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

FJ7. How much did you earn in this fishery in (THE MOST RECENT YEAR)?

$ _________ over the entire season ❒ 99998. DON'T KNOW
❒ 99999. NO ANSWER

FJ8. Before the season started, how much did you think you would earn?

❒ 1. $__________
❒ 2.BETWEEN $________ AND_________
❒ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN

❒ 8. DON'T REMEMBER WHAT I EXPECTED
❒ 9. NO ANSWER

FJ9. What fringe benefits did you earn on this job?

❒ 0. NONE
❒ 1. HEALTH INSURANCE
❒ 2. PENSION OR RETIREMENT BENEFITS
❒ 3. OTHER ________________________
❒ 4. OTHER ________________________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

FJ10. About how many hours would you say you worked per week during the season?

[ ] HOURS/WEEK ❒ 998. DON'T KNOW ❒ 999. NO ANSWER

FJ11. When you worked in (FISHING JOB), ARE/WERE some of the people you work with:

FAMILY MEMBERS? ❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

FJ12. FRIENDS? ❒ 1. YES ❒ 2. NO ❒ 8. DON'T KNOW ❒ 9. NO ANSWER

FJ13. If you want to work in (FISHING JOB) next year, are you very certain you can have the job, almost certain, somewhat uncertain, very uncertain, or certain that you won't have it?

❒ 1. CERTAIN I WILL HAVE IT
❒ 2. ALMOST CERTAIN
❒ 3. SOMEWHAT UNCERTAIN
❒ 4. VERY UNCERTAIN
❒ 5. CERTAIN I WON'T HAVE IT

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

POSSIBLE JOB

LOOK AT Q.B8. **IF B8 IS 1. YES**. THAT IS, R ONLY GAVE POSSIBLE JOB IN RESPONSE TO NOT BEING ABLE TO FISH COOK INLET IN FUTURE YEARS.
SKIP PJ1 AND START WITH PJ2.

PJ1. Would (possible job) mean you couldn't fish in Cook Inlet or could you do both?

- ❒ 1. INSTEAD OF
- ❒ 2. COULD DO BOTH
- ❒ 3. COULD DO BOTH, BUT WON'T
- ❒ 4. COOK INLET WAS NOT AN OPTION
- ❒ 5. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

PJ2. What kind of work would you do in (POSSIBLE JOB)?

____

____

PJ3. What would be your usual duties or activities at this job?

____

PJ4. Would this work most likely be located on the Kenai Peninsula, somewhere else in Alaska, or outside Alaska?

- ❒ 1. KENAI PENINSULA
- ❒ 2. ELSEWHERE IN AK
- ❒ 3. OUTSIDE AK
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

PJ5. On (POSSIBLE JOB) would you be working for wages, self-employed, or working without pay (such as for family)?

- ❒ 1. WAGE AND SALARY WORKER
- ❒ 2. SELF EMPLOYED
- ❒ 3. UNPAID FAMILY WORKER → SKIP TO Q.PJ8
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO NSWER

PJ6. What do you think your rate of pay would be?

PJ6a. $_________ **PJ6b.** per
❐ 2.BETWEEN $________ AND_________

❐ 8. DON'T KNOW
❐ 9. NO ANSWER

❐ 1. HOUR
❐ 2. DAY
❐ 3. WEEK
❐ 4. MONTH
❐ 5. OTHER__________

PJ7. What fringe benefits do you think you would earn on (POSSIBLE JOB)?

❐ 0. NONE
❐ 1. HEALTH INSURANCE
❐ 2. PENSION OR RETIREMENT BENEFITS
❐ 3. OTHER ________________________
❐ 4. OTHER ________________________

❐ 8. DON'T KNOW
❐ 9. NO ANSWER

PJ8. How many hours per week do you think you would work on (POSSIBLE JOB)?

[ ]
HOURS/WEEK ❐ 998. DON'T KNOW ❐ 999. NO ANSWER

PJ9. If you work in (POSSIBLE JOB 1), would some of the people you would work with be:

FAMILY MEMBERS?	❐ 1. YES	❐ 2. NO	❐ 8. DON'T KNOW	❐ 9. NO ANSWER
PJ10. FRIENDS?	❐ 1. YES	❐ 2. NO	❐ 8. DON'T KNOW	❐ 9. NO ANSWER

PJ11. If you worked in (POSSIBLE JOB) and wanted to continue, are you very certain you would be able to continue, almost certain, somewhat uncertain, or very uncertain?

❐ 1. CERTAIN COULD CONTINUE
❐ 2. ALMOST CERTAIN
❐ 3. SOMEWHAT UNCERTAIN
❐ 4. VERY UNCERTAIN
❐ 5. CERTAIN COULDN'T CONTINUE

❐ 8. DON'T KNOW
❐ 9. NO ANSWER

OTHER NON FISHING JOB #: ____________________

OJ1. What kind of work do you do in (OTHER JOB):

____

____

OJ2. What are your usual duties or activities at this job?

____

OJ3. What year did you most recently work in [OTHER JOB]?

YEAR__________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

OJ4. Is/was this year-round employment?

❒ 1. YES ❒ 2. NO →SKIP TO OJ6

OJ5. If you fished Cook Inlet (THIS/THAT) year, were you on paid vacation, leave without pay, or some other status in (OTHER JOB 1)?

❒ 1. PAID
❒ 2. LEAVE WITHOUT PAY
❒ 3. OTHER ______________
❒ 7. DIDN'T FISH COOK INLET
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

SKIP TO Q. OJ8

OJ6. About what date did you start that year?

START DATE____________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

OJ7. And when did you finish?

END DATE_____________ ❒ 98. DON'T KNOW ❒ 99. NO ANSWER

NEXT PAGE

OJ8. On (OTHER JOB), were/are you working for wages, self-employed, or working without pay (such as for family)?

- ❒ 1. WAGE AND SALARY WORKER
- ❒ 2. SELF EMPLOYED
- ❒ 3. UNPAID WORKER →SKIP TO OJ12
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

OJ9. In (YEAR) what is/was your rate of pay?

$_________

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

OJ9a. per

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

OJ10. Before (YEAR) started, how much did you think you would earn?

- ❒ 1. $__________
- ❒ 2.BETWEEN $________ AND_________
- ❒ 3. I DIDN'T KNOW HOW MUCH I WOULD EARN
- ❒ 8. DON'T REMEMBER WHAT I EXPECTED
- ❒ 9. NO ANSWER

OJ10a. per

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. OTHER__________

OJ11. What fringe benefits did you earn on (OTHER JOB)?

- ❒ 0. NONE
- ❒ 1. HEALTH INSURANCE
- ❒ 2. PENSION OR RETIREMENT BENEFITS
- ❒ 3. OTHER ______________________
- ❒ 4. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

OJ12. Did you work in (OTHER JOB) instead of fishing in Cook Inlet (this/that) year, did you do both, or could you have done both, but you didn't?

- ❒ 1. INSTEAD OF
- ❒ 2. DID BOTH
- ❒ 3. COULD HAVE DONE BOTH, BUT DIDN'T
- ❒ 4. COOK INLET WAS NOT AN OPTION
- ❒ 5. OTHER ______________________
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

OJ13. How many hours per week did you usually work in (OTHER JOB)?

[ ] HOURS/WEEK ❒ 998. DON'T KNOW ❒ 999. NO ANSWER

OJ14. Was/is this work located on the Kenai Peninsula, somewhere else in Alaska, or outside Alaska?

❒ 1. KENAI PENINSULA
❒ 2. ELSEWHERE IN AK
❒ 3. OUTSIDE AK
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

OJ15. When you work in (OTHER JOB), are some of the people you work with:

FAMILY MEMBERS?	❒ 1. YES	❒ 2. NO	❒ 8. DON'T KNOW	❒ 9. NO ANSWER
OJ16. FRIENDS?	❒ 1. YES	❒ 2. NO	❒ 8. DON'T KNOW	❒ 9. NO ANSWER

OJ17. If you wanted to work again in (OTHER JOB) next year, are you very certain you could have the job, almost certain, somewhat uncertain, very uncertain, or certain you wouldn't have it?

❒ 1. CERTAIN I WILL HAVE IT
❒ 2. ALMOST CERTAIN
❒ 3. SOMEWHAT UNCERTAIN
❒ 4. VERY UNCERTAIN
❒ 5. CERTAIN I WON'T HAVE IT
❒ 8. DON'T KNOW
❒ 9. NO ANSWER

CS Number:

1994 Cook Inlet Salmon Survey
Institute of Social and Economic Research
Post Season Sport Resident Interview

December 13, 1994

1. INTERVIEWER ID____________ 2. INTERVIEWER'S INTV. NO.__________

3. R'S PHONE NO.______________ 4. STUDY NUMBER __________

	FIRST COLUMN	DISP NO.	FISH HH?	SECOND COLUMN	DISP NO.	FISH HH?	THIRD COLUMN	DISP NO.	FISH HH?
1	XYZ1			XYZ9					
2	XYZ2			XYZ10					
3	XYZ3			XYZ11					
4	XYZ4			XYZ12					
5	XYZ5			XYZ13					
6	XYZ6			XYZ14					
7	XYZ7			XYZ15					
8	XYZ8			XYZ16					

(1) Hello, I'm (name) calling for the University of Alaska. I am a member of a research team conducting a special study for the State of Alaska.

(2) Is this (phone number) ?

YES

NO → Thank you very much but I seem to have dialed the wrong number. It is possible that your number may be called at a later time.

(3) Is this a residence ?

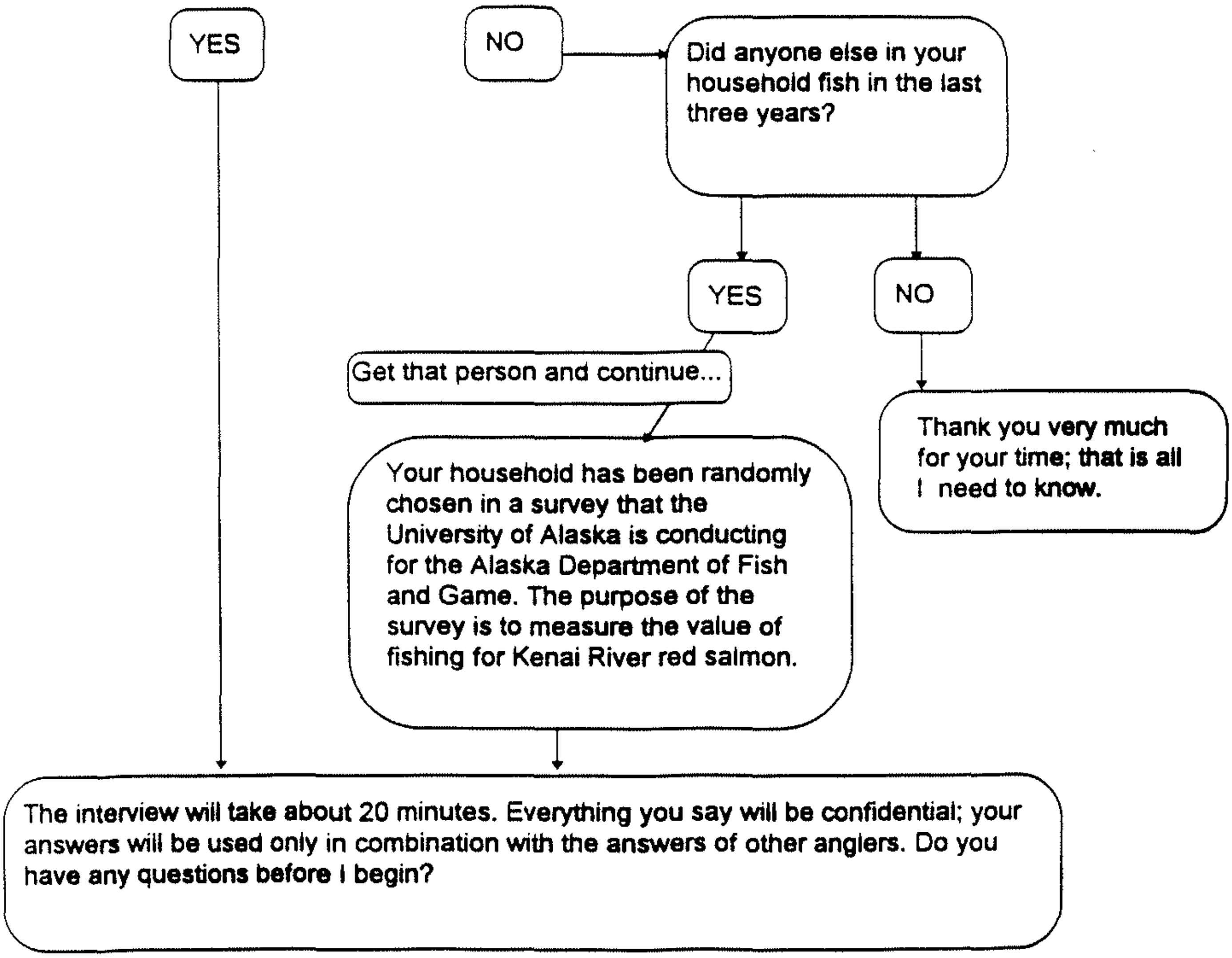
YES

NO → Thank you very much but we are only interviewing in private residences.

❒ PRIVATE OR SEMI-PRIVATE PHONE IN DORM/BARRACKS
(SPECIFY TYPE OF HOUSING______________________)

CONTINUE WITH (4)

4) Your household has been randomly chosen in a survey that the University of Alaska is conducting for the Alaska Department of Fish and Game. The purpose of the survey is to measure the value of fishing for Kenai River red salmon. Did you fish with rod and reel, a dipnet, or in a subsistence fishery in southcentral Alaska any time in the last three years?



CONTINUE WITH MAIN QUESTIONNAIRE

SECTION A: FISHING ACTIVITIES

START TIME: ________

A1. The first set of questions is about fishing with a rod and reel. From May to October of 1994, how many trips did your household take to fish with a rod and reel? This includes all trips for all species in Southcentral.

[ ] NUMBER OF TRIPS

❐ 998. DON'T KNOW
❐ 999. NO ANSWER

A2. Is this more, less, or about the same number of trips as your household took in 1993?

❐ 1. MORE
❐ 2. LESS

❐ 3. SAME
❐ 8. DON'T KNOW
❐ 9. NO ANSWER

SKIP TO Q. A3

A2a. Why was this year different?

A3. Which of the last three years did your household fish for red salmon? (CHECK AS MANY AS APPLY)

❐ 94

❐ 93
❐ 92

IF 94 IS NOT CHECKED SKIP TO Q.A4

❐ 00. NONE
❐ 98. DON'T KNOW
❐ 99. NO ANSWER

SKIP TO Q.A11

A3a. How many trips did your household take between May and October of 1994 to fish for red salmon?

❐ 998. DON'T KNOW
❐ 999. NO ANSWER

[ ] NUMBER OF TRIPS

A4. Still talking about rod and reel fishing, we are interested in red salmon caught in July and August from the Kenai River and from the lakes and streams which empty into it. These include the Russian and Moose Rivers, and the Trail, Kenai, Hidden and Skilak lakes, as well as other lakes and streams. Which of the last three years did your household fish for red salmon in the Kenai River area? (CHECK AS MANY AS APPLY)

- ❒ 94 → (continue to A5)
- ❒ 93
- ❒ 92

[redacted]

- ❒ 00. NONE
- ❒ 98. DON'T KNOW
- ❒ 99. NO ANSWER

SKIP TO Q.A11

A5. How many trips did your household take in July and August of [redacted] to fish for red salmon in the Kenai River area?

[ ] NUMBER OF TRIPS

998. DON'T KNOW
999. NO ANSWER

A5a. How many days altogether did your household spend fishing on these trips?

[ ] NUMBER OF DAYS

998. DON'T KNOW
999. NO ANSWER

A6. How many of these trips were with a guide?

[ ] NUMBER OF TRIPS

998. DON'T KNOW
999. NO ANSWER

A7. Now, thinking just of yourself, if you had wanted to, could you have fished more days than you did?

- ❑ 1. YES → (continue to A7a)

- ❑ 2. NO
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

SKIP TO Q. A8

A7a. How many more days could you have fished?

__________ NUMBER OF DAYS

- ❑ 998. DK
- ❑ 999. NA

A8. Is your household satisfied with the number of red salmon you took with rod **and reel from the** Kenai River area over the last three years?

☐ 1. YES
☐ 8. DON'T KNOW
☐ 9. NO ANSWER
SKIP TO Q.A10

☐ 2. NO
CONTINUE WITH Q.A9

A9. Did you not get enough fish because:

a. you didn't have enough time to go fishing?	☐ 1. YES ☐ 2. NO
b. it took too long to catch a fish?	☐ 1. YES ☐ 2. NO
c. the daily limit was too low?	☐ 1. YES ☐ 2. NO
d. the number of days the fishery was open was too low?	☐ 1. YES ☐ 2. NO
e. some other reason?	☐ 1. YES ☐ 2. NO

A10. And, when your household fishes for red salmon in the Kenai River area, do you **take your limit**, almost always, frequently, occasionally, or rarely?

☐ 1. ALMOST ALWAYS OR ALWAYS
☐ 2. FREQUENTLY
☐ 3. OCCASIONALLY
☐ 4. RARELY OR NEVER

☐ 8. DON'T KNOW
☐ 9. NO ANSWER

A11. Now I'd like to ask you about dipnetting instead of rod and reel fishing. Which of the last three years has your household fished for red salmon with a dipnet in a personal use or subsistence fishery?

❐ 94

❐ 93
❐ 92
[redacted]

❐ 00. NONE
❐ 98. DON'T KNOW
❐ 99. NO ANSWER
SKIP TO Q.A17

A12. How many of these dipnet trips were to the lower Kenai River?

NUMBER OF TRIPS

IF NONE, SKIP TO Q.A16

A13. How many red salmon did your household take on these trips to the lower Kenai?

❐ 1. NUMBER or
❐ 2. POUNDS

❐ 998. DON'T KNOW
❐ 999. NO ANSWER
❐ 000. NONE
SKIP TO Q.A15

A14. Of these, about how many were taken under subsistence regulations?

❐ 1. NUMBER or
❐ 2. POUNDS

❐ 998. DON'T KNOW
❐ 999. NO ANSWER

A15. How many salmon other than reds did your household take dipnetting the lower Kenai?

❐ 1. NUMBER or
❐ 2. POUNDS

❐ 998. DON'T KNOW
❐ 999. NO ANSWER

A16. I would like to ask about why your household goes dipnetting. For each reason I read, please tell me whether it is <u>always</u> important in your decision to go dipnetting, <u>sometimes</u> important, or <u>never</u> important.

IMPORTANCE OF ITEM TO DECISION TO GO DIPNETTING:	1. ALWAYS 2. SOMETIMES 3. NEVER
A16a. Getting food?	
A16b. Having fun?	
A16c. Having a chance to be with family and friends?	
A16d. Doing something challenging?	
A16e. Anything else? ❐ 2. NO ❐ 1. YES→(SPECIFY):	

A17. Now I would like to ask about subsistence setnetting. Which, if any, of the **last three years has** your household had a subsistence setnet in Cook Inlet?

- ☐ 94
- ☐ 93
- ☐ 92
- ☐ 00. NONE
- ☐ 98. DON'T KNOW
- ☐ 99. NO ANSWER

SKIP TO Q.A21

A18. Since May, how many times has your household fished with a subsistence **setnet in Cook** Inlet?

[ ] NUMBER OF TRIPS

- ☐ 998. DON'T KNOW
- ☐ 999. NO ANSWER

A19. How many red salmon did you take?

[ ]
- ☐ 1. NUMBER or
- ☐ 2. POUNDS
- ☐ 998. DON'T KNOW
- ☐ 999. NO ANSWER

A20. How many salmon other than reds did you take?

[ ]
- ☐ 1. NUMBER or
- ☐ 2. POUNDS
- ☐ 998. DON'T KNOW
- ☐ 999. NO ANSWER

ALL RESPONDENTS

A21. Last summer the price for fresh whole red salmon in the supermarket was about $5 per pound. Would your household be likely to fish more for red salmon if the supermarket price were $8.00 per pound? (THIS IS FOR WHOLE FRESH FISH IN SEASON)

❑ 1. YES→SKIP TO Q.A22
❑ 2. NO→ CONTINUE

❑ WOULD NEVER BUY
SKIP TO Q.A23

❑ 8. DON'T KNOW
❑ 9. NO ANSWER

A21a. How about if the price were $12.00 per pound?

❑ 1. YES
❑ 2. NO
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

A22. If your household caught and kept more red salmon, what would you buy less of at the supermarket?
(ANYTHING ELSE?)

____

____

____

A23. If your household decided to fish more because there were more red salmon in the Kenai River, would you use rod and reel, a dipnet, or a subsistence setnet?
(WHICH WOULD YOU BE MORE LIKELY TO USE?)

❑ 1. ROD & REEL
❑ 2. DIPNET
❑ 3. SETNET
❑ 7. STILL WOULDN'T FISH FOR REDS
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

Record No: 630

SECTION B: RESPONSES TO FISHERIES CHANGES

B1. The next section deals with possible changes in the Kenai red salmon late run, which occurs during July and the first half of August. The bag limit currently starts at three fish per day and increases to 6 per day when enough fish have entered the river.

If anglers could keep 6 fish per day rather than 3 from the start of the season, would your household change the time spent fishing for Kenai red salmon with a rod and reel?

❑ 1. YES

❑ 2. NO WOULD FISH SAME AMOUNT
SKIP TO Q. B5

❑ 7. DON'T FISH AND WOULDN'T
❑ 8. DON'T KNOW
❑ 9. NO ANSWER
SKIP TO Q. B6

B2. Would your household take more or fewer trips?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B2a. How many (MORE/FEWER) trips would you take to the Kenai? Then how many trips altogether would you take to the Kenai? _____

_______ NUMBER OF TRIPS
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

IF R WOULD MAKE ZERO TRIPS, SKIP TO Q. B6

B3. Would your household trips be the same number of days as now, more, or fewer?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B3a. How many (MORE/FEWER) days per trip would you spend?

_______ DAYS/TRIP
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

B4. And on a typical day fishing for Kenai red salmon, would your household spend about the same number of hours fishing as now, more or fewer?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B4a. How many (MORE/FEWER) hours per day would you fish?

_______ CHANGE IN HOURS
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

CONTINUE

Record No: 630

B5. Suppose Fish and Game could raise the bag limit if they could watch the run more closely. Anglers could pay for this extra work through a fish stamp. Those who wanted to keep 6 fish per day instead of 3 would buy the stamp, and the money would go to Fish and Game. Would your household pay **$10.00** dollars for a fish stamp to increase your bag limit from 3 to 6? (FISH AND GAME MIGHT STILL INCREASE THE BAG LIMIT FOR EVERYONE LATE IN THE SEASON.)

❑ 1. YES ↓

❑ 2. NO ↓

❑ 8. DK→ SKIP TO Q.B6

❑ 9. NA→ SKIP TO Q.B6

B5a. Would you pay **$20.00** dollars?

❑ 1. YES ❑ 2. NO

CONTINUE WITH B6, NEXT PAGE

B5b. Would you pay **$5.00** dollars?

❑ 1. YES
SKIP TO B6, NEXT PAGE

❑ 2. NO→ CONTINUE WITH B5c.

B5c. Would you be willing to pay anything?

❑ 1. YES
CONTINUE WITH B6, NEXT PAGE

❑ 2. NO

B5d. (IF NOTHING) Why is that?

CONTINUE WITH B6, NEXT PAGE

B6. Fish and Game could also let more fish into the Kenai River. If **200 thousand** more red salmon entered the river, the average angler might take **35** percent less time to catch a fish, at the peak of the run. (CURRENTLY, DURING THE PEAK OF AVERAGE AND LOW RUNS, FISH AND GAME ESTIMATES IT TAKES ABOUT 4 HOURS TO CATCH A FISH.)

More anglers might decide to fish the Kenai, increasing crowds by **15 percent**.

A few more king salmon would also enter the Kenai along with the extra reds, although most anglers wouldn't notice any difference.

If this happened, that is, if there were better red salmon catch rates, a few more king salmon, and more anglers on the river, would your household change the time spent fishing in the Kenai River area?

❑ 1. YES

❑ 2. NO WOULD FISH SAME AMOUNT
SKIP TO Q. B10

❑ 7. DON'T FISH AND WOULDN'T
❑ 8. DON'T KNOW
❑ 9. NO ANSWER
SKIP TO Q. B11

B7. Would your household take more or fewer trips?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B7a. How many (MORE/FEWER) trips would you take to the Kenai? Then how many trips altogether would you take to the Kenai? _____

_____ NUMBER OF TRIPS
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

IF R WOULD MAKE ZERO TRIPS, SKIP TO Q. B11

B8. Would your household trips be the same number of days as now, more, or fewer?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B8a. How many (MORE/FEWER) days per trip would you spend?

_____ DAYS/TRIP
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

B9. And on a typical day fishing for Kenai red salmon, would your household spend about the same number of hours fishing as now, more or fewer?

❑ 1. MORE
❑ 2. FEWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B9a. How many (MORE/FEWER) hours per day would you fish?

_____ CHANGE IN HOURS
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

CONTINUE

Record No: 630

B10. One way Fish and Game could put more fish in the river would be to increase run size by improving salmon habitat. Anglers could pay for these improvements if they had to buy a fish stamp to fish for Kenai red salmon. Would your household pay **$10.00** dollars for a fish stamp if there were 200 thousand more red salmon in the Kenai?

❑ 1. YES ↓

❑ 2. NO ↓

❑ 8. DK→SKIP TO Q.B11
❑9. NA→SKIP TO Q.B11

B10a. Would you pay **$20.00** dollars?

❑ 1. YES ❑ 2. NO

SKIP TO B11, NEXT PAGE

B10b. Would you pay **$5.00** dollars?

❑ 1. YES
SKIP TO B11, NEXT PAGE

❑ 2. NO→ CONTINUE WITH B10c.

B10c. Would you be willing to pay anything?

❑ 1. YES
CONTINUE WITH B11, NEXT PAGE
❑ 2. NO

B10d. (IF NOTHING) Why is that?

CONTINUE WITH B11, NEXT PAGE

B10ALT. SALMON ENHANCEMENT ALTERNATIVE:

2. improve habitat.

Record No: 630

B11. If 200 thousand more late run red salmon were allowed into the Kenai, the personal use fishery on the lower river could also take some of the additional fish. At present, Alaska residents with a sport license can dipnet 6 fish per day, once enough fish have entered the river.

With more fish, the personal use fishery could be opened earlier or the bag limit could be increased. If the personal use fishery opened two weeks earlier, or the bag limit doubled from 6 to 12 fish per day, do you think your household would try to dipnet more, fewer, or the same number of Kenai red salmon compared to now?

❑ 1. MORE
❑ 2. FEWER
❑ 3. SAME
→ CONTINUE

❑ 7. STILL WOULDN'T PARTICIPATE
→ SKIP TO CHECKPOINT, PAGE B-18

❑ 8. DON'T KNOW
❑ 9. NO ANSWER
→ CONTINUE

B12. Which would you prefer, opening the season two weeks earlier than now, or doubling the bag limit?

❑ 1. LONGER SEASON

COMPLETE LONGER SEASON Q. B13

❑ 2. HIGHER BAG
❑ 3. NO PREFERENCE
❑ 4. BOTH
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

COMPLETE HIGHER BAG, Q. B18

DIPNET LONGER SEASON

B13. If the personal use fishery opened two weeks earlier than now, it might double the number of fish available. If this happened, would your household change the time spent dipnetting for Kenai red salmon?

- ❑ 1. YES
- ❑ 2. NO
- ❑ 8. DON'T KNOW
- ❑ 9. NO ANSWER

SKIP TO Q. B17

B14. Would your household take more or fewer trips?

- ❑ 1. MORE
- ❑ 2. FEWER

B14a. How many (MORE/FEWER) trips would you take to dipnet the Kenai? Then how many trips altogether would you take to the Kenai? _____

_________ NUMBER OF TRIPS ❑ 98. DON'T KNOW ❑ 99. NO ANSWER

IF R WOULD MAKE ZERO TRIPS, SKIP TO CHECKPOINT, PAGE B-18

- ❑ 3. SAME
- ❑ 8. DON'T KNOW
- ❑ 9. NO ANSWER

B15. Would your household's trips be more, fewer or the same number of days as now?

- ❑ 1. MORE
- ❑ 2. FEWER

B15a. How many (MORE/FEWER) days would you spend per trip?

_________ DAYS PER TRIP ❑ 98. DON'T KNOW ❑ 99. NO ANSWER

- ❑ 3. SAME
- ❑ 8. DON'T KNOW
- ❑ 9. NO ANSWER

B16. And on a typical day dipnetting for Kenai red salmon, would your household spend more, fewer, or about the same number of hours fishing as now?

- ❑ 1. MORE
- ❑ 2. FEWER

B16a. How many (MORE/FEWER) hours per day would you fish?

_________ HOURS PER DAY ❑ 98. DON'T KNOW ❑ 99. NO ANSWER

- ❑ 3. SAME
- ❑ 8. DON'T KNOW
- ❑ 9. NO ANSWER

CONTINUE

Record No: 630

B17. Suppose anglers who wanted to dipnet the earlier opening had to buy an early season permit. Would your household pay **$20.00** dollars for a permit?
(ANGLERS WITHOUT THE PERMIT WOULD HAVE THE SAME DIPNET SEASON AS UNDER CURRENT REGULATIONS. ANGLERS WITH THE PERMIT COULD DIPNET EARLIER)

❑ 1. YES ❑ 2. NO ❑ 8. DK ❑ 9. NA

SKIP TO CHECKPOINT. PAGE B-18

B17a. Would you pay **$30.00** dollars?

❑ 1. YES ❑ 2. NO

SKIP TO CHECKPOINT. PAGE B-18

B17b. Would you pay **$15.00** dollars?

❑ 1. YES
SKIP TO CHECKPOINT. PAGE B-18

❑ 2. NO→ CONTINUE WITH B17c.

B17c. Would you be willing to pay anything?

❑ 1. YES
SKIP TO CHECKPOINT. PAGE B-18
❑ 2. NO

B17d. (IF NOTHING) Why is that?

SKIP TO CHECKPOINT. PAGE B-18

DIPNET HIGHER BAG LIMIT

B18. If your household could take 12 fish per day instead of 6, would that change the time your household spends dipnetting for Kenai red salmon?
(THE SEASON WOULD BE THE SAME AS NOW.)

❑ 1. YES

❑ 2. NO
❑ 8. DON'T KNOW
❑ 9. NO ANSWER
SKIP TO Q. B22

B19. Would your household take more or fewer trips?

❑ 1. MORE
❑ 2. FEWER → B19a. How many (MORE/FEWER) trips would you take to dipnet the Kenai? Then how many trips altogether would you take to the Kenai? ____

____ NUMBER OF TRIPS
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

IF R WOULD MAKE ZERO TRIPS, SKIP TO CHECKPOINT, PAGE B-18

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B20. Would your household's trips be more, fewer, or the same number of days as now?

❑ 1. MORE
❑ 2. FEWER → B20a. How many (MORE/FEWER) days would you spend per trip?

____ DAYS PER TRIP
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

B21. And on a typical day dipnetting for Kenai red salmon, would your household spend more, **fewer**, or about the same number of hours fishing as now?

❑ 1. MORE
❑ 2. FEWER → B21a. How many (MORE/FEWER) hours per day would you fish?

____ HOURS PER DAY
❑ 98. DON'T KNOW
❑ 99. NO ANSWER

❑ 3. SAME
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

CONTINUE

Record No: 630

B22. Suppose dipnetters who wanted to keep 12 fish per day instead of 6 had to buy a permit. Would your household pay **$20.00** dollars for a permit?
(ANGLERS WITHOUT THE PERMIT WOULD BE ABLE TO KEEP ONLY 6 FISH PER DAY)

❑ 1. YES

❑ 2. NO

❑ 8. DK
❑ 9. NA
SKIP TO CHECKPOINT, PAGE B-18

B22a. Would you pay **$30.00** dollars?

❑ 1. YES ❑ 2. NO

SKIP TO CHECKPOINT, PAGE B-18

B22b. Would you be willing to pay more than **$15.00** dollars?

❑ 1. YES
SKIP TO CHECKPOINT, PAGE B-18

❑ 2. NO→ CONTINUE WITH B22c.

B22c. Would you be willing to pay anything?

❑ 1. YES
SKIP TO CHECKPOINT, PAGE B-18
❑ 2. NO

B22d. (IF NOTHING) Why is that?

SKIP TO CHECKPOINT, PAGE B-18

CHECKPOINT

IF R RESPONDED TO ANY OF THE ALTERNATIVES IN SECTION B THAT HE/SHE WOULD:

FISH MORE OFTEN ON THE KENAI, CONTINUE WITH Q. B23. ❒

FISH LESS OFTEN ON THE KENAI, SKIP TO Q. B27, PAGE B-19 ❒

IF NO CHANGE, SKIP TO SECTION C ❒

B23. If your household fished the Kenai River area more often, what would you do less of in order to have more time to fish the Kenai? (MORE THAN ONE ANSWER MAY APPLY)

❒ 1. WORK
❒ 8. DK
❒ 9. NA

SKIP TO SECTION C

❒ 2. OTHER FISHING

❒ 3. OTHER

B24. Where would you fish less, and how many fewer trips would you take there in order to fish more for Kenai reds?

SITE	TARGET SPECIES	# OF TRIPS

B25. LIST ACTIVITIES

a. ____________________

b. ____________________

c. ____________________

B26. How much money would you expect to save by not doing (ACTIVITIES)?

❒ 0. NONE

____
DOLLARS

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

IF R FISHED LESS UNDER ANY ALTERNATIVE IN SECTION B, CONTINUE WITH NEXT PAGE OTHERWISE, SKIP TO SECTION C

REMINDER: COMPLETE B27 - B29 <u>ONLY</u> IF R RESPONDED SOMEWHERE IN SECTION B THAT HE/SHE WOULD FISH <u>LESS</u> OFTEN ON THE KENAI
OTHERWISE SKIP TO SECTION C

B27. If your household fished the Kenai River area less often, what would your household do instead? (MORE THAN ONE ANSWER MAY APPLY)

- ❒ 1. WORK
- ❒ 8. DK
- ❒ 9. NA

SKIP TO SECTION C

- ❒ 2. OTHER FISHING → B28
- ❒ 3. OTHER → B29

B28. Where would you fish more, and how many more trips would you take there?

SITE	TARGET SPECIES	# OF TRIPS

B29. LIST ACTIVITIES

a. ____________________

b. ____________________

c. ____________________

B30. How much money would you expect to spend doing (ACTIVITIES)?

❒ 0. NONE

____
DOLLARS

❒ 8. DON'T KNOW
❒ 9. NO ANSWER

CONTINUE WITH SECTION C

SECTION C: BACKGROUND INFORMATION

C1. In what community do you live? ______________

C2. How many years have you lived in Alaska?

[ ] YEARS

- ☐ 5. LIVED IN ALASKA ALL LIFE
- ☐ 9. NO ANSWER

SKIP TO C4

C3. How important were recreation opportunities in your decision to move to Alaska: very important, somewhat important, or not important?

- ☐ 1. VERY IMPORTANT
- ☐ 2. SOMEWHAT IMPORTANT
- ☐ 3. NOT IMPORTANT
- ☐ 8. DON'T KNOW
- ☐ 9. NO ANSWER

C4. Did the Kenai River sport fishing opportunities make a difference in where you chose to live?

- ☐ 1. YES
- ☐ 2. NO
- ☐ 8. DON'T KNOW
- ☐ 9. NO ANSWER

C5. Does your household own:

ITEM	OWNS?	# MORE FISH TO PURCHASE ITEM
a. a cabin or land that you use for fishing on the Kenai River?	☐1. YES ☐ 2. NO	
b. a boat that you use for fishing on the Kenai River?	☐1. YES ☐ 2. NO	
c. a freezer?	☐1. YES ☐ 2. NO	
d. a smoker or canner?	☐1. YES ☐ 2. NO	

C6. How many more Kenai red salmon would your household have to catch each year, to make you decide to buy.... (EACH ITEM R DOESN'T OWN)

C6e. How many more Kenai red salmon would your household have to catch each year, to make you decide to buy more fishing gear?

[ ] NUMBER OF FISH

- ☐ 998. DON'T KNOW
- ☐ 999. NO ANSWER

IF R OWNS CABIN OR LAND FOR FISHING THE KENAI, CONTINUE WITH C7

IF NOT, SKIP TO C10

ASK ONLY IF R'S HOUSEHOLD OWNS CABIN FOR FISHING THE KENAI

C7. This year, how many days did your household use your (CABIN/LAND)?

[ ] DAYS

- ❒ 998. DON'T KNOW
- ❒ 999. NO ANSWER

C8. Of those days, how many days did your household fish for late run reds in the Kenai River area?

[ ] DAYS

- ❒ 998. DON'T KNOW
- ❒ 999. NO ANSWER

C9. What is the market value of this property?

[ ] DOLLARS

- ❒ 9999998. DON'T KNOW
- ❒ 9999999. NO ANSWER

C10. How old are you?

[ ] YEARS

C11. Do you expect to retire in Alaska?

❒ 1. YES ❒ 2. NO→ SKIP TO Q.C13 ❒ 3. ALREADY RETIRED→ SKIP TO Q. C15

C12. When you retire, do you expect to fish more?

- ❒ 1. YES
- ❒ 2. NO
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER

CONTINUE WITH Q. C13

C13. What is your occupation? ______________________________

C14. And what is/was your rate of pay?

$__________

- ❒ 0. WORK WITHOUT PAY (SKIP C14a)
- ❒ 7. REFUSED
- ❒ 8. DON'T KNOW
- ❒ 9. NO ANSWER (SKIP C14a)

C14a. per

- ❒ 1. HOUR
- ❒ 2. DAY
- ❒ 3. WEEK
- ❒ 4. MONTH
- ❒ 5. YEAR
- ❒ 6. OTHER__________

C15. Including yourself, how many people live in your household?

______ PEOPLE

IF ONLY ONE, SKIP TO C17

C16. For each household member other than yourself, could you tell me their age and whether or not they have fished in the last three years?

PERSON #:	1	2	3	4	5	6	7	8	9
AGE (YRS)									
FISHES? (Y/N)									

C17. What race do you consider yourself to be?

❑ 1. WHITE
❑ 2. NATIVE
❑ 3. OTHER (SPECIFY:____________________)

C18. What do you think your household's total 1994 income will be before taxes, but after taking out any business expenses?

______ DOLLARS

❑ 999998. DON'T KNOW
❑ 999999. NO ANSWER

C18. Overall, how would you describe your fishing skills: beginner, intermediate, advanced, or expert?

❑ 1. BEGINNER
❑ 2. INTERMEDIATE
❑ 3. ADVANCED
❑ 4. EXPERT
❑ 8. DON'T KNOW
❑ 9. NO ANSWER

C19. (RECORD SEX)

❑ 1. MALE
❑ 2. FEMALE

Thank you! Those are all the questions I have.

______ END TIME

A5. ______ (B2 / B7) A12. ______ (B14 / B19)

B2. HIGHER BAG LIMIT	B7. BETTER CATCH RATE	B14. or B19. DIPNET
❑ FISH MORE OFTEN	❑ FISH MORE OFTEN	❑ FISH MORE OFTEN
❑ FISH LESS OFTEN	❑ FISH LESS OFTEN	❑ FISH LESS OFTEN

Dear Alaska Visitor

Thank you for answering our survey last year about your 1993 visit to Alaska. We hope you will answer a few questions about the red (sockeye) salmon fishery in July and early August on the Kenai Peninsula. The Alaska Department of Fish and Game has hired the University of Alaska to study the economic value of this fishery.

You reported that you fished for red salmon or king salmon in the Kenai River system during your 1993 visit to Alaska. You may recall that although the bag limit is normally three fish, it was reduced to two fish for most of the season. As a part of our study, we need information that we can get only from the people who fished the area, both Alaska residents and non-Alaskans. Your responses will help Alaska to manage its fisheries for the benefit of all users.

This questionnaire has an identification number so we can check your name off our mailing list when you return your questionnaire. Of course, your responses will be kept confidential and used only in combination with the answers of other anglers.

Thank you for your help.

Sincerely,

Scott Goldsmith
Professor of Economics

Anchorage
Kenai
Seward
Homer
KENAI PENINSULA

Please cut on dotted line, fold and tape. Do not staple

Please think about your 1993 trip when answering questions 1, 2, and 3.

1. **The bag limit on Kenai River late-run (July-August) red salmon is normally three fish a day, but for most of 1993 it was two fish. Suppose the bag limit had been one fish per day during your visit. Also suppose that it took the same amount of time to catch a fish as it did in 1993. Would your fishing have been different? (Check all that apply.)**
   - ❑ Did not fish for late-run Kenai River reds
   - ❑ Would have fished less for reds on the Kenai
   - ❑ Would have fished more in other locations
     - ❑ for reds ❑ for species other than reds
   - ❑ No. My fishing would have been the same
   - ❑ Would have shortened my visit to Alaska by ____ days
   - ❑ Other

   1a. **Now suppose the bag limit could have been increased, instead of lowered. Would you have been willing to pay $30 for a special Kenai River red salmon fish stamp to raise the bag limit to six fish a day?**
   ❑ Yes ❑ No

2. How important was fishing for Kenai River late-run red salmon in your 1993 decision to visit Alaska?
   ❑ Not at all important ❑ Somewhat important ❑ Very important

3. **Did you have any information about the 1993 bag limits and openings in the late-run Kenai River fishery before your visit to Alaska?**
   ❑ Yes ❑ No

4. **Did you visit Alaska in** *1994*?
   ❑ Yes → 4a. **How important was fishing for Kenai River late-run red salmon in your decision to visit Alaska in 1994?**
   ❑ Not at all important ❑ Somewhat important ❑ Very important
   ❑ No

5. **Do you plan to visit Alaska again?**
   ❑ Definitely ❑ Probably ❑ Possibly ❑ Unlikely ❑ Never

   5a. **Suppose the bag limit for Kenai River late-run red salmon were increased to six per day. Also suppose it took the same amount of time to catch a fish as it did in 1993. Would you be more likely to visit Alaska again?**
   ❑ Yes ❑ No

6. **All together how many trips have you ever made to Alaska?** ________

7. **Would you recommend a fishing trip to Alaska to your friends?**
   ❑ Yes
   ❑ No → 7a. **If the bag limit on Kenai River late-run red salmon were increased to six fish per day, would that change your recommendation?**
   ❑ Yes ❑ No

8. **Is there anything else you would like us to know about fishing for red salmon?**

WORKING DRAFT

Dear Alaska Visitor

Thank you for answering our survey last year about your 1993 visit to Alaska. We hope you will take a moment to answer a few questions about the late run red (sockeye) salmon fishery in July and early August on the Kenai Peninsula, even though you didn't fish there. The Alaska Department of Fish and Game has hired the University of Alaska to study the economic value of this fishery.

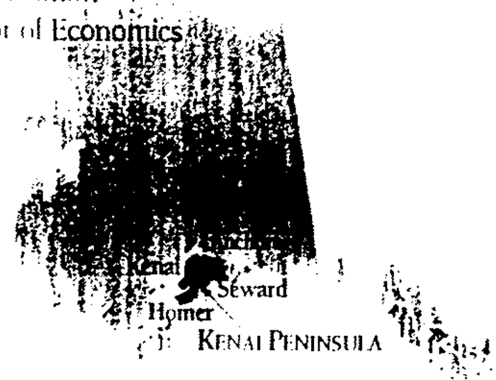
You reported that you fished in Southcentral Alaska during your 1993 visit. As a part of our study, we need information that we can get only from people who fished in Alaska, both Alaska residents and non residents. Your responses are helping Alaska to manage its fisheries for the benefit of all users.

This questionnaire has an identification number so we can check your name off our mailing list when you return your questionnaire. Of course, your responses will be kept confidential and used only in combination with the answers of other anglers.

Thank you for your help.

Sincerely,

Scott Goldsmith
Professor of Economics



Please cut on dotted line, fold and tape. Do not staple.

1995 *Please think about your 1993 trip when answering questions 1, 2, and 3.*

1. **The reasons you didn't fish for late-run red salmon on the Kenai River during your 1993 trip were (check all that apply):**
   - ❑ Didn't have time to visit this fishery
   - ❑ Didn't know about this fishery
   - ❑ Bag limit was too low
   - ❑ Liked other fisheries better
   - ❑ Not in Alaska during the season for late run reds (July and early August)
   - ❑ Other ________

   1a. Suppose the bag limit had been six fish per day instead of two during your visit. Also suppose that it would have taken 25% less time to catch a fish as it did in 1993. Would you have fished for Kenai River late-run red salmon? (Check all that apply.)
   - ❑ No. I still would not have fished for Kenai River reds
   - ❑ Yes. I would have fished for Kenai River reds
   - ❑ Would have fished less in other locations
     - ❑ for reds ❑ for species other than reds
   - ❑ Would have lengthened my visit to Alaska by ____ days
   - ❑ Other ________

2. **How important was fishing for Kenai River late-run red salmon in your 1993 decision to visit Alaska?**
   ❑ Not at all important ❑ Somewhat important ❑ Very important

3. **Did you have any information about the 1993 bag limits and openings in the late-run Kenai River fishery before your visit to Alaska?**
   ❑ Yes ❑ No

4. **Did you visit Alaska in *1994*?**
   - ❑ Yes → **4a. How important was fishing for Kenai River late-run red salmon in your decision to visit Alaska in *1994*?**
     ❑ Not at all important ❑ Somewhat important ❑ Very important
   - ❑ No

5. **Do you plan to visit Alaska again?**
   ❑ Never ❑ Unlikely ❑ Possibly ❑ Probably ❑ Definitely

   5a. Suppose the bag limit for Kenai River late-run red salmon were increased to six per day. Would you be more likely to visit Alaska again?
   ❑ Yes ❑ No

6. **All together how many trips have you ever made to Alaska?** _____

7. **Would you recommend a trip to Alaska to your friends?**
   ❑ Yes ❑ No → **7a. If the bag limit on Kenai River late-run red salmon were increased to six fish per day, would that change your recommendation?**
   ❑ Yes ❑ No

8. **Is there anything else you would like us to know about fishing for red salmon?**

WORKING DRAFT

5/5/93 ID #ZZ ZZ

ISER 1993 RESIDENT ANGLER PRE-SEASON SURVEY

SPONSOR:
ALASKA DEPARTMENT OF FISH & GAME
DIVISION OF SPORT FISH

TELEPHONE COVER SHEET

1. INTERVIEWER ID ____
2. INTERVIEWER'S INTV. NO. _____
3. PHONE NO. _________
4. STUDY NO. ________

	FIRST COLUMN	DISP NO.	SECOND COLUMN	DISP NO.	THIRD COLUMN	DISP NO.	FOURTH COLUMN	DISP NO.
1	XYZ1		XYZ9					
2	XYZ2		XYZ10					
3	XYZ3		XYZ11					
4	XYZ4		XYZ12					
5	XYZ5		XYZ13					
6	XYZ6		XYZ14					
7	XYZ7		XYZ15					
8	XYZ8		XYZ16					

(1) Hello, I'm ___(name)___ calling for the University of Alaska. I am a member of a research team conducting a special study for the State of Alaska.

(2) Is this (phone number) ?

YES → (3)

NO → Thank you very much, but I seem to have dialed the wrong number. It is possible that your number may be called at a later time.

(COMPLETE COVER SHEET)

(3) Is this a residence?

YES → CONTINUE WITH (4)

NO → Thank you very much, but we are only interviewing in private residences.

(COMPLETE COVER SHEET)

(4) Your household has been randomly chosen in a survey that the University of Alaska is conducting for the Alaska Department of Fish and Game. The purpose of the survey is to measure the value of sport fishing in Alaska and to estimate how different state policies might change sport fishing. By sport fishing, I mean fishing with a rod and reel as well as dipnetting and noncommercial clam digging. Does anyone in your household expect to go fishing in Alaska this year?

YES

NO

Has anyone in your household gone fishing in Alaska in the last three years?

YES

NO

Thank you very much for your time! That's all I need to know.

Am I speaking with a household member that knows about your household's fishing activities? (Is that you?)

YES

NEW PERSON

Your household has been randomly chosen in a survey that the University of Alaska is conducting for the Alaska Department of Fish and Game. The purpose of the survey is to measure the value of recreational fishing in Alaska and to estimate how different state policies might change recreational fishing.

CONTINUE WITH MAIN QUESTIONNAIRE

Phone # ____________

Begin Time ________

NAME: ______________________________

ADDRESS: ______________________________

____

____

ID # __________

SECTION A: EQUIPMENT

A1. I would like to ask you about your household's recent fishing activities. What you tell us will help the State of Alaska to take fishing into account in state budgeting and planning. This interview should take less than a half an hour. Everything you say is confidential. Do you have any questions before I begin?

I would like to start by asking you about the equipment your household could use to go fishing. Does your household own one or more boats?

1. YES 2. NO 9. NO ANSWER

A2. Do members of your household have regular access to a boat used for recreational fishing?

1. YES 2. NO 9. NA
(SKIP TO Q.A4)

A3. Would you briefly describe each boat you have?

A3a. BOAT #1: ______________________________

A3b. BOAT #2: ______________________________

A3c. BOAT #3: ______________________________

A4. Does your household own one or more planes?

1. YES 2. NO 9. NO ANSWER

A5. Do members of your household have regular access to a plane used for recreational fishing?

1. YES 2. NO 9. NA
(SKIP TO Q.A7)

A6. Would you briefly describe each plane you have?

A6a. PLANE #1: ______________________________

A6b. PLANE #2: ______________________________

A7. Would you briefly describe the vehicles – such as RVs, campers, cars, and ATVs – that your household uses to go fishing?

A7a. VEHICLE #1: ______________________________

A7b. VEHICLE #2: ______________________________

A7c. VEHICLE #3: ______________________________

A7d. VEHICLE #4: ______________________________

(COMPLETE ALL BOAT, PLANE, AND VEHICLE PROFILES AND CONTINUE WITH Q.A8)

A8. Does your household own or have a long-term lease on a cabin or land that you camp on?

1. CABIN 2. LAND 5. NO 9. NO ANSWER – (SKIP TO Q.A17)

A9. (IF NO: Do members of your household have regular access to a cabin used for recreational fishing?)

1. YES 2. NO 9. NO ANSWER
(SKIP TO Q.A17)

A10. Where is the (cabin/land) located? (What is closest community?)

A11. How do you usually get there?
1. DRIVE 3. BOAT
2. FLY 4. ATV/SNOWMOBILE

A12. How many hours does it usually take to get there? [ ] (HOURS) 99. NA

A13. In what year did you acquire it? [ ] (YEAR) 99. NA

A14. How much do you think the (cabin and the land it is on/the land) is worth today?

[ ] (THOUSANDS OF DOLLARS) 998. DON'T KNOW
999. NO ANSWER

A15. How much did you spend last year on maintenance, improvements, and repairs?

[ ] (DOLLARS) 9998. DON'T KNOW
9999. NO ANSWER

A16. Do nearby fishing opportunities account for all, part, or none of the reasons why you have this (cabin/land)?

1. ALL 2. PART 3. NONE 8. DON'T KNOW 9. NO ANSWER
0. INHERITED OR GIVEN CABIN

A17. About how much do you think all your household's fishing tackle, gear, books, equipment, and other fishing supplies are worth today? [ ] (DOLLARS) 9998. DK 9999. NA

A18. About how much did your household spend last year on these kinds of fishing supplies and equipment? [ ] (DOLLARS) 9998. DK 9999. NA 0000. NONE (SKIP TO Q.A20)

A19. In what community did you buy most of these supplies and equipment last year? ____________

A20. How much is your general camping equipment worth today? [ ] (DOLLARS) 998. DK 999. NA 000. NONE (SKIP TO Q.B1)

A21. What percentage of your household's use of this equipment is for fishing? [ ] (PERCENT) 998. DK 999. NA

SECTION B: SPORT FISHING EXPERIENCE

B1. I would like to learn about the days on which a member of your household went fishing last year between about May 1st and the end of October 1992. Thinking of the **last summer season** – May 1st 1992 through October 30, 1992, on how many **days** did your household (ACTIVITY)? (IF R SAYS 2+ DAYS, ASK: And how many separate **trips** was that?)

HOUSEHOLD FISHING: MAY 1 – OCT. 31 1992	NUMBER DAYS	NUMBER TRIPS
B1a. Have a guide take you fishing?		
B1b. Take a charter boat or charter a plane fishing?		
B1c. Fish with rod & reel other than on a charter or with a guide?		
B1d. Dig razor clams or harvest other shellfish?		
B1e. Dipnet?		

B2. Turning now to the period between November 1st 1992 and April 30th, 1993, on how many days, if at all, did a member of your household do any of the kinds of fishing we just talked about? (IF R SAYS 2+ DAYS, ASK: How many separate trips would this have been?)

☐ (DAYS) ☐ (TRIPS)

998. DON'T KNOW
999. NO ANSWER
000. NONE-SKIP TO Q.C1

Would you tell me the month and fishing location of each trip?

TRIP#	LOG#	MONTH	FISHING SITE	SALT/FRESHWATER
1.	____	____	__________	1. SALT 2. FRESH
2.	____	____	__________	1. SALT 2. FRESH
3.	____	____	__________	1. SALT 2. FRESH
4.	____	____	__________	1. SALT 2. FRESH
5.	____	____	__________	1. SALT 2. FRESH
6.	____	____	__________	1. SALT 2. FRESH
7.	____	____	__________	1. SALT 2. FRESH
8.	____	____	__________	1. SALT 2. FRESH
9.	____	____	__________	1. SALT 2. FRESH
10.	____	____	__________	1. SALT 2. FRESH
11.	____	____	__________	1. SALT 2. FRESH
12.	____	____	__________	1. SALT 2. FRESH

TRIP#	LOG#	MONTH	FISHING SITE	SALT/FRESHWATER
13.	____	____	________________	1. SALT 2. FRESH
14.	____	____	________________	1. SALT 2. FRESH
15.	____	____	________________	1. SALT 2. FRESH
16.	____	____	________________	1. SALT 2. FRESH
17.	____	____	________________	1. SALT 2. FRESH
18.	____	____	________________	1. SALT 2. FRESH
19.	____	____	________________	1. SALT 2. FRESH
20.	____	____	________________	1. SALT 2. FRESH
21.	____	____	________________	1. SALT 2. FRESH
22.	____	____	________________	1. SALT 2. FRESH
23.	____	____	________________	1. SALT 2. FRESH
24.	____	____	________________	1. SALT 2. FRESH
25.	____	____	________________	1. SALT 2. FRESH
26.	____	____	________________	1. SALT 2. FRESH
27.	____	____	________________	1. SALT 2. FRESH
28.	____	____	________________	1. SALT 2. FRESH
29.	____	____	________________	1. SALT 2. FRESH
30.	____	____	________________	1. SALT 2. FRESH

IF R HAS REPORTED 2 OR MORE TRIPS TO THE SAME SITE, USE YOUR RANDOM NUMBERS TABLE TO SELECT 1 TRIP TO THAT SITE.

LOG NUMBER: [ ] NUMBER OF TRIPS TO THE SAME SITE: [ ]

LOG NUMBER: [ ] NUMBER OF TRIPS TO THE SAME SITE: [ ]

LOG NUMBER: [ ] NUMBER OF TRIPS TO THE SAME SITE: [ ]

B3. I would like to ask you for some information about each of these trips. Thinking about the (FIRST) trip:

COMPLETE TRIP LOGS FOR ALL TRIPS AND CONTINUE WITH SECTION C:

SECTION C: FISHING PREFERENCES

C1. Now I would like to learn about your household's fishing preferences. I'd like to start with the reasons why your household chooses **where** to go fishing. For each reason, please tell me whether the reason is **always** important, **sometimes** important, or **never** important to your household.

HOW OFTEN REASON IS IMPORTANT TO DECISION ON WHERE TO FISH:		**1. ALWAYS 2. SOMETIMES 3. NEVER**
C1a.	How often is being in an area of exceptional beauty an important reason: always, sometimes, or never?	
C1b.	Having a good chance to catch a lot of fish?	
C1c.	Having a good chance to catch a trophy-sized fish?	
C1d.	A site limited to fly-fishing?	
C1e.	Opportunity to participate in a fishing derby?	
C1f.	A site limited to catch and release fishing?	
C1g.	An area with few other anglers?	
C1h.	Not having to travel a long time?	
C1i.	Not having to spend a lot of money to get there?	
C1j.	An area with road access?	
C1k.	An area with fly-in access?	
C1l.	An area with a good boat launching place?	
C1m.	An area with a marine anchorage?	
C1n.	Low chance of bear encounters?	
C1o.	Not seeing clearcuts?	
C1p.	Not seeing mining operations?	
C1q.	Not seeing commercial development?	
C1r.	Not seeing evidence of human settlement?	
C1s.	Not having to walk very far?	

C2. Now please tell me whether each of the following five reasons is **always** important, **sometimes** important, or **never** an important reason **why** your household goes fishing.

HOW OFTEN REASON IS IMPORTANT TO DECISION TO FISH:	**1. ALWAYS** **2. SOMETIMES** **3. NEVER**
C2a. To get food?	
C2b. To have fun?	
C2c. To do something with friends?	
C2d. To do something with family?	
C2e. To do something challenging?	

C3. For each of the following, please tell me whether it is a **very** important, **somewhat** important, or **not** an important source of information about the best locations to fish.

HOW IMPORTANT IS SOURCE OF INFORMATION ON BEST LOCATIONS TO FISH:	**1. VERY** **2. SOMEWHAT** **3. NOT**
C3a. Friends or relatives?	
C3b. Newspapers?	
C3c. Books and magazines?	
C3d. Department of Fish & Game publications?	
C3e. Television or radio?	

C4. Overall, how would you rate the fishing skills of the most experienced angler in your household: beginner, intermediate, advanced, or expert?

1. BEGINNER   2. INTERMEDIATE   3. ADVANCED   4. EXPERT

8. DON'T KNOW   9. NO ANSWER

C5. Does your household have a good idea of the best locations to fish?

1. YES   2. NO   9. NO ANSWER

C6. How many fishing trips do you think your household will take between May 1st this year and October 31st?

[ ] (TRIPS)   998. DON'T KNOW (PROBE: More than 5?)
999. NO ANSWER

C7. What percentage of the meat and fish your household ate last year came from the hunting and fishing of household members?

[ ] (PERCENT)   998. DON'T KNOW
(PROBE: More than 25%? More than 75%?)

999. NO ANSWER

C8. And what percentage of the meat and fish your household ate last year came from people who live in another household?

[ ] (PERCENT)

998. DON'T KNOW
(PROBE: More than 10%? More than 25%?)

999. NO ANSWER

C9. How many people in your household are

C9a. under 18? [ ] 9. NO ANSWER

C9b. between 18 and 49? [ ] 9. NO ANSWER

C9c. 50 or over? [ ] 9. NO ANSWER

C10. How many years altogether have you lived in Alaska?

[ ] (YEARS) 99. NO ANSWER

C11. How many years altogether have you lived in (COMMUNITY)?

[ ] (YEARS) 99. NO ANSWER

C12. How important are nearby hunting and fishing opportunities to your household as a reason for living in this community: very important, somewhat important, or not very important?

1. VERY IMPORTANT 2. SOMEWHAT IMPORTANT 3. NOT VERY IMPORTANT

8. DON'T KNOW 9. NO ANSWER

C13. (If you haven't lived in this community all your life), how important were hunting and fishing opportunities to your actual decision to move here: very important, somewhat important, or not very important?

1. VERY IMPORTANT 2. SOMEWHAT IMPORTANT 3. NOT VERY IMPORTANT

0. LIVED HERE ALL LIFE 8. DON'T KNOW 9. NO ANSWER

C14. In 1992, what was your household's total income before taxes? We just need a rough idea, say to the nearest $10,000.

[ ] (THOUSANDS OF DOLLARS)

997. $997,000 OR MORE
998. DON'T KNOW
999. NO ANSWER

C15. How many people in your household are retired?

[ ] (NUMBER) 9. NO ANSWER

C16. How many people in your household are self-employed?

[ ] (NUMBER) 9. NO ANSWER

You have been very patient with all my questions, thank you! We will keep all that you have said confidential.

I would like to ask for your help over the coming months. I would like you to keep a diary of your household's fishing trips. We will use this diary to answer questions about where people go fishing, how often they go fishing, and how much money they spend. It will mean spending a few minutes writing down information about each time someone in your household goes fishing. In a month or so I will send you the diary that I would like you to use to mail back. I will include the stamps so you won't have to pay for postage. May I have your name and address to send you a diary? (RECORD ON COVER SHEET)

Thank you for all your time and information. I hope you have a good fishing season!

TIME FINISHED: ________

TOTAL TIME: ________

ID# ________

NOVEMBER 1ST 1992 - APRIL 30TH 1993
FISHING TRIP LOG

FL1. LOG NUMBER: [ ]

FL2. How many people from your household went on this trip? [ ] (NUMBER)

FL3. On each day of this trip, how many household members actually fished?

DAY:	1	2	3	4
NUMBER OF PERSONS WHO FISHED	[ ]	[ ]	[ ]	[ ]

FL4. And how many hours did your household spend fishing there? [ ] (HOURS)

FL5. How many hours did it take to get there? (considering all the kinds of transportation you used to get there) [ ] (HOURS)

FL6. Did you start from your home or somewhere else? (Where was that?)
1. HOME
2. CABIN/LAND
3. OTHER: ______

FL7. Did you consider the time spent getting there more of a **benefit** or more of a **cost** of the trip?
1. BENEFIT
2. COST
8. DK
9. NA

FL8. How much did fishing account for the reason why your household took this trip: All? Half? What percent would you say? [ ] (PERCENT)

FL9. What kind of fish were you trying to catch? [ ] (SPECIES CODE)

FL10. How many fish did members of your household actually catch? [ ] (NUMBER)

FL11. How many did you keep? [ ] (NUMBER)

FL12. What else did your household catch? How many did you keep?

	SPECIES	NUMBER CAUGHT	NUMBER KEPT
FL12a-c.	[ ]	[ ]	[ ]
FL12d-f.	[ ]	[ ]	[ ]

FL13. Could any of the household members who went fishing on this trip have stayed home and earned money on their job instead?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

FL14. How much could they have earned had they not gone fishing? $__________

FL15. Did you take a commercial airline, train, or ferry on this trip?

FL15a. AIRLINE 1. YES 2. NO   FL15b. TRAIN 1. YES 2. NO
FL15c. FERRY 1. YES 2. NO

FL16. How much did your household spend on the (airline/train/ferry/etc)? [ ] (DOLLARS)

FL17. Did your household pay anyone to take you fishing – like a charter service or a guide? (NOT INCLUDING SCHEDULED AIR SERVICE)

1. YES   2. NO   9. NO ANSWER

2. NO / 9. NO ANSWER → SKIP TO Q.FL21

FL18. How much did you pay them? [ ] (DOLLARS)   9998. DON'T KNOW
9999. NO ANSWER

FL19. In what community is the service you used located? ____________________

FL20. Which of the following services did they provide. Did they:

CHARTER/GUIDE SERVICES **NOV. 1, 1992 – APRIL 30, 1993**	**1. YES** **2. NO**
a. Take you to the fish site by air?	
b. Take you to the fish site by boat?	
c. Provide other transportation?	
d. Serve as a guide while fishing?	
e. Provide fishing tackle?	
f. Provide lodging?	
g. Provide food?	

[*** INTERVIEWER NOTE: ASK FL21 ONLY IF R WAS NOT ICE FISHING.]

FL21. Did you use a boat on the trip?

1. YES   2. NO → SKIP TO Q.FL27
9. NO ANSWER → SKIP TO Q.FL27

FL22. How many hours did you run the boat to get to the fishing site? [ ] (HOURS)

FL23. How many hours did you run the boat to fish? [ ] (HOURS)

FL24. Was it your household's boat? 1. YES 2. NO

FL25. (IF NO) If you leased or rented it, how much did it cost? [ ]

FL26. (IF R OWNS 2+ BOATS) Which boat did you use? [ ] (BOAT NUMBER)

FL27. Did you use a private plane on the trip?

1. YES — 2. NO — 9. NO ANSWER

(2. NO / 9. NO ANSWER: SKIP TO Q.FL32)

FL28. How many hours did you fly?

[ ] (HOURS) — 00. NONE; 98. DON'T KNOW

FL29. Was it your household's plane? 1. YES 2. NO

FL30. (IF NO) If you leased or rented it, how much did it cost? [ ]

FL31. (IF R OWNS 2+ PLANES) Which plane did you use?

[ ] (PLANE NUMBER) — 9. NO ANSWER

FL32. Did you use any vehicles on the trip?

1. YES — 2. NO — 9. NO ANSWER

(2. NO / 9. NO ANSWER: SKIP TO Q.FL37)

FL33. How many miles did you drive to get to the fishing site?

[ ] (MILES) — 98. DON'T KNOW; 99. NO ANSWER

FL34. Was it your household's vehicle? 1. YES 2. NO

FL35. (IF NO) If you leased or rented it, how much did it cost? [ ]

FL36. (IF R OWNS 2+ VEHICLES) Which vehicle did you use?

[ ] (VEHICLE NUMBER) — 9. NO ANSWER

FL37. How much did your household spend eating and drinking out on this trip (in addition to what you paid to the guide)?

[ ] (DOLLARS) — 998. DON'T KNOW; 999. NO ANSWER

FL38. How much did your household spend on lodging or camping fees (in addition to what you paid to the guide)?

[ ] (DOLLARS) — 998. DON'T KNOW; 999. NO ANSWER

FL39. And how much did your household spend on bait, launching fees, entry fees or other costs related to this trip (in addition to what you paid to the guide)?

[ ] (DOLLARS) — 9998. DON'T KNOW; 9999. NO ANSWER

ID# ____

BOAT #1 PROFILE

BP1. BOAT NUMBER: [ ]			
BP2. How many feet long is this boat?	[ ]	(FEET)	98. DON'T KNOW 99. NO ANSWER
BP3. How many years old is it?	[ ]	(YEARS)	98. DON'T KNOW 99. NO ANSWER
BP4. In what year did you purchase it?	[ ]	(YEAR)	98. DON'T KNOW 99. NO ANSWER
BP5. In what community did you buy it?	____________		
BP6. How much do you think the boat is worth today?	[ ]	(DOLLARS)	999,998. DONT KNOW 999,999. NO ANSWER
BP7. At cruising speed, how many gallons of fuel does it use per hour?	[.]	(GALLONS)	99.98 DON'T KNOW 99.99 NO ANSWER
BP8. In what community do you keep it in the winter?	____________		
BP9. What, if anything, did it cost to keep it there last winter?	[ ]	(DOLLARS)	998. DONT KNOW 999. NO ANSWER
BP10. In what community do you keep it in the summer?	____________		
BP11. What, if anything, did it cost to keep it there last summer?	[ ]	(DOLLARS)	998. DONT KNOW 999. NO ANSWER
BP12. How much did you spend on this boat in the last twelve months on maintenance, improvements, and repairs?	[ ]	(DOLLARS)	9998. DONT KNOW 9999. NO ANSWER
BP13. In what community was most of this work done?	____________		
BP14. How much did you spend on this boat in the last twelve months on insurance and other expenses we haven't talked about?	[ ]	(DOLLARS)	9998. DONT KNOW 9999. NO ANSWER
BP15. About how many hours did your household use this boat for recreational fishing in the last twelve months?	[ ]	(HOURS)	998. DONT KNOW 999. NO ANSWER
BP16. And how many hours did your household use this boat in total in the last 12 months?	[ ]	(HOURS)	998. DONT KNOW 999. NO ANSWER

ID# _____

PLANE #1 PROFILE

PP1. PLANE NUMBER: [ ]

PP2. How many years old is this plane? [ ] (YEARS) 98. DONT KNOW 99. NO ANSWER

PP3. In what year did you purchase it? [ ] (YEAR) 98. DONT KNOW 99. NO ANSWER

PP4. In what community did you buy it? ______________________

PP5. How much do you think the plane is worth today? [ ] (THOUSANDS OF DOLLARS) 998. DONT KNOW 999. NO ANSWER

PP6. At cruising speed, how many gallons of fuel does it use per hour? [ ] (GALLONS) 98. DON'T KNOW 99. NO ANSWER

PP7. Can this plane land on the water? 1. YES 2. NO 9. NO ANSWER

PP8. How much did you spend on this plane in the last twelve months on maintenance, improvements, and repairs? [ ] (DOLLARS) 9998. DK 9999. NA

PP9. In what community was most of this work done? ______________________

PP10. How much did you spend on tie-down fees, insurance and other fixed costs in the last 12 months? [ ] (DOLLARS) 9998. DK 9999. NA

PP11. About how many hours did your household log on this plane for recreational fishing trips in the last 12 months? [ ] (HOURS) 998. DK 999. NA

PP12. And how many hours did your household use this plane in total in the last 12 months? [ ] (HOURS) 998. DK 999. NA

ID# ______

VEHICLE #1 PROFILE

VP1. VEHICLE NUMBER: [ ]

VP2. In what year did you purchase or lease it? [ ] (YEAR) 98. DK / 99. NO

00. DON'T OWN ←——→ (SKIP REST OF PROFILE)

VP3. How many years old is this vehicle? [ ] (YEARS) 98. DONT KNOW / 99. NO ANSWER

VP4. In what community did you buy it? ______________________

VP5. How much do you think the vehicle is worth today? [ ] (THOUSANDS OF DOLLARS) 998. DK / 999. NA

VP6. How many miles per gallon does it get (taking into account trailering a boat, if you do)? [ ] (MPG) 98. DONT KNOW / 99. NO ANSWER

VP7. How much did you spend on this vehicle in the last twelve months on maintenance, improvements, repairs? [ ] (DOLLARS) 9998. DK / 9999. NA

VP8. In what community was most of this work done? ______________________

VP9. How much did you spend on storage fees, insurance and other fixed costs in the last 12 months? [ ] (DOLLARS) 9998. DK / 9999. NA

VP10. About how many miles did your household drive this vehicle on recreational fishing trips in the last 12 months? [ ] (MILES) 998. DK / 999. NA

VP11. And how many miles did your household put on this vehicle altogether in the last twelve months? [ ] (MILES) 998. DK / 999. NA

ISER 1993 RESIDENT ANGLER POST-SEASON SURVEY

SPONSOR:
ALASKA DEPARTMENT OF FISH & GAME
DIVISION OF SPORT FISH

TELEPHONE COVER SHEET

1. INTERVIEWER ID ____
2. INTERVIEWER'S INTV. NO. _____
3. PHONE NO. _________
4. STUDY NO. ________

CALL RECORD

DATE	DAY	TIME	DISP NO.	COMMENTS

(1) Hello, I'm ____(NAME)____ calling for the University of Alaska and the Department of Fish and Game. May I please speak with (FIRST NAME/a household member that knows about your household's fishing activities?) (Is that you?)

(2) I am a member of a research team conducting a special study for the State of Alaska. In June, I believe your household participated in a survey that we conducted. I am calling to ask about your household's sport fishing this past summer and to get your opinions on several sport fishing issues.

CONTINUE WITH MAIN QUESTIONNAIRE

STUDY NO ________ BEGIN TIME ________

SECTION A: EQUIPMENT

A1. As we mentioned in June, what you tell us will help the State of Alaska to take fishing into account in state budgeting and planning. This interview should take less than an hour. Everything you say is confidential. Do you have any questions before I begin?

I would like to start by asking you about recent purchases of equipment that your household could use to go fishing. Since June, did your household purchase a boat and use it for sport fishing?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

A2. Would you briefly describe this boat? (NOTE: ADD DESCRIPTION TO HOUSEHOLD PROFILE LISTING OF BOATS AND IDENTIFY WITH THE WORD "**NEW**")

____

COMPLETE BOAT PROFILE

INTERVIEWER CHECKPOINT

___ R REPORTED 1 OR MORE BOATS ON HH PROFILE ----> CONTINUE WITH Q.A3

___ R DID NOT REPORT BOATS ON HH PROFILE -----> SKIP TO Q.A4

A3. Do you still have the (BOAT/BOATS) you told me about in June?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

A3a. Which one do you no longer have?

____

A4. Since June, did your household purchase a plane and use it for sport fishing?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

A5. Would you briefly describe the plane? (ADD DESCRIPTION TO HOUSEHOLD PROFILE LISTING OF PLANES AND IDENTIFY WITH THE WORD "**NEW**")

____

COMPLETE PLANE PROFILE

INTERVIEWER CHECKPOINT

___ R REPORTED 1 OR MORE PLANES ON HH PROFILE ----> CONTINUE WITH Q.A6

___ R DID NOT REPORT PLANES ON HH PROFILE -----> SKIP TO Q.A7

A6. Do you still have the (PLANE/PLANES) you told me about in June?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

A6a. Which one do you no longer have?

____

A7. Since June, did your household purchase a vehicle – such as an RV, camper, car, or ATV – and use it for sport fishing?

1. YES 2.NO 8. DON'T KNOW 9. NO ANSWER

A8. Would you briefly describe this vehicle?
(ADD DESCRIPTION TO HOUSEHOLD PROFILE LISTING OF VEHICLES AND IDENTIFY WITH THE WORD "**NEW**")

____

COMPLETE VEHICLE PROFILE

INTERVIEWER CHECKPOINT

___ R REPORTED 1 OR MORE CARS ON HH PROFILE ----> CONTINUE WITH Q.A9

___ R DID NOT REPORT CARS ON HH PROFILE -----> SKIP TO Q.A10

A9. Do you still have the (VEHICLE/VEHICLES) you told me about in June?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

A9a. Which one do you no longer have?

____

A10. Since June, did your household purchase or lease a cabin or land that you used for sport fishing?

1. CABIN
2. LAND
5. NO
8. DON'T KNOW
9. NO ANSWER
→ SKIP TO INTERVIEWER CHECKPOINT

A11. Where is the (cabin/land) located? (What is closest community?)

____

A12. How do you usually get there?

1. DRIVE
2. FLY
3. BOAT
4. ATV/SNOWMOBILE
5. COMBINATION
8. DON'T KNOW
9. NO ANSWER

A13. How many hours does it usually take to get there?

[.] (HOURS)
99.98 DON'T KNOW
99.99 NO ANSWER

A14. How much did you pay for it?

[ ]
000000. INHERITED/GIFT
999998. DON'T KNOW
999999. NO ANSWER

A15. Do nearby fishing opportunities account for all, part, or none of the reasons why you have this (cabin/land)?

1. ALL
2. PART
3. NONE
0. INHERITED IT
8. DON'T KNOW
9. NO ANSWER

INTERVIEWER CHECKPOINT

___ R HAS CABIN -----> CONTINUE WITH Q.A16

___ R DOES NOT HAVE A CABIN -----> SKIP TO SECTION B, P.4

A16. Over the last year, about how many nights has someone in your household stayed in your cabin as part of a fishing trip?

[ ] NIGHTS

998. DON'T KNOW
999. NO ANSWER

SECTION B: SPORT FISHING EXPERIENCE

INTERVIEWER MAY CHECKPOINT

____ MAY TRIP DATA COMPLETE (SKIP TO JUNE CHECKPOINT, BELOW)

____ MAY TRIP DATA INCOMPLETE (GET HIGHLIGHTED DATA, THEN GO TO JUNE CHECKPOINT, BELOW)

____ MAY TRIP DATA MISSING (CONTINUE WITH Q.B1)

B1. I would like to learn about the fishing trips made by your household between May 1st and May 31st. Did anyone in your household go fishing in May?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

(2. NO →) SKIP TO JUNE CHECKPOINT, BELOW

B2. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

INTERVIEWER JUNE CHECKPOINT

____ JUNE TRIP DATA COMPLETE (SKIP TO JULY CHECKPOINT, NEXT PAGE)

____ JUNE TRIP DATA INCOMPLETE (GET HIGHLIGHTED DATA, THEN GO TO JULY CHECKPOINT, NEXT PAGE)

____ JUNE TRIP DATA MISSING (CONTINUE WITH Q.B3)

B3. Now, did anyone in your household go fishing in June?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

(2. NO →) SKIP TO JULY CHECKPOINT, NEXT PAGE

B4. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

INTERVIEWER JULY CHECKPOINT

____ JULY TRIP DATA COMPLETE (SKIP TO AUGUST CHECKPOINT, BELOW)

____ JULY TRIP DATA INCOMPLETE (GET HIGHLIGHTED DATA, THEN GO TO AUGUST CHECKPOINT, BELOW)

____ JULY TRIP DATA MISSING (CONTINUE WITH Q.B5)

B5. Now, did anyone in your household go fishing in July?

1. YES 2.NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO AUGUST CHECKPOINT, BELOW

B6. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

INTERVIEWER AUGUST CHECKPOINT

____ AUGUST TRIP DATA COMPLETE (SKIP TO Q.B9)

____ AUGUST TRIP DATA INCOMPLETE (GET HIGHLIGHTED DATA, THEN GO TO Q.B9)

____ AUGUST TRIP DATA MISSING (CONTINUE WITH Q B.7)

B7. Now, did anyone in your household go fishing in August?

1. YES 2.NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO Q.B9

B8. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

B9. Now, did anyone in your household go fishing in September?

1. YES 2.NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO Q.B11

B10. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

B11. Now, has anyone in your household gone fishing so far in October?

1. YES   2. NO   8. DON'T KNOW   9. NO ANSWER

SKIP TO Q.B13

B12. Would you tell me the date and fishing location of each trip, whether it was fresh or saltwater, and the kind of fish you were trying to catch? (RECORD INFORMATION ON TRIP DATA SHEET)

B13. Do you think that someone in your household will take a fishing trip during the rest of October?

1. YES   2. NO   8. NOT SURE   9. NO ANSWER

B13a. (IF YES) How many fishing trips do you expect your household will make? [ ]

(SELECT 3 TRIPS TO ASK ABOUT, USING THE RANDOM NUMBER TABLE. IF 2 OR MORE OF THE SELECTED TRIPS ARE TO THE SAME SITE, GET ANOTHER NUMBER FROM THE RANDOM NUMBER TABLE. THUS, EACH TRIP WILL BE TO A DIFFERENT SITE.)

I am going to need more information about three of your trips. When you've made more than one trip to the same site, I will only ask about one of them; please be patient while I look at a chart to select which of your trips I need to know more about.

I would like to ask you for some information about your (NUMBER/DATE) trip to (SITE).

COMPLETE TRIP LOGS FOR 3 TRIPS SELECTED AND GO TO SECTION C

SECTION C: ANNUAL EXPENDITURES

C1. Over the last 12 months (since October 1, 1992), about how much did your household spend on **overnight lodging and camping fees** while on fishing trips?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE
→ Skip to Q.C4

C2. Can you think of any fishing trips where someone in your household stayed overnight at a location **between** home and where you fished (that is, not at the fishing site or your home)?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO QUESTION C4

C3. Could you please tell me the location and fishing site of each trip and how much your household spent on lodging and camping fees altogether at each different location?

	LODGING LOCATION		FISHING SITE		DOLLARS
C3a.	________	C3b.	________	C3c.	________
C3d.	________	C3e.	________	C3f.	________
C3g.	________	C3h.	________	C3i.	________
C3j.	________	C3k.	________	C3l.	________

C4. Over the last year, about how much did your household spend on **fishing tackle**, including rods, reels, lures, downriggers, and bait?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE
→ Skip to Q.C8

C5. Did your household make any of these purchases outside of Alaska or through the mail?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO QUESTION C6

C5a. How much did you spend on these purchases?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

(NOTE: IF R MADE ALL PURCHASES OUTSIDE STATE, SKIP TO Q.C8)

C6. How much, if anything, did your household spend on tackle within Alaska but outside (YOUR COMMUNITY)?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE
→ Skip to Q.C8

C7. Could you list each Alaskan community where you purchased these items and how much you spent?

COMMUNITY	DOLLARS
C7a. ______	C7b. ______
C7c. ______	C7d. ______
C7e. ______	C7f. ______
C7g. ______	C7h. ______

C8. Over the last year, about how much did your household spend on **food purchased in restaurants** while on fishing trips?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C9. And over the last year, about how much did your household spend on **groceries** for fishing trips?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE
→ Skip to Q.C10

C9a. How much, if any, of this grocery money did your household spend outside (<u>YOUR COMMUNITY</u>)?

[ ] DOLLARS

9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C10. Of all the **gas or diesel fuel** your household used on fishing trips in the last year, what percent would you say was purchased outside (<u>YOUR COMMUNITY</u>)?

[ ] PERCENT

998. DON'T KNOW
999. NO ANSWER
000. NONE

C11. Over the last year, about how much did your household spend on:

C11a. **fishing air charters?** $______
9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C11b. **fishing boat charters?** $______
9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C11c. **other fish guiding services?** $______
9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C11d. **commercial transportation?** $______
9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

C11e. **fishing equipment rental?** $______
9998. DON'T KNOW
9999. NO ANSWER
0000. NONE

SECTION D: POLICY CHOICES

D1. Is anyone in your household a member of a sport fishing organization?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

(2, 8, 9:) SKIP TO SE KING FISHERY SECTION, Q.D2

(IF YES) What organization or organizations?

D1a. (FIRST) ______________________

D1b. (SECOND) ______________________

SOUTHEAST KING SALMON FISHERY QUESTIONS

D2. Now I would like to ask you about the southeast Alaska king salmon sport fishery. Has your household fished for king salmon in southeast Alaska within the past three years?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

(2, 8, 9:) SKIP TO KENAI SOCKEYE SECTION, P.13

D3. Please keep the southeast Alaska king salmon sport fishery in mind while I ask you the next few questions. People have different reasons for fishing for king salmon. For example, some people might be mainly interested in the challenge of catching a king salmon. Other people might care about bringing home fish to eat. I would like to learn about why **your** household fishes for these kings. For each reason, please tell me whether it is **always** important, **sometimes** important, or **never** important to your household.

HOW OFTEN REASON IS IMPORTANT TO DECISION TO FISH FOR SE KING SALMON:	**1. ALWAYS** **2. SOMETIMES** **3. NEVER**
D3a. How often is the chance to bring home king salmon to eat an important reason for fishing: always, sometimes, or never?	
D3b. How often is doing something challenging an important reason?	
D3c. How often is the chance to catch a trophy king salmon an important one?	
D3d. How often is getting out just for the enjoyment of fishing an important reason?	

D4. Now I'm going to ask you how different things affect your household's enjoyment when you fish for king salmon in southeast Alaska. For each question, please tell me if your experience is improved **a lot**, improved **a little**, or **not affected at all**?

THINGS THAT IMPROVE YOUR HOUSEHOLD'S ENJOYMENT WHEN FISHING FOR SE KING SALMON:	**1. A LOT** **2. A LITTLE** **3. NO EFFECT** **4. LOWERED**
D4a. How does catching your limit affect the enjoyment? does it improve it a lot, improve it a little, or not affect it at all?	
D4b. Catching a trophy king?	
D4c. Catching a wild king instead of a hatchery king?	

D5. Now I'm going to ask how different kinds of fishing regulations would affect your household's enjoyment when fishing for southeast king salmon. How would having the bag limit lowered from two to one affect the enjoyment: lower it **a little**, lower it **a lot**, **not affect it at all**, or **raise it**?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

D5a. Why is that?

1. FEWER ANGLERS
2. ________________
3. ________________

D6. The current minimum length is 28 inches; how would it affect the enjoyment if the minimum were changed to 30 inches?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

D6a. Why is that?

1. FEWER ANGLERS
2. ________________
3. ________________

D7. If downriggers were banned, how would that affect the enjoyment?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

D7a. Why is that?

1. FEWER ANGLERS
2. ______________________
3. ______________________

D8. Suppose the regulations were changed from a bag limit of one to catch and release for fish under 40 inches; how would that affect your household's enjoyment?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

D8a. Why is that?

1. FEWER ANGLERS
2. ______________________
3. ______________________

D9. Has your household fished for king salmon in southeast Alaska this year?

1. YES
2. NO
8. DON'T KNOW
9. NO ANSWER

SKIP TO KENAI SOCKEYE SECTION, P. 13

D10. (IF YES) How many members of your household fished for king salmon in Southeast Alaska this year? [ ]

(ASK ONLY IF MORE THAN 1 FISHED)

D11. How many were younger than 16? [ ]

D12. How many of them were 60 or older? [ ]

D13. Now I would like your opinion about how best to manage the southeast king salmon sport fishery. As you may know, under the Board of Fisheries' management plan, there is a daily personal bag limit of two king salmon, each of which must be at least 28 inches in length. But the management plan also requires that king salmon sport fishing be restricted in order to make sure that the total sport harvest of king salmon is within the target range established by the Board of Fisheries.

Among the options allowed are: (1) reducing the bag limit from 2 to 1, (2) increasing the minimum length to 30 inches, and (3) banning the use of downriggers.

If Fish and Game has to restrict the harvest, which option would you prefer be used first: (1) reducing the bag limit from 2 to 1, (2) increasing the minimum length from 28 to 30 inches, or (3) banning the use of downriggers?

1. REDUCE BAG LIMIT FROM 2 to 1
2. INCREASE MINIMUM LENGTH TO 30 INCHES
3. BAN USE OF DOWNRIGGERS
8. DON'T KNOW
9. NO ANSWER

D14. Which option would you prefer be used **last**? (READ TWO REMAINING OPTIONS IF NECESSARY)

1. REDUCE BAG LIMIT FROM 2 to 1
2. INCREASE MINIMUM LENGTH TO 30 INCHES
3. BAN USE OF DOWNRIGGERS
8. DON'T KNOW
9. NO ANSWER

D15. Suppose the bag limit had already been lowered from 2 to 1 and it became necessary to reduce harvests even more. Which option would you prefer be used first: (1) allowing only catch and release fishing, (2) increasing the minimum length from 28 to 30 inches, or (3) banning the use of downriggers?

1. ALLOW ONLY CATCH AND RELEASE
2. INCREASE MINIMUM LENGTH TO 30 INCHES
3. BAN USE OF DOWNRIGGERS
8. DON'T KNOW
9. NO ANSWER

D16. Which option would you prefer be used **last**? (READ TWO REMAINING OPTIONS IF NECESSARY)

1. ALLOW ONLY CATCH AND RELEASE FISHING
2. INCREASE MINIMUM LENGTH TO 30 INCHES
3. BAN USE OF DOWNRIGGERS
8. DON'T KNOW
9. NO ANSWER

D17. The management plan also allows applying some restrictions only to **guided** anglers. For example, downriggers may be banned only on guided boats, rather than on all boats. In the future, if banning downriggers is considered, do you think downriggers should be banned for guided boats first or for all boats at the same time?

1. GUIDED FIRST
2. ALL AT THE SAME TIME
8. DON'T KNOW
9. NO ANSWER

D18. In the future, if the bag limit for king salmon is to be reduced from two to one, would you prefer it be reduced for guided boats first, or for all boats at the same time?

1. GUIDED FIRST
2. ALL AT THE SAME TIME
8. DON'T KNOW
9. NO ANSWER

D19. This year the season started with a daily personal limit of two king salmon, each of which had to be at least 28 inches in length. On June 17, the limit was lowered to one king and the use of downriggers was banned. Did your household go king salmon fishing less often because of the reduced bag limit?

1. YES
2. NO
9. NO ANSWER

SKIP TO Q.D21

D20. (IF YES) How many more days would your household have fished if the bag limit hadn't been reduced? [ ]

D21. Did your household go king salmon fishing less often because of the ban on downriggers?

1. YES → D22
2. NO — SKIP TO Q.D23
9. NO ANSWER — SKIP TO Q.D23

D22. (IF YES) How many more days would your household have fished if downriggers hadn't been banned? [ ]

D23. In 1993, for the first time, sport fishermen had to buy a king salmon tag that cost $10 to fish for king salmon. How many tags did your household buy?

[ ] TAGS

98. DON'T KNOW
99. NO ANSWER
00. NONE

KENAI SOCKEYE FISHERY QUESTIONS

D24. Now I would like to ask you about the Kenai River late sockeye run. By the late sockeye run, I mean reds that enter the Kenai River in late June. Has your household fished for sockeye in the Kenai River within the past **three** years?

1. YES → D25
2. NO — SKIP TO CHENA GRAYLING SECTION, P. 18
8. DON'T KNOW — SKIP TO CHENA GRAYLING SECTION, P. 18
9. NO ANSWER — SKIP TO CHENA GRAYLING SECTION, P. 18

D25. Now I'm going to ask you about fishing the late sockeye run on the Kenai River. Please keep this in mind for the next few questions. People fish for different reasons. For example, some people want to bring home as many fish as possible. Others are fishing mostly for the experience and don't care so much about what they bring home.

I would like to learn about why **your** household fishes for sockeye on the Kenai River. For each reason I read, please tell me whether the reason is **always** important, **sometimes** important, or **never** important to your household.

HOW OFTEN REASON IS IMPORTANT TO DECISION TO FISH FOR KENAI SOCKEYE:	1. ALWAYS 2. SOMETIMES 3. NEVER
D25a. How often is the chance to bring home sockeye salmon to eat an important reason for fishing for Kenai River sockeye: always, sometimes, or never?	
D25b. How often is the chance to catch a trophy sockeye salmon an important reason?	
D25c. How often is doing something challenging an important reason?	
D25d. How often is getting out just for the enjoyment of fishing an important reason?	

D26. Now I'm going to ask you how different things affect your household's enjoyment when fishing. First, I'll ask about things that may increase the enjoyment. For each question, please tell me if your enjoyment is increased **a lot**, increased a **little**, or **not affected at all**.

THINGS THAT INCREASE YOUR HOUSEHOLD'S ENJOYMENT WHEN FISHING FOR KENAI SOCKEYE:	**1. A LOT 2. A LITTLE 3. NO EFFECT**
D26a. How does catching your limit affect the enjoyment of fishing for sockeye on the Kenai River? does it raise it a lot, raise it a little, or not affect it at all?	
D26b. Catching a trophy-size fish?	
D26c. Not having to walk far to get to where you are going to fish?	
D26d. Having a good trail to get to where you are going to fish?	
D26e. Being able to park in a parking lot?	
D26f. Having restroom facilities nearby?	
D26g. Fishing in an area with few other anglers?	

D27. Now I'll ask about things that may lower your household's enjoyment. For each question, please tell me if your enjoyment is lowered **a lot**, lowered **a little**, or **not affected at all**.

THINGS THAT LOWER THE QUALITY OF THE EXPERIENCE WHEN FISHING FOR KENAI SOCKEYE:	**1. A LOT 2. A LITTLE 3. NO EFFECT**
D27a. For your household, how does having lots of other anglers around affect the enjoyment of fishing for sockeye on the Kenai? does it lower it a lot, lower it a little, or not affect it at all?	
D27b. Not catching any fish?	
D27c. Seeing large numbers of guided anglers?	
D27d. Being asked to show your fishing license?	
D27e. Seeing other people catch more than their limit?	
D27f. Seeing other people snagging fish?	
D27g. Seeing litter?	

D28. Has your household fished for sockeye, commonly called reds, in the Kenai River **this** year?

1. YES — 2. NO — 8. DON'T KNOW — 9. NO ANSWER

(2, 8, 9) SKIP TO CHENA GRAYLING SECTION, P. 18

D28b. (IF YES) How many members of your household fished? ______

D29. Now I'm going to ask you how different fishing regulations would affect your household's enjoyment when fishing the late sockeye run. How would having the bag limit lowered from three to two affect the enjoyment: **lower it a little, lower it a lot, not affect it at all**, or **raise it**.

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

(4) D29a. Why is that?

1. FEWER ANGLERS
2. ______
3. ______

D30. What if the bag limit were lowered from two to one. How would it affect the enjoyment: **lower it a little, lower it a lot, not affect it at all**, or **raise it**.

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

(4) D30a. Why is that?

1. FEWER ANGLERS
2. ______
3. ______

D31. How would going from a bag limit of one to catch and release fishing affect your household's enjoyment?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

(4) D31a. Why is that?

1. FEWER ANGLERS
2. ______
3. ______

D32. How would having the river closed to fishing between 11:00 p.m. and 6:00 a.m. affect your household's enjoyment?

1. LOWER IT A LITTLE
2. LOWER IT A LOT
3. NOT AFFECT IT
4. RAISE IT
8. DON'T KNOW
9. NO ANSWER

D32a. Why is that?

1. FEWER ANGLERS
2. ______________________
3. ______________________

D33. Now I would like your opinion about how Fish and Game should manage the Kenai River late salmon run. At the beginning of the season, if Fish and Game doesn't know the size of the run, would you rather see them start the season with a bag limit of three and risk having to lower the limit to one fish later in the season, or would you rather see them start the season with a bag limit of two, with the possibility of later raising the limit to three if the run is large enough?

1. START WITH BAG LIMIT OF 3
2. START WITH BAG LIMIT OF 2
8. DON'T KNOW
9. NO ANSWER

D34. If Fish and Game needs to lower harvests of sockeye, would you rather they lower the bag limit from three to two or close the fishery at certain times?

1. LOWER BAG LIMIT → SKIP TO Q.D36
2. RESTRICT FISHING TIME
8. DON'T KNOW
9. NO ANSWER

D35. If Fish and Game needs to close the sockeye fishery at certain times, what days of the week or times of the day would you like to have it closed?

	DAY	:	TIME
	DAY	:	TIME

D36. For the past few years, there has been a personal use sockeye dipnet fishery on the lower Kenai River with a daily bag limit of six. If you had a choice of fishing in the Kenai dipnet fishery with a bag limit of six or the Kenai rod and reel sport fishery with a bag limit of three, would you always fish the sport fishery, usually fish the sport fishery, usually fish the dipnet fishery, or always fish the dipnet fishery?

1. ALWAYS SPORT FISH
2. USUALLY SPORT FISH
3. USUALLY DIPNET
4. ALWAYS DIPNET → SKIP TO Q.D38
8. DON'T KNOW
9. NO ANSWER

D37. Suppose the bag limit in the sport fishery were two, would your answer be the same?

1. YES
2. NO
8. DON'T KNOW
9. NO ANSWER

D38. Biologists are concerned that the Kenai River salmon runs could be harmed due to habitat damage as more and more anglers fish the Kenai. I'm going to read you a list of proposals which have been made for protecting Kenai River salmon habitat. For each proposal, please tell me whether you would strongly support it, mildly support it, mildly oppose it, or strongly oppose it.

ATTITUDES TOWARD MEASURES TO PROTECT KENAI RIVER:	**1. STRONGLY SUPPORT** **2. MILDLY SUPPORT** **3. MILDLY OPPOSE** **4. STRONGLY OPPOSE** **8. DON'T KNOW**
D38a. Increase areas that are only for drift boats; that means having more non-motorized areas.	
D38b. Have any work that puts silt or debris into the river be done in the winter months.	
D38c. Close part of the stream bank for a few years to allow plants to grow back; then open this area and close another.	
D38d. Develop boardwalks or paths for people to get to the river to limit erosion of the bank.	
D38e. Put in roads to other areas of the state to reduce the number of people fishing the Kenai River.	
D38f. Open some areas of the river to fishing only from a boat; that means no fishing from the shore in those areas.	

CHENA GRAYLING FISHERY QUESTIONS

D39. Did anyone in your household fish for grayling on the Chena River this year?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO STOCKED LAKES QUESTIONS, BELOW

D40. As you may know, because grayling stocks in the Chena have been low, only catch and release fishing has been allowed since 1992. As a result of the Department's management, the number of grayling in the Chena is increasing, and within a few years, it is likely that anglers will be able to keep some fish. How important is it to your household to be able to keep some Chena River grayling: very important, somewhat important, not very important, or not at all important?

1. VERY IMPORTANT
2. SOMEWHAT IMPORTANT
3. NOT VERY IMPORTANT
4. NOT AT ALL IMPORTANT
8. DON'T KNOW
9. NO ANSWER

D41. Would you rather see a bag limit on the Chena of two grayling of any size or a bag limit of two grayling of which only one may be over 14 inches?

1. 2 GRAYLING, ANY SIZE
2. 2 GRAYLING, 1 OVER 14"
8. DON'T KNOW
9. NO ANSWER

STOCKED LAKES QUESTIONS

D42. The Department of Fish and Game stocks more than 200 lakes in Alaska, mostly with enough rainbow trout, grayling, arctic char, or salmon to produce good catches of pan-sized fish. Have members of your household fished at any of these stocked lakes in the last three years?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO CLOSING, P.20

D43. Some anglers have suggested that the Department select several lakes with good potential for growing big fish and sustaining a big-fish fishery. Regulations would be implemented that would make these lakes catch and release for small fish but would allow the keeping of a few big fish. Would your household like to see development of this type of fishery in your area?

1. YES 2. NO 8. DON'T KNOW 9. NO ANSWER

SKIP TO Q.D47

D44. (IF YES) What one species would you prefer?

____

D45. For that one species, what would you prefer be the minimum length for fish that could be kept? [ ] INCHES

D46. What would you prefer be the daily bag limit for that one species in these lakes? [ ] NUMBER

D47. People have different reasons for fishing in stocked lakes. For example, some people might be mainly interested in catching fish to eat, while others might be mainly interested in the challenge of catching fish. I would like to learn about why **your** household fishes in these lakes. For each reason, please tell me whether the reason is always important, sometimes important, or never important to your household.

HOW OFTEN REASON IS IMPORTANT TO DECISION TO FISH IN STOCKED LAKES:	**1. ALWAYS** **2. SOMETIMES** **3. NEVER**
D47a. How often is the chance to bring fish home to eat an important reason for fishing: always, sometimes, or never?	
D47b. How often is doing something challenging an important reason?	
D47c. How often is the chance to catch a trophy fish an important reason?	
D47d. How often is getting out just for the enjoyment of fishing an important reason?	

D48. Now I'm going to ask you how different things affect your household's enjoyment when you fish in stocked lakes. First, I'll ask about things that may increase the enjoyment for some people. For each question, please tell me if your household's enjoyment is increased **a lot**, increased **a little**, or **not affected at all**.

THINGS THAT INCREASE YOUR HOUSEHOLD'S ENJOYMENT WHEN FISHING IN STOCKED LAKES:	**1. A LOT** **2. A LITTLE** **3. NO EFFECT**
D48a. How does catching your limit affect the enjoyment? does it increase it a lot, increase it a little, or not affect it at all?	
D48b. Catching a trophy-size fish?	
D48c. Not having to walk far to get to where you are going to fish?	
D48d. Having a good trail to get to where you are going to fish?	
D48e. Having campground facilities nearby?	
D48f. Having restroom facilities nearby?	
D48g. Having a boat launch nearby?	

D49. Now I'll ask about things that may lower your household's enjoyment. For each question, please tell me if the enjoyment is lowered **a lot**, lowered **a little**, or **not affected at all**.

THINGS THAT LOWER THE ENJOYMENT OF FISHING IN STOCKED LAKES:	**1. A LOT 2. A LITTLE 3. NO EFFECT**
D49a. For your household, how does having lots of other anglers around affect the enjoyment of fishing in stocked lakes? does it lower it a lot, lower it a little, or not affect it at all?	
D49b. Not catching any fish?	
D49c. Seeing other people catching more than their limit?	
D49d. Being asked to show your fishing license?	
D49e. Seeing litter?	

CLOSING

Thank you for all your time. You've been very patient with all of my questions. The information you've given me will help Fish & Game when making decisions. Happy Fishing!

TIME FINISHED: ________

STUDY NO ____

BOAT PROFILE

BBP1. BOAT NUMBER: [ ]

BBP2. How many feet long is this boat? [ ] (FEET) 98. DON'T KNOW 99. NO ANSWER

BBP3. How many years old is it? [ ] (YEARS) 98. DON'T KNOW 99. NO ANSWER

BBP4. In what community did you buy it? ____________

BBP5. How much did you pay for it? [ ] (DOLLARS) 999,998. DON'T KNOW 999,999. NO ANSWER

BBP6. At cruising speed, how many gallons of fuel does it use per hour? [.] (GALLONS) 99.98 DON'T KNOW 99.99 NO ANSWER

BBP7. In what community will you keep it in the winter? ____________

BBP8. What will it cost to keep it there in the winter? [ ] (DOLLARS) 9998. DON'T KNOW 9999. NO ANSWER

BBP9. In what community did you keep it this summer? ____________

BBP10. What, if anything, did it cost to keep it there this summer? [ ] (DOLLARS) 9998. DON'T KNOW 9999. NO ANSWER

BBP11. How much did you spend on this boat this summer on maintenance, improvements and repairs? [ ] (DOLLARS) 9998. DON'T KNOW 9999. NO ANSWER

BBP12. In what community was most of this work done? ____________

BBP13. How much did you spend on this boat this summer on insurance and other expenses we haven't talked about? [ ] (DOLLARS) 9998. DON'T KNOW 9999. NO ANSWER

BBP14. About how many hours did your household use this boat for recreational fishing this summer? [ ] (HOURS) 9998. DON'T KNOW 9999. NO ANSWER

BBP15. And how many hours did your household use this boat in total this summer? [ ] (HOURS) 9998. DON'T KNOW 9999. NO ANSWER

STUDY NO ______ **PLANE PROFILE**

PPP1. PLANE NUMBER: [ ]

PPP2. How many years old is this plane? [ ] (YEARS) 98. DON'T KNOW 99. NO ANSWER

PPP3. In what community did you buy it? ______________________

PPP4. How much did you pay for it? [ ] (DOLLARS) 999998. DON'T KNOW 999999. NO ANSWER

PPP5. At cruising speed, how many gallons of fuel does it use per hour? [ ] (GALLONS) 98. DON'T KNOW 99. NO ANSWER

PPP6. Can this plane land on the water? 1. YES 2. NO 9. NO ANSWER

PPP7. How much did you spend on this plane this summer on maintenance, improvements, and repairs? [ ] (DOLLARS) 9998. DK 9999. NA

PPP8. In what community was most of this work done? ______________________

PPP9. How much did you spend on tie-down fees, insurance and other fixed costs this summer? [ ] (DOLLARS) 9998. DK 9999. NA

PPP11. About how many hours did your household log on this plane for recreational fishing trips this summer? [ ] (HOURS) 998. DK 999. NA

PPP12. And how many hours did your household use this plane in total this summer? [ ] (HOURS) 998. DK 999. NA

STUDY NO ______

VEHICLE PROFILE

VVP1. VEHICLE NUMBER: [ ]

VVP2.	How many years old is this vehicle?	[ ]	(YEARS)	98. DON'T KNOW 99. NO ANSWER
VVP3.	In what community did you buy it?	______		
VVP4.	How much did you pay for it?	[ ]	(DOLLARS)	999998. DK 999999. NA
VVP5.	How many miles per gallon does it get (taking into account trailering a boat, if you do)?	[ ]	(MPG)	98. DON'T KNOW 99. NO ANSWER
VVP6.	How much did you spend on this vehicle this summer on maintenance, improvements and repairs?	[ ]	(DOLLARS)	9998. DK 9999. NA
	VVP7. In what community was most of this work done?	______		
VVP8.	How much did you spend on storage fees, insurance and other fixed costs this summer?	[ ]	(DOLLARS)	9998. DK 9999. NA
VVP9.	About how many miles did your household drive this vehicle on recreational fishing trips this summer?	[ ]	(MILES)	99998. DK 99999. NA
VVP10.	And how many miles did your household put on this vehicle altogether this summer?	[ ]	(MILES)	99998. DK 99999. NA

Appendix G

Cook Inlet Salmon Data

Table G-1: Selected Kenai River Sockeye Salmon Data

	1981	1982	1983	1984	1985	1986	1987
Total Cook Inlet sockeye salmon return	2,560,000	4,490,000	6,490,000	3,400,000	5,500,000	5,840,000	11,950,000
Total sockeye of Kenai Origin	943,297	2,404,118	3,440,053	975,896	2,114,961	2,842,352	8,905,949
Data for sockeye salmon of Kenai River origin:							
Commercial Harvest	530,239	1,772,577	2,779,191	626,906	1,596,396	2,320,018	7,199,968
Personal use/subsistence harvest	149	0	7,562	0	805	0	24,090
Sport harvest, Cook Inlet to bridge	5,270	11,710	22,960	4,419	14,940	21,177	85,020
Inriver (Sonar)	407,639	619,831	630,340	344,571	502,820	501,157	1,596,871
Sport harvest, Bridge to Moose River	5,336	14,829	22,454	2,183	13,025	13,846	65,841
Sport harvest, Moose River to Skilak	4,266	12,136	15,180	2,300	13,299	13,533	39,926
Hidden Personal Use	0	0	0	0	0	0	0
Hidden Spawners	15,938	9,790	11,297	27,784	24,832	17,530	43,487
Sport Harvest, Skilak to Kenai Lake	4,849	11,432	10,672	6,800	15,948	23,842	50,032
Sport Harvest, Russian River	23,720	10,320	16,000	21,970	58,410	30,810	40,575
Russian River Spawners	44,523	30,800	33,734	92,659	136,969	40,281	53,932
Spawners, remainder of drainage	309,007	530,524	521,003	190,875	240,337	361,315	1,303,078
Total spawners	369,468	571,114	566,034	311,318	402,138	419,126	1,400,497

	1988	1989	1990	1991	1992	1993	1994
Total Cook Inlet sockeye salmon return	9,000,000	7,100,000	5,000,000	3,600,000	10,800,000	6,500,000	5,100,000
Total sockeye of Kenai Origin	6,056,105	5,561,491	2,772,564	1,812,003	8,120,080	3,590,207	3,119,387
Data for sockeye salmon of Kenai River origin:							
Commercial Harvest	4,968,129	3,798,449	2,076,357	1,083,880	6,997,282	2,736,678	2,091,776
Personal use/subsistence harvest	16,880	51,192	3,477	27,195	47,465	25,588	1,390
Sport harvest, Cook Inlet to bridge	49,627	111,890	33,210	53,331	80,535	38,379	23,397
Inriver (Sonar)	1,021,469	1,599,959	659,520	647,597	994,798	813,617	1,004,214
Sport harvest, Bridge to Moose River	43,494	90,550	37,199	56,059	85,942	41,457	
Sport harvest, Moose River to Skilak	29,178	45,844	22,083	24,768	40,617	18,724	125,000
Hidden Personal Use	0	0	0	72,060	0	0	0
Hidden Spawners	50,907	7,770	77,959	35,576	32,911	11,582	8,000
Sport Harvest, Skilak to Kenai Lake	30,452	28,942	28,291	27,444	35,398	30,107	
Sport Harvest, Russian River	19,536	55,210	56,175	31,449	26,101	26,772	22,269
Russian River Spawners	42,476	138,377	83,434	78,175	63,478	99,259	122,078
Spawners, remainder of drainage	805,426	1,233,266	354,379	322,066	710,351	585,716	726,867
Total spawners	898,809	1,379,413	515,772	435,817	806,740	696,557	856,945

Source: Doug McBride and Steve Hammarstrom, Assessment of Sockeye Salmon Returns to the Kenai River, Table 1. Updated data for 1993 and 1994 provided by Steve Hammarstrom of the Alaska Department of Fish and Game. ISER file: Kenai Sockeye Summary.

Table G-2. Average Nominal and Real Ex-Vessel Prices for Cook Inlet Gillnet Salmon Fisheries

	Nominal Prices (not adjusted for inflation)					Consumer price index	Real prices (expressed in 1994 dollars)				
	Sockeye	Chinook	Chum	Coho	Pink		Sockeye	Chinook	Chum	Coho	Pink
1969	$0.28	$0.38	$0.12	$0.19	$0.14	39.6	$0.95	$1.30	$0.41	$0.65	$0.48
1970	$0.28	$0.40	$0.14	$0.25	$0.14	41.1	$0.92	$1.31	$0.46	$0.82	$0.46
1971	$0.30	$0.37	$0.15	$0.21	$0.15	42.3	$0.96	$1.18	$0.48	$0.67	$0.48
1972	$0.34	$0.47	$0.20	$0.27	$0.19	43.4	$1.06	$1.46	$0.62	$0.84	$0.59
1973	$0.65	$0.62	$0.42	$0.50	$0.30	45.3	$1.94	$1.85	$1.25	$1.49	$0.89
1974	$0.91	$0.88	$0.53	$0.66	$0.46	50.2	$2.45	$2.37	$1.43	$1.77	$1.24
1975	$0.63	$0.54	$0.41	$0.54	$0.35	57.1	$1.49	$1.28	$0.97	$1.28	$0.83
1976	$0.76	$0.92	$0.54	$0.61	$0.37	61.5	$1.67	$2.02	$1.19	$1.34	$0.81
1977	$0.87	$1.26	$0.61	$0.72	$0.39	65.6	$1.78	$2.59	$1.26	$1.49	$0.79
1978	$1.32	$1.16	$0.51	$0.99	$0.34	70.2	$2.54	$2.23	$0.98	$1.90	$0.65
1979	$1.41	$1.63	$0.88	$0.98	$0.34	77.6	$2.45	$2.84	$1.53	$1.70	$0.59
1980	$0.85	$1.15	$0.54	$0.58	$0.34	85.5	$1.34	$1.82	$0.84	$0.91	$0.54
1981	$1.20	$1.46	$0.65	$0.83	$0.38	92.4	$1.76	$2.14	$0.95	$1.21	$0.56
1982	$1.10	$1.27	$0.49	$0.72	$0.18	97.4	$1.52	$1.76	$0.68	$1.00	$0.25
1983	$0.74	$0.98	$0.37	$0.45	$0.18	99.2	$1.01	$1.33	$0.50	$0.62	$0.25
1984	$0.97	$1.06	$0.40	$0.65	$0.24	103.3	$1.27	$1.39	$0.52	$0.85	$0.31
1985	$1.25	$1.24	$0.45	$0.70	$0.20	105.8	$1.60	$1.58	$0.57	$0.90	$0.25
1986	$1.44	$1.04	$0.39	$0.64	$0.15	107.8	$1.80	$1.30	$0.48	$0.80	$0.18
1987	$1.55	$1.34	$0.39	$0.77	$0.23	108.2	$1.93	$1.67	$0.48	$0.96	$0.29
1988	$2.55	$1.65	$0.86	$1.38	$0.52	108.6	$3.16	$2.04	$1.07	$1.72	$0.65
1989	$1.72	$1.35	$0.40	$0.69	$0.36	111.7	$2.08	$1.63	$0.48	$0.84	$0.44
1990	$1.71	$1.19	$0.52	$0.77	$0.29	118.6	$1.95	$1.36	$0.59	$0.88	$0.33
1991	$1.06	$1.21	$0.30	$0.55	$0.13	124.0	$1.15	$1.31	$0.33	$0.60	$0.14
1992	$1.59	$1.29	$0.38	$0.65	$0.13	128.2	$1.68	$1.36	$0.40	$0.69	$0.14
1993	$1.03	$1.03	$0.34	$0.57	$0.13	132.2	$1.05	$1.06	$0.35	$0.58	$0.13
1994	$1.46	$0.93	$0.30	$0.67	$0.14	135.0	$1.46	$0.93	$0.30	$0.67	$0.14
1995	$1.15	$1.00	$0.27	$0.45	$0.15	138.2	$1.12	$0.98	$0.26	$0.44	$0.15

Sources: 1969-1994: Commercial Fisheries Entry Commission (prices through 1980 are for drift gillnet harvests; prices for 1980-94 are for all gillnet harvests, 1994 data are preliminary); 1995: Alaska Department of Fish and Game, Commercial Fisheries Managmement and Development Division, 1995 Salmon Season, Preliminary Data, updated 10/06/95. Consumer Price Index is Anchorage Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-U), as cited in Alaska Department of Labor, Alaska Economic Trends, June 1995, page 2. 1995 CPI figure is for first half of year only. ISER file: Cook Inlet Ex-Vessel Prices.

Table G-3. Commercial Fisheries Entry Commission Data for Cook Inlet Salmon Harvests, by Species and Gear Group, 1980-1993

	Species	Gear	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Number of fish harvested	Chinook	Gillnet	14,023	12,462	21,764	21,456	10,701	24,986	39,989	40,084	30,225	28,037	17,466	14,387	19,585	19,938
		Seine	199	864	172	51	75	85	51	526	549	612	199	576	603	1,079
	Chum	Gillnet	390,391	840,501	1,440,053	1,119,235	686,849	773,009	1,137,243	351,228	715,038	125,368	353,135	282,554	276,596	125,361
		Seine	72,776	329,134	191,998	187,942	89,584	26,421	80,262	156,965	319,768	9,420	5,013	22,623	20,511	1,776
	Coho	Gillnet	279,454	491,140	797,781	518,277	452,914	652,330	760,178	451,446	563,767	345,196	502,785	432,269	470,229	309,934
		Seine	6,051	3,577	42,475	8,827	13,402	5,585	15,258	10,970	4,742	1,950	733	7,068	3,049	1,710
	Pink	Gillnet	1,813,034	195,937	806,482	90,704	635,912	110,641	1,315,201	118,605	500,344	83,958	616,276	18,668	712,150	112,943
		Seine	863,099	3,210,408	535,755	907,074	682,159	1,206,819	1,394,049	192,207	895,420	1,280,662	353,781	722,535	187,853	445,283
	Sockeye	Gillnet	1,603,510	1,492,927	3,302,253	5,091,440	2,149,309	4,060,542	4,813,820	9,494,203	6,858,591	5,035,300	3,620,573	2,206,855	9,132,042	4,770,699
		Seine	39,529	56,605	88,931	145,938	228,003	255,332	213,054	220,648	306,309	110,396	188,032	281,250	143,537	195,896
Average harvest weight (pounds)	Chinook	Gillnet	26.29	23.64	28.54	29.26	28.77	27.76	25.83	28.92	29.19	23.64	21.92	21.15	22.93	26.83
		Seine	5.35	4.59	12.12	21.55	7.97	9.18	12.14	9.73	12.61	11.29	13.10	6.68	9.84	8.64
	Chum	Gillnet	7.32	7.66	8.24	7.75	7.56	7.60	7.42	7.10	7.66	7.25	7.10	6.56	6.75	5.83
		Seine	7.77	8.20	9.05	9.20	8.86	8.37	8.10	8.31	9.46	8.92	9.56	7.54	9.02	6.79
	Coho	Gillnet	5.83	6.56	7.15	6.89	7.09	7.17	6.42	6.58	7.06	6.58	6.45	6.09	6.43	5.88
		Seine	6.54	7.94	8.95	7.31	8.75	10.95	8.50	8.34	8.77	6.04	6.61	6.31	7.96	5.77
	Pink	Gillnet	3.48	3.70	3.89	3.40	4.03	7.45	3.72	3.54	3.75	3.29	3.40	3.20	3.88	3.10
		Seine	3.18	3.72	3.22	3.01	3.50	3.49	3.41	3.47	3.01	3.08	2.76	2.63	3.26	2.81
	Sockeye	Gillnet	5.93	6.41	7.00	6.42	5.91	5.64	5.77	6.73	6.62	6.59	6.41	5.62	6.59	5.88
		Seine	5.29	5.75	5.95	4.84	4.48	4.65	4.19	4.69	4.73	4.75	3.95	4.14	4.39	4.23
Harvest volume (pounds)	Chinook	Gillnet	368,695	294,611	621,244	627,846	307,824	693,588	1,032,869	1,159,363	882,248	662,870	382,862	304,226	449,163	534,852
		Seine	1,064	3,965	2,085	1,099	598	780	619	5,116	6,921	6,908	2,607	3,846	5,932	9,319
	Chum	Gillnet	2,859,028	6,434,689	11,859,794	8,671,734	5,194,678	5,877,290	8,437,468	2,494,481	5,480,491	908,403	2,506,805	1,853,820	1,866,025	730,782
		Seine	565,273	2,698,177	1,738,352	1,729,982	793,915	221,272	650,251	1,303,913	3,024,462	84,044	47,935	170,550	185,054	12,061
	Coho	Gillnet	1,629,848	3,220,845	5,704,097	3,573,316	3,213,285	4,676,129	4,877,631	2,970,143	3,980,503	2,272,482	3,244,489	2,633,521	3,024,521	1,821,018
		Seine	39,586	28,391	380,074	64,495	117,292	61,148	129,764	91,488	41,607	11,778	4,843	44,630	24,271	9,871
	Pink	Gillnet	6,316,406	724,336	3,138,638	308,340	2,563,398	824,095	4,890,025	419,289	1,877,701	275,881	2,093,715	59,739	2,763,753	349,629
		Seine	2,747,458	11,947,013	1,724,031	2,727,840	2,385,877	4,210,741	4,755,991	666,235	2,692,944	1,938,691	977,529	1,903,285	612,275	1,249,676
	Sockeye	Gillnet	9,513,130	9,576,766	23,129,253	32,691,887	12,698,973	22,911,363	27,776,702	63,856,869	45,381,309	33,205,338	23,192,145	12,399,425	60,147,333	28,055,791
		Seine	208,990	325,615	529,074	705,957	1,021,254	1,188,065	892,978	1,035,813	1,448,597	524,756	742,576	1,164,393	630,607	829,009
Harvest value (dollars)	Chinook	Gillnet	423,999	431,016	787,116	612,150	327,217	859,238	1,070,052	1,552,387	1,451,298	892,886	456,754	367,201	578,522	553,037
		Seine	1,224	4,964	2,613	870	454	968	167	4,558	9,772	7,972	2,662	3,734	5,914	8,303
	Chum	Gillnet	1,529,580	4,182,548	5,858,738	3,165,183	2,077,871	2,621,717	3,256,863	967,859	4,735,144	360,636	1,301,032	554,292	701,625	249,197
		Seine	302,421	1,257,350	721,416	515,535	193,715	68,594	178,169	545,036	2,673,624	28,743	27,754	43,831	44,598	3,570
	Coho	Gillnet	937,163	2,676,522	4,112,654	1,622,285	2,095,062	3,282,643	3,121,684	2,292,950	5,493,094	1,577,103	2,495,012	1,456,337	1,975,012	1,030,696
		Seine	22,762	21,293	255,030	27,539	91,722	25,804	87,331	89,567	68,901	6,148	2,431	22,181	14,393	4,067
	Pink	Gillnet	2,147,578	278,145	564,955	56,118	615,216	163,171	718,834	96,436	978,282	99,317	615,552	7,826	367,579	45,102
		Seine	934,136	5,256,686	256,881	665,593	620,328	922,152	794,250	279,819	2,103,189	1,591,231	293,259	230,297	118,781	174,955
	Sockeye	Gillnet	8,086,161	11,530,426	25,395,920	24,322,764	12,305,305	28,726,357	40,026,228	98,914,290	115,540,813	57,146,387	39,635,376	13,120,483	95,934,996	28,981,632
		Seine	177,642	342,221	550,237	511,819	938,532	1,285,486	1,136,761	1,672,838	3,582,380	905,729	1,118,319	1,060,762	923,839	651,601
Average ex-vessel price ($/lb)	Chinook	Gillnet	$1.15	$1.46	$1.27	$0.98	$1.06	$1.24	$1.04	$1.34	$1.65	$1.35	$1.19	$1.21	$1.29	$1.03
		Seine	$1.15	$1.25	$1.25	$0.79	$0.76	$1.24	$0.27	$0.89	$1.41	$1.15	$1.02	$0.97	$1.00	$0.89
	Chum	Gillnet	$0.54	$0.65	$0.49	$0.37	$0.40	$0.45	$0.39	$0.39	$0.86	$0.40	$0.52	$0.30	$0.38	$0.34
		Seine	$0.54	$0.47	$0.42	$0.30	$0.24	$0.31	$0.27	$0.42	$0.88	$0.34	$0.58	$0.26	$0.24	$0.30
	Coho	Gillnet	$0.58	$0.83	$0.72	$0.45	$0.65	$0.70	$0.64	$0.77	$1.38	$0.69	$0.77	$0.55	$0.65	$0.57
		Seine	$0.58	$0.75	$0.67	$0.43	$0.78	$0.42	$0.67	$0.98	$1.66	$0.52	$0.50	$0.50	$0.59	$0.41
	Pink	Gillnet	$0.34	$0.38	$0.18	$0.18	$0.24	$0.20	$0.15	$0.23	$0.52	$0.36	$0.29	$0.13	$0.13	$0.13
		Seine	$0.34	$0.44	$0.15	$0.24	$0.26	$0.22	$0.17	$0.42	$0.78	$0.40	$0.30	$0.12	$0.19	$0.14
	Sockeye	Gillnet	$0.85	$1.20	$1.10	$0.74	$0.97	$1.25	$1.44	$1.55	$2.55	$1.72	$1.71	$1.06	$1.59	$1.03
		Seine	$0.85	$1.05	$1.04	$0.73	$0.92	$1.08	$1.27	$1.62	$2.47	$1.73	$1.51	$0.91	$1.46	$0.79

Source: Commercial Fisheries Entry Commission. ISER file: CFEC Cook Inlet Data.

Table G-4. Cook Inlet Gill Net Salmon Harvest Data, 1980-1995

	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Number harvested (fish)	Chinook	14,023	12,462	21,764	21,456	10,701	24,986	39,989	40,084	30,225	28,037	17,466	14,387	19,585	19,938	20,000	19,000
	Chum	390,391	840,501	1,440,053	1,119,235	686,849	773,009	1,137,243	351,228	715,038	125,368	353,135	282,554	276,596	125,361	330,000	750,000
	Coho	279,454	491,140	797,781	518,277	452,914	652,330	760,178	451,446	563,767	345,196	502,785	432,269	470,229	309,934	600,000	406,000
	Pink	1,813,034	195,937	806,482	90,704	635,912	110,641	1,315,201	118,605	500,344	83,958	616,276	18,668	712,150	112,943	2,170,000	2,953,000
	Sockeye	1,603,510	1,492,927	3,302,253	5,091,440	2,149,309	4,060,542	4,813,820	9,494,203	6,858,591	5,035,300	3,620,573	2,206,855	9,132,042	4,770,699	3,710,000	3,130,000
Average weight (pounds)	Chinook	26.29	23.64	28.54	29.26	28.77	27.76	25.83	28.92	29.19	23.64	21.92	21.15	22.93	26.83	30.61	31.62
	Chum	7.32	7.66	8.24	7.75	7.56	7.60	7.42	7.10	7.66	7.25	7.10	6.56	6.75	5.83	6.89	7.00
	Coho	5.83	6.56	7.15	6.89	7.09	7.17	6.42	6.58	7.06	6.58	6.45	6.09	6.43	5.88	7.18	6.46
	Pink	3.48	3.70	3.89	3.40	4.03	7.45	3.72	3.54	3.75	3.29	3.40	3.20	3.88	3.10	3.22	3.10
	Sockeye	5.93	6.41	7.00	6.42	5.91	5.64	5.77	6.73	6.62	6.59	6.41	5.62	6.59	5.88	5.64	5.90
Harvest weight (pounds)	Chinook	368,695	294,611	621,244	627,846	307,824	693,588	1,032,869	1,159,363	882,248	662,870	382,862	304,226	449,163	534,852	650,000	600,000
	Chum	2,859,028	6,434,689	11,859,794	8,671,734	5,194,678	5,877,290	8,437,468	2,494,481	5,480,491	908,403	2,506,805	1,853,820	1,866,025	730,782	2,300,000	3,720,000
	Coho	1,629,848	3,220,845	5,704,097	3,573,316	3,213,285	4,676,129	4,877,631	2,970,143	3,980,503	2,272,482	3,244,489	2,633,521	3,024,521	1,821,018	4,300,000	2,620,000
	Pink	6,316,406	724,336	3,138,638	308,340	2,563,398	824,095	4,890,025	419,289	1,877,701	275,881	2,093,715	59,739	2,763,753	349,629	6,980,000	9,150,000
	Sockeye	9,513,130	9,576,766	23,129,253	32,691,887	12,698,973	22,911,363	27,776,702	63,856,869	45,381,309	33,205,338	23,192,145	12,399,425	60,147,333	28,055,791	20,890,000	18,470,000
Harvest value (dollars)	Chinook	423,999	431,016	787,116	612,150	327,217	859,238	1,070,052	1,552,387	1,451,298	892,886	456,754	367,201	578,522	553,037	604,500	600,000
	Chum	1,529,580	4,182,548	5,858,738	3,165,183	2,077,871	2,621,717	3,256,863	967,859	4,735,144	360,636	1,301,032	554,292	701,625	249,197	690,000	1,000,000
	Coho	937,163	2,676,522	4,112,654	1,622,285	2,095,062	3,282,643	3,121,684	2,292,950	5,493,094	1,577,103	2,495,012	1,456,337	1,975,012	1,030,696	2,881,000	1,180,000
	Pink	2,147,578	278,145	564,955	56,118	615,216	163,171	718,834	96,436	978,282	99,317	615,552	7,826	367,579	45,102	977,200	1,370,000
	Sockeye	8,086,161	11,530,426	25,395,920	24,322,764	12,305,305	28,726,357	40,026,228	98,914,290	115,540,813	57,146,387	39,635,376	13,120,483	95,934,996	28,981,632	30,499,400	21,240,000
Average price ($/lb)	Chinook	$1.15	$1.46	$1.27	$0.98	$1.06	$1.24	$1.04	$1.34	$1.65	$1.35	$1.19	$1.21	$1.29	$1.03	$0.93	$1.00
	Chum	$0.54	$0.65	$0.49	$0.37	$0.40	$0.45	$0.39	$0.39	$0.86	$0.40	$0.52	$0.30	$0.38	$0.34	$0.30	$0.27
	Coho	$0.58	$0.83	$0.72	$0.45	$0.65	$0.70	$0.64	$0.77	$1.38	$0.69	$0.77	$0.55	$0.65	$0.57	$0.67	$0.45
	Pink	$0.34	$0.38	$0.18	$0.18	$0.24	$0.20	$0.15	$0.23	$0.52	$0.36	$0.29	$0.13	$0.13	$0.13	$0.14	$0.15
	Sockeye	$0.85	$1.20	$1.10	$0.74	$0.97	$1.25	$1.44	$1.55	$2.55	$1.72	$1.71	$1.06	$1.59	$1.03	$1.46	$1.15

Sources: 1980-93: Commercial Fisheries Entry Commission. 1994-95: ADFG preliminary data, except that 1994 price data were provided by CFEC and 1994 value data were calculated by multiplying ADFG data for harvest volume by CFEC price data. Note that ADFG data are rounded, so that average weight times number of fish does not necessarily exactly equal harvest weight. 1994 and 1995 data include seine harvests. ISER file: Gill Net Harvest Data.

Table G-5: Summary Economic Data for the Cook Inlet Salmon Drift Gillnet Fishery

Year	Permanent Permits Issued to Residents	Permanent Permits Issued to Non-Res.	Interim Use Permits Issued	Total Permits Issued	Total Permits Fished	Total Gross Earnings	Average Gross Earnings	Total Pounds Landed	Average Permit Price
1982	382	172	37	591	577	$24,514,672	$42,486	30,315,342	$57,866
1983	390	165	32	587	580	$19,592,016	$33,779	31,386,861	$69,720
1984	400	156	32	588	578	$10,390,271	$17,976	14,582,818	$66,306
1985	394	163	34	591	584	$18,729,910	$32,072	19,830,693	$62,759
1986	396	163	29	588	584	$29,957,219	$51,297	30,140,256	$63,902
1987	401	159	26	586	585	$61,662,596	$105,406	41,727,427	$86,542
1988	402	159	24	585	584	$78,124,815	$133,775	35,218,949	$126,138
1989	400	161	24	585	10	$33,363	$3,336	26,090	$168,400
1990	391	170	24	585	582	$28,384,895	$48,771	19,874,014	$203,063
1991	397	165	22	584	578	$8,099,133	$14,012	9,215,538	$177,214
1992	389	173	21	583	580	$66,362,035	$114,417	45,304,704	$88,816
1993	384	179	20	583	580	$16,537,133	$28,512	16,815,486	$89,786

****Estimates of gross earnings not produced unless values have been determined for at least 95% of the pounds landed.*

1. Data has been omitted when fewer than four people participated in a fishery.

2. Gross earnings are estimated using an average annual ex-vessel price per area, species and gear type.

3. These data are aggregated by the type of permit fished, and thus contains both targeted species and incidentally landed species.

4. Average Permit Price Notes:

A---indicates that there were no monetary transfers for this fishery.

A...indicates confidential information because fewer than four surveys exist.

5. Data includes only commercial catch landed on valid permits. Data associated with test fishing, illegal landings, derbies, educational permits, or unmatchable permits are excluded.

Source: Commercial Fisheries Entry Commission, Basic Information Table #1a, Summary Data on Limited Fisheries, 1977-1992 (S03H: Cook Inlet Salmon Drift Gillnet), January 1994.

Table G-6: Summary Economic Data for the Cook Inlet Salmon Setnet Fishery

Year	Permanent Permits Issued to Residents	Permanent Permits Issued to Non-Res.	Interim Use Permits Issued	Total Permits Issued	Total Permits Fished	Total Gross Earnings	Average Gross Earnings	Total Pounds Landed	Average Permit Price
1982	692	52	4	748	602	$12,203,219	$20,271	14,133,076	$17,190
1983	682	61	2	745	626	$10,160,167	$16,230	14,440,616	$18,340
1984	668	75	1	744	620	$6,963,551	$11,232	9,293,068	$17,078
1985	677	67	1	745	625	$16,812,737	$26,900	14,688,006	$16,312
1986	666	77	0	743	645	$18,259,250	$28,309	16,892,594	$18,310
1987	664	79	0	743	650	$41,837,116	$64,365	28,964,555	$26,727
1988	660	83	0	743	655	$49,936,893	$76,240	22,330,850	$41,151
1989	647	96	0	743	658	$59,818,985	$90,910	37,160,146	$57,694
1990	646	97	0	743	662	$16,129,521	$24,365	11,550,650	$91,171
1991	645	100	0	745	648	$7,361,565	$11,360	7,986,161	$65,875
1992	638	107	0	745	654	$33,100,968	$50,613	22,876,698	$40,793
1993	638	107	0	745	641	$14,314,327	$22,331	14,668,304	$36,478

****Estimates of gross earnings not produced unless values have been determined for at least 95% of the pounds landed.*

1. Data has been omitted when fewer than four people participated in a fishery.
2. Gross earnings are estimated using an average annual ex-vessel price per area, species, and gear type.
3. These data are aggregated by the type of permit fished, and thus contains both targeted species and incidentally landed species.
4. Average Permit Price Notes:
A---indicates that there were no monetary transfers for this fishery.
A...indicates confidential information because fewer than four surveys exist.
5. Data includes only commercial catch landed on valid permits. Data associated with test fishing, illegal landings, derbies, educational permits, or unmatchable permits are excluded.

Source: Commercial Fisheries Entry Commission, Basic Information Table #1a, Summary Data on Limited Fisheries, 1977-1992 (S04H: Cook Inlet Salmon Setnet), January 1994.

Table G-7. CFEC Quartile Earnings Reports:
Cook Inlet Set Gill Net Fishery

Year 1993 Fishery Code: S04H

	Permits		Estimated Gross Earnings			
Quartile	Number	Percent	Total	Percent	Average	
1	23	3.59	$3,587,845	25.06	$155,993	actual
(high)	23	3.59	$3,587,845	25.06	$155,993	cum.
2	52	8.11	$3,570,177	24.94	$68,657	actual
	75	11.7	$7,158,022	50.01	$95,440	cum.
3	121	18.88	$3,582,836	25.03	$29,610	actual
	196	30.58	$10,740,858	75.04	$54,800	cum.
4	445	69.42	$3,573,469	24.96	$8,030	actual
(low)	641	100	$14,314,327	100	$22,331	cum.

Total pounds represented in this table: 14,668,304

Year 1992 Fishery Code: S04H

	Permits		Estimated Gross Earnings			
Quartile	Number	Percent	Total	Percent	Average	
1	21	3.21	$8,359,707	25.26	$398,081	actual
(high)	21	3.21	$8,359,707	25.26	$398,081	cum.
2	45	6.88	$8,164,036	24.66	$181,423	actual
	66	10.09	$16,523,743	49.92	$250,360	cum.
3	101	15.44	$8,292,373	25.05	$82,103	actual
	167	25.54	$24,816,117	74.97	$148,600	cum.
4	487	74.46	$8,284,851	25.03	$17,012	actual
(low)	654	100	$33,100,968	100	$50,613	cum.

Total pounds represented in this table: 22,876,698

Year 1991 Fishery Code: S04H

	Permits		Estimated Gross Earnings			
Quartile	Number	Percent	Total	Percent	Average	
1	31	4.78	$1,828,047	24.83	$58,969	actual
(high)	31	4.78	$1,828,047	24.83	$58,969	cum.
2	69	10.65	$1,858,470	25.25	$26,934	actual
	100	15.43	$3,686,517	50.08	$36,865	cum.
3	132	20.37	$1,837,328	24.96	$13,919	actual
	232	35.8	$5,523,845	75.04	$23,810	cum.
4	416	64.2	$1,837,720	24.96	$4,418	actual
(low)	648	100	$7,361,565	100	$11,360	cum.

Total pounds represented in this table: 7,986,161

Table G-8. CFEC Quartile Earnings Reports:
Cook Inlet Drift Gill Net Fishery

Year 1993 Fishery Code: S03H

Quartile	Permits Number	Permits Percent	Estimated Gross Earnings Total	Estimated Gross Earnings Percent	Estimated Gross Earnings Average	
1	97	16.72	$4,117,563	24.9	$42,449	actual
(high)	97	16.72	$4,117,563	24.9	$42,449	cum.
2	127	21.9	$4,162,868	25.17	$32,778	actual
	224	38.62	$8,280,431	50.07	$36,966	cum.
3	149	25.69	$4,120,347	24.92	$27,653	actual
	373	64.31	$12,400,778	74.99	$33,246	cum.
4	207	35.69	$4,136,355	25.01	$19,982	actual
(low)	580	100	$16,537,133	100	$28,512	cum.

Total pounds represented in this table: 16,815,486

Year 1992 Fishery Code: S03H

Quartile	Permits Number	Permits Percent	Estimated Gross Earnings Total	Estimated Gross Earnings Percent	Estimated Gross Earnings Average	
1	101	17.41	$16,550,406	24.94	$163,865	actual
(high)	101	17.41	$16,550,406	24.94	$163,865	cum.
2	126	21.72	$16,582,288	24.99	$131,605	actual
	227	39.14	$33,132,694	49.93	$145,959	cum.
3	148	25.52	$16,675,007	25.13	$112,669	actual
	375	64.66	$49,807,701	75.05	$132,821	cum.
4	205	35.34	$16,554,334	24.95	$80,753	actual
(low)	580	100	$66,362,035	100	$114,417	cum.

Total pounds represented in this table: 45,304,704

Year 1991 Fishery Code: S03H

Quartile	Permits Number	Permits Percent	Estimated Gross Earnings Total	Estimated Gross Earnings Percent	Estimated Gross Earnings Average	
1	93	16.09	$2,033,277	25.1	$21,863	actual
(high)	93	16.09	$2,033,277	25.1	$21,863	cum.
2	119	20.59	$2,012,221	24.84	$16,909	actual
	212	36.68	$4,045,498	49.95	$19,083	cum.
3	145	25.09	$2,028,910	25.05	$13,992	actual
	357	61.76	$6,074,408	75	$17,015	cum.
4	221	38.24	$2,024,725	25	$9,162	actual
(low)	578	100	$8,099,133	100	$14,012	cum.

Total pounds represented in this table: 9,215,538

Table G-9. Net Weight and Average Wholesale Value of Cook Inlet Salmon Production, 1991-1994

Species	Process	Volume (pounds)				Value ($)			
		1991	1992	1993*	1994*	1991	1992	1993*	1994*
Sockeye	Canned	905,867	2,641,169				$9,495,410		
	Fresh	1,562,619	1,674,213			$4,576,684	$4,329,760		
	Frozen	11,140,605	40,270,844	26,263,052	16,965,686	$22,997,407	$124,382,277	$54,717,951	$46,332,055
	Other	73,179	88,119			$220,194	$441,700		
	Fresh, roe	76,956	481,118			$329,821	$2,366,223		
	Other, roe	275,728	1,259,284	937,883	709,653	$1,640,276	$7,426,987	$6,106,672	$4,404,114
	Total	14,034,954	46,414,747	27,200,935	17,675,339	$29,764,382	$148,442,357	$60,824,623	$50,736,169
Chinook	Canned								
	Fresh	198,986	248,921			$490,484	$788,203		
	Frozen	511,186	1,073,284	1,070,245	781,275	$2,700,790	$4,482,795	$4,706,063	$2,400,964
	Other	5,954	11,636			$41,458	$85,666		
	Fresh, roe	92,476	7,276			$456,578	$26,728		
	Other, roe	4,742	23,007	31,630	33,051	$28,258	$125,356	$261,720	$157,741
	Total	813,344	1,364,124	1,101,875	814,326	$3,717,568	$5,508,748	$4,967,783	$2,558,705
Chum	Canned								
	Fresh	797,567	1,346,196			$1,158,562	$2,080,847		
	Frozen	3,525,110	3,478,940	2,280,379	3,397,728	$4,532,433	$4,362,217	$2,466,260	$3,066,464
	Other	28,209				$48,196			
	Fresh, roe	32,613	22,626			$116,620	$78,747		
	Other, roe	43,304	78,161	68,340	125,670	$210,073	$448,900	$563,301	$610,800
	Total	4,350,886	4,825,136	2,348,719	3,523,398	$5,739,191	$6,443,064	$3,029,561	$3,677,264
Coho	Canned	12,576				$84,497			
	Fresh	227,015	371,035			$348,268	$703,731		
	Frozen	2,870,974	3,425,772	1,634,130	3,645,959	$4,969,464	$5,166,242	$2,552,075	$6,855,878
	Other	15,107	12,904			$28,071	$87,563		
	Fresh, roe	38,502	29,162			$164,328	$113,713		
	Other, roe	39,838	70,503	49,002	136,532	$216,313	$383,378	$284,416	$756,145
	Total	3,204,012	3,909,376	1,683,132	3,782,491	$5,810,941	$6,454,627	$2,836,491	$7,612,023
Pink	Canned	1,460,004	2,729,247			$9,887,158	$4,507,389		
	Fresh	96,303	450,971			$73,138	$562,500		
	Frozen	4,970,001	2,323,576	5,299,476	14,824,433	$3,523,010	$1,587,262	$5,298,152	$17,404,257
	Other	104,339				$100,348			
	Fresh, roe	115,677	32,823			$155,281	$46,171		
	Other, roe	407,814	268,235	255,021	930,686	$1,018,571	$934,060	$983,864	$2,819,500
	Total	7,154,138	5,804,852	5,554,497	15,755,119	$14,757,506	$7,637,382	$6,282,016	$20,223,757
All Salmon Species	Canned	2,378,447	5,370,416			$9,971,655	$14,002,799		
	Fresh	2,882,490	4,091,336			$6,647,136	$8,465,041		
	Frozen	23,017,876	50,572,416	36,547,282	39,615,081	$38,723,104	$139,980,793	69,740,501	76,059,618
	Other	226,788	112,659			$438,267	$614,929		
	Fresh, roe	356,224	573,005			$1,222,628	$2,631,582		
	Other, roe	771,426	1,699,190	1,341,876	1,935,592	$3,113,491	$9,318,681	$8,199,973	$8,748,300
	Total	29,633,251	62,419,022	37,889,158	41,550,673	$60,116,281	$175,013,825	$77,940,474	$84,807,918

*Data by type of product were not available. The figure for "frozen" salmon is for all non-roe products; the figure for "other roe" is for all roe products.

Source: Alaska Department of Fish and Game, based on Commercial Operator's Annual Reports. File: Cook Inlet Prod.

Table G-10. Cook Inlet Salmon Average Wholesale Prices and Production Shares, 1991 & 1992

Species	Process	Average Price ($/lb)		Percentage of Total Volume		Percentage of Total Value	
		1991	1992	1991	1992	1991	1992
Sockeye	Canned		$3.60	6%	6%	0%	6%
	Fresh	$2.93	$2.59	11%	4%	15%	3%
	Frozen	$2.06	$3.09	79%	87%	77%	84%
	Other	$3.01	$5.01	1%	0%	1%	0%
	Fresh, roe	$4.29	$4.92	1%	1%	1%	2%
	Other, roe	$5.95	$5.90	2%	3%	6%	5%
	Total			100%	100%	100%	100%
Chinook	Canned			0%	0%	0%	0%
	Fresh	$2.46	$3.17	24%	18%	13%	14%
	Frozen	$5.28	$4.18	63%	79%	73%	81%
	Other	$6.96	$7.36	1%	1%	1%	2%
	Fresh, roe	$4.94	$3.67	11%	1%	12%	0%
	Other, roe	$5.96	$5.45	1%	2%	1%	2%
	Total			100%	100%	100%	100%
Chum	Canned			0%	0%	0%	0%
	Fresh	$1.45	$1.55	18%	28%	20%	32%
	Frozen	$1.29	$1.25	81%	72%	79%	68%
	Other	$1.71		1%	0%	1%	0%
	Fresh, roe	$3.58	$3.48	1%	0%	2%	1%
	Other, roe	$4.85	$5.74	1%	2%	4%	7%
	Total			100%	100%	100%	100%
Coho	Canned	$6.72		0%	0%	1%	0%
	Fresh	$1.53	$1.90	7%	9%	6%	11%
	Frozen	$1.73	$1.51	90%	88%	86%	80%
	Other	$1.86	$6.79	0%	0%	0%	1%
	Fresh, roe	$4.27	$3.90	1%	1%	3%	2%
	Other, roe	$5.43	$5.44	1%	2%	4%	6%
	Total			100%	100%	100%	100%
Pink	Canned	$6.77	$1.65	20%	47%	67%	59%
	Fresh	$.76	$1.25	1%	8%	0%	7%
	Frozen	$.71	$.68	69%	40%	24%	21%
	Other	$.96		1%	0%	1%	0%
	Fresh, roe	$1.34	$1.41	2%	1%	1%	1%
	Other, roe	$2.50	$3.48	6%	5%	7%	12%
	Total			100%	100%	100%	100%

Source: Alaska Department of Fish and Game, based on Commercial Operator's Annual Reports (see Table G-9). File: Cook Inlet Prod.

Table G-11.
Kenai Peninsula Borough
Fish Processing Employment

Month	West Kenai Peninsula Borough	Kenai Peninsula Borough Total
Jan-92	287	377
Feb-92	400	522
Mar-92	524	700
Apr-92	976	1119
May-92	807	1140
Jun-92	1671	1984
Jul-92	3122	3404
Aug-92	1964	2239
Sep-92	1048	1180
Oct-92	389	469
Nov-92	201	266
Dec-92	173	232
Jan-93	319	394
Feb-93	404	464
Mar-93	793	890
Apr-93	663	796
May-93	889	1080
Jun-93	1734	2061
Jul-93	2777	3063
Aug-93	1694	2011
Sep-93	642	816
Oct-93	257	329
Nov-93	148	207
Dec-93	121	180
Jan-94	390	464
Feb-94	542	614
Mar-94	685	753
Apr-94	367	522
May-94	672	958
Jun-94	1657	1950
Jul-94	2254	2620
Aug-94	1573	1888
Sep-94	962	1184
Oct-94	420	512
Nov-94	159	248
Dec-94	155	249

Source: Alaska Department of Labor, Research and Analysis Division. ISER file: Processing Employment.

Table G-12. Cook Inlet Drift Net and East Side Set Net Salmon Harvests by Statistical Area

	Permits with Reported Landings			Sockeye Harvest		
	1992	1993	1994	1992	1993	1994
Drift Net	581	580	571		2,558,492	1,878,463
Set Net						
All Upper Cook Inlet	639	624	603		2,196,206	1,688,929
All Central District	529	513	497		2,049,887	1,568,787
East Side (Central District, Upper Subdistrict)	449	437	427		1,941,706	1,482,957
Statistical Area 244-21 only (Ninilchik)	100	93	103		151,620	231,551
Statistical Area 244-22 only (Cohoe)	120	115	129		291,372	446,209
Statistical Area 244-30 only (Kalifonsky Beach)	186	171	179		678,731	492,917
Statistical Area 244-40 only (Salamatof)	142	129	139		819,983	312,280
Drift Net and Set Net	1220	1204	1174		4,754,698	3,567,392

(c) Upper Cook Inlet Fisheries Annual Managment Reports, 1992, 1993 and 1994.
ISER file: Harvest by Area

Table G-13. Cook Inlet Salmon Permits: Selected Data

	1990	1991	1992	1993	1994
Drift Net					
Total permanent permits issued (a)	583	584	583	583	
Total permanent permits issued to residents (a)	397	389	384	384	
Resident share	68%	67%	66%	66%	
Total permits fished (a)	582	578	580	580	
Maximum number of permits fished in any week (b)	583	516	580	581	
Permits with reported landings (c)			581	580	571
Set Net					
Total permanent permits issued (a)	743	745	745	745	
Total permanent permits issued to residents (a)	647	646	638	538	
Resident share	87%	87%	86%	72%	
Total permits fished (a)	662	648	654	641	
Maximum number of permits fished in any week (b)	542	516	555	546	
Permits with reported landings (c):					
All Upper Cook Inlet			639	624	603
All Central District			529	513	497
All Central District, Upper Subdistrict			449	437	427
Statistical Area 244-21 only			100	93	103
Statistical Area 244-22 only			120	115	129
Statistical Area 244-30 only			186	171	179
Statistical Area 244-40 only			142	129	139

(a) CFEC, Basic Information Table #1a.

(b) Calculated by ISER based on fish ticket data.

(c) Upper Cook Inlet Fisheries Annual Managment Reports, 1992, 1993 and 1994.

ISER file: Number of permits.

Table G-14: Upper Cook Inlet Commercial Sockeye Salmon Harvest by Gear Type and Area, 1966-1994

	Central District Drift Gillnet		Central District Set Gillnet				Northern District Set Gillnet		
			East Side		Kalgin/West Side				
Year	Number	%	Number	%	Number	%	Number	%	Total
1966	1,103,261	59.6	485,330	26.2	132,443	7.2	131,080	7.1	1,852,114
1967	890,152	64.6	303,858	22.0	66,414	4.8	118,065	8.6	1,378,489
1968	561,737	50.8	317,535	28.7	85,049	7.7	140,575	12.7	1,104,896
1969	371,747	53.7	210,834	30.5	71,184	10.3	38,050	5.5	691,815
1970	460,690	62.9	142,701	19.5	62,723	8.6	66,458	8.9	732,572
1971	423,107	66.5	111,505	17.5	61,144	9.6	40,533	6.4	636,289
1972	506,281	57.5	204,599	23.3	83,176	9.5	85,755	9.7	879,811
1973	375,695	56.1	188,816	28.2	59,973	8.9	45,614	6.8	670,098
1974	265,771	53.5	136,889	27.5	52,962	10.7	41,563	8.4	497,185
1975	368,124	53.8	177,336	25.9	73,765	10.8	65,526	9.7	684,751
1976	1,055,786	63.4	476,376	28.6	62,338	3.7	69,649	4.2	1,664,149
1977	1,073,098	52.3	751,178	36.6	104,265	5.1	123,780	6.0	2,052,321
1978	1,803,479	68.8	660,797	25.2	105,767	4.0	51,378	2.0	2,621,421
1979	454,707	49.1	248,359	26.8	108,422	11.7	113,918	12.2	925,406
1980	770,247	48.9	559,812	35.6	137,882	8.8	105,647	6.7	1,573,588
1981	633,280	44.0	496,003	34.5	60,217	4.2	249,662	17.3	1,439,262
1982	2,103,429	64.5	971,423	29.8	66,952	2.1	118,060	3.6	3,259,864
1983	3,222,428	63.8	1,508,511	29.9	134,575	2.7	184,219	3.6	5,049,733
1984	1,235,337	58.6	490,273	23.3	162,139	7.7	218,695	10.4	2,106,714
1985	2,032,957	50.1	1,561,200	38.4	285,081	7.0	181,191	4.5	4,060,429
1986	2,834,534	59.2	1,657,904	34.6	153,714	3.2	141,830	3.0	4,787,982
1987	5,631,746	59.3	3,495,802	36.8	208,036	2.2	164,602	1.7	9,500,186
1988	4,129,878	60.4	2,428,597	35.5	146,154	2.1	129,713	1.9	6,834,342
1989	3	0.0	4,543,066	90.7	186,828	3.7	280,801	5.6	5,010,698
1990	2,305,742	64.0	1,116,975	31.0	84,949	2.4	96,398	2.7	3,604,064
1991	1,117,514	51.3	844,156	38.8	99,705	4.6	116,201	5.3	2,177,576
1992	6,069,495	66.6	2,838,076	31.2	131,291	1.4	69,478	0.8	9,108,340
1993	2,558,492	53.8	1,941,706	40.8	108,181	2.3	146,319	3.1	4,754,698
1994	1,878,463	52.7	1,482,957	41.6	85,830	2.4	120,142	3.4	3,567,392
Average[1]	**1,651,331**	**57.5**	**921,768**	**33.5**	**106,940**	**6.0**	**113,370**	**6.5**	**2,793,410**

[1] *1989 excluded from average.*

Table G-15: Estimated Hours Fished in Cook Inlet East-Side Fisheries, 1990-1993

		Number fishing (a)		Open fishing hours (b)			Total hours fished, by week (c)		Total hours fished, by year	
Year	Week	Drift	Set	Drift	Set North	Set South	Drift	Set (d)	Drift	Set
90	21	0	0				0	0		
90	22	0	12				0	0		
90	23	0	127				0	0		
90	24	0	133				0	0		
90	25	0	157				0	0		
90	26	503	143	24	0	0	12,072	0		
90	27	574	435	24	24	24	13,776	10,440		
90	28	567	350	12	12	12	6,804	4,200		
90	29	582	542	57	56	71	33,174	34,417		
90	30	583	522	62	58	101	36,146	41,499		
90	31	577	539	62	76	51	35,774	34,227		
90	32	380	421	36	24	24	13,680	10,104		
90	33	211	320	36	24	24	7,596	7,680		
90	34	57	111	36	0	0	2,052	0		
90	35	23	71	36	0	0	828	0		
90	36	3	38	36	0	0	108	0		
90	37	1	13				0	0	162,010	142,567
91	22	0	15				0	0		
91	23	0	131				0	0		
91	24	0	148				0	0		
91	25	0	159				0	0		
91	26	10	151	12	0	0	120	0		
91	27	41	345	41	24	48	1,681	12,420		
91	28	557	411	24	24	24	13,368	9,864		
91	29	577	513	24	24	71	13,848	24,368		
91	30	0	154	0	12	12	0	1,848		
91	31	540	516	74	24	101	39,960	32,250		
91	32	386	435	41	24	60	15,826	18,270		
91	33	188	215	24	12	12	4,512	2,580		
91	34	40	113	36	0	0	1,440	0		
91	35	13	70	36	0	0	468	0		
91	36	0	40	36	0	0	0	0		
91	37	1	18				0	0		
91	38	0	8				0	0		
91	39	0	1				0	0	91,223	101,600
92	22	0	30				0	0		
92	23	0	103				0	0		
92	24	0	145				0	0		
92	25	0	129				0	0		
92	26	318	119	12	0	0	3,816	0		
92	27	552	388	36	12	24	19,872	6,984		
92	28	574	424	24	24	24	13,776	10,176		
92	29	578	555	98	126	126	56,644	69,930		
92	30	580	534	61	83	83	35,380	44,322		
92	31	576	501	82	144	144	47,232	72,144		
92	32	383	463	128	166	166	49,024	76,858		
92	33	184	338	24	24	24	4,416	8,112		
92	34	64	123	36	0	0	2,304	0		
92	35	7	79	36	0	0	252	0		
92	36	1	30	36	0	0	36	0		
92	37	0	17				0	0		
92	38	0	4				0	0	232,752	288,526
93	23	0	15				0	0		
93	24	0	89				0	0		
93	25	0	119				0	0		
93	26	266	107	12	0	12	3,192	642		
93	27	534	367	24	12	24	12,816	6,606		
93	28	560	437	33	24	33	18,480	12,455		
93	29	580	546	61	63	80	35,380	39,039		
93	30	581	521	118	166	106	68,558	70,856		
93	31	572	488	95	137	51	54,340	45,872		
93	32	385	427	90	137	24	34,650	34,374		
93	33	128	280	24	24	24	3,072	6,720		
93	34	18	83	24	0	0	432	0		
93	35	8	53	24	0	0	192	0		
93	36	4	33	24	0	0	96	0		
93	37	0	20				0	0		
93	38	0	10				0	0	231,208	216,563

(a) Based on number of permits with reported landings, calculated from ADFG fish ticket data.
(b) Set net hours are north and south of Blanchard Line; based on ADFG management reports.
(c) Calculated by multiplying number fishing by open fishing hours.
(d) Based on the assumption that 50% of set net operations are located north of the Blanchard line.
ISER file: Hours & fishers dbase.

Appendix H

Analysis of Permit Holder Survey

Table H-1: Estimation of the Number of Permits Fished in 1994

	Sample		Population	
	Set Net	Drift Net	Set Net	Drift Net
Total permits ('93)	274	227	745	583
not planning to fish pre-season	-4.4%	-0.4%	-33	-2
North & West: first screen	-26.0%		-185	
Permits not fished in '94	2.6%	-0.2%	-13	1
North & West: second screen	-2.9%		-15	
Total permits fished E side			514	580

Table H-2: Estimation of Commerical Survey Weights

Sampling fraction:	Set Net	Drift Net	
completed pre-season	262	225	
plus permit won't be fished	12	2	
not completed post season	-10	-24	(excluding didn't fish) (not adjusted for multiple permits)
completed sample	264	203	(including N, W & didn't fish)
total permits	745	583	
sampling fraction	0.35436	0.3482	
raw weight	2.82197	2.87192	
adjustment factor	0.719	1.005	
adjusted sampling fraction	0.25479	0.34994	
1-adj.smpl fraction	0.74521	0.65006	

Set Net

permits per operation	1	2	3	4	5	6	7	8	11	Total
no. operations surveyed	34	27	21	8	4	7	1	1	1	104
no. permits represented	34	54	63	32	20	42	7	8	11	271
Pr(not selected)^n	0.6456	0.4168	0.2691	0.1738	0.1122	0.0724	0.0468	0.0302	0.0081	
Adjusted Pr(not selected)^n	0.7452	0.5553	0.4138	0.3084	0.2298	0.1713	0.1276	0.0951	0.0394	
weight	3.9249	2.2489	1.7060	1.4459	1.2984	1.2067	1.1463	1.1051	1.0410	
weighted permits	133	121	107	46	26	51	8	9	11	514
								Control Total		514

Drift Net

permits per operation	1	2	3	Total
no. operations surveyed	195	3	3	201
number of permits	195	6	9	210
Pr(not selected)^n	0.6518	0.4248	0.2769	
Adjusted Pr(not selected)^n	0.6501	0.4226	0.2747	
weight	2.8576	1.7318	1.3787	
weighted permits	557	10	12	580
		Control Total		580

Notes: The formula for the weight is 1/(1-P^n) where P is the probability of one permit not being selected.
^n raises it to the nth power, and n is the number of permits in the operation. The probability has been adjusted so that the projected total number of permits matches the control total.
The adjustment accounts for the multiple permits lost due to refusal or no contact during the post-season survey, as well as systematic differences between drift and set in didn't fish and non-response.

ISER file: H1,H2 Weights.

Table H-3. Cook Inlet Permit Holder Survey Analysis:
Estimation of Weights for Expanding from Responses for Operations to Totals for Fishery

	Drift Net Fishery			East-Side Set Net Fishery									Total	
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net
Estimated number of permits fished in 1994 (a)													580	514
1 - adjusted sampling fraction (b)													0.6501	0.7452
Number of survey interviews (c)	195	3	3	34	27	21	8	4	7	1	1	1	201	104
Number of permits in respondents' operations	195	6	9	34	54	63	32	20	42	7	8	11	210	271
Average weight (d)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041		
Estimated number of operations (e)	557	5	4	133	61	36	12	5	8	1	1	1	567	258
Estimated number of permits (f)	557	10	12	133	121	107	46	26	51	8	9	11	580	514
Location of set net respondents' sites:														
North of Blanchard line				18	10	9	3	2	3					
South of Blanchard line				11	17	10	5	2	4	1	1	1		
Not known				5	0	2	0	0	0	0	0	0		
Estimated operations north of Blanchard line (%)				62%	37%	47%	38%	50%	43%	0%	0%	0%		51%
Estimated permits north of Blanchard line (%)				62%	37%	47%	38%	50%	43%	0%	0%	0%		45%
Estimated operations north of Blanchard line				83	22	17	4	3	4	0	0	0		133
Estimated permits north of Blanchard line				83	45	51	17	13	22	0	0	0		231

(a) For details of estimation of number of permits fished, see Table H-1.
(b) For calculation of adjusted sampling fraction, see Table H-2.
(b) Includes only interviews with permit holders who fished.
(d) Weight used to extrapolate respondents operations to total population. Formula is (1/1-P^n) where P is the probability of one permit not being selected = (1 - adjusted sampling fraction). For details on calculation of weights, see Table H-2.
(e) Calculated by multiplying the number of respondents by the average weight.
(f) Calculated by multiplying the estimated number of operations by the number of permits per operation
ISER file. Survey-Weights.

Table H-4. Cook Inlet Permit Holder Survey Analysis: Average Harvest and Gross Revenue per Operation and Estimated Total Harvest and Gross Revenue

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Average 1994 harvest (lbs) (c)	23471	29833	22600	26137	38430	48405	67923	97356	66197	18000	189960	189960			
Average 1994 revenues (d)	$34525	$33666	$32000	$32396	$52218	$64376	$109571	$131000	$133252	$26000	$312456	$250000			
Estimated total harvest (000 lbs) (e)	13081	155	93	3488	2333	1734	786	506	559	21	210	198	13329	9834	23163
Estimated total revenues ($000) (e)	$19241	$175	$132	$4323	$3171	$2306	$1267	$680	$1126	$30	$345	$260	19548	13508	33057
Estimated average price/lb													$1.47	$1.37	$1.43

(a) See estimates in Table H-1.

(b) See Table H-2 for calculation of weights.

(c) Based on responses to permit holder survey question A-20. Average harvest was missing for 11-permit operations. Average harvest was assumed to be equal to the average harvest for 8-permit operations.

(d) Based on responses to permit holder survey question A-18.

(e) Calculated by multiplying number of interviews times weight times average for individual operations. Note that the total harvest estimate exceeds total harvest reported for Cook Inlet by ADF&G; thus permit holders reported harvests are biased upwards. However, average price/lb is consistent with ADFG estimates of average price.

ISER file. Survey-Harvest Estimates.

Table H-5. Cook Inlet Permit Holder Survey Analysis:
Average Cost per Operation and Estimated Total Costs

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Average costs per operation															
Variable costs (c)															
Food	1217	1367	1323	1636	2617	2624	3600	2588	4583	1000	7000	22000			
Fuel	1707	1933	2000	1130	1847	1333	2203	1560	2458	2200	4600	7000			
Boat or camp supplies	1031	1067	800	885	2070	1323	1218	5323	3233	400	19000	10000			
Equipment repair	2830	10917	650	1061	2541	3207	2901	3417	3750	2600	3500	2500			
Other supplies	711	1100	33	614	286	909	625	63	1666	500	0	0			
Fixed Costs (d)															
Mooring and storage	838	1100	533	239	406	395	300	0	0	0	0	1000			
Insurance	3436	2533	1400	1708	1916	2975	2631	1450	2987	2600	0	4000			
Services like accountants or lawyers	789	767	300	1272	669	2482	2163	1625	1217	500	250	700			
Licenses, fees & association dues	715	867	440	778	1452	1737	2191	2464	2467	400	3000	3500			
Property taxes	864	1433	1267	1150	1028	1160	1038	2175	2554	1800	0	400			
Interest expenses	2389	3000	0	1481	1358	1085	3463	3200	6133	0	35000	0			
Cook Inlet permit principal paid	6811	0	0	2203	1426	291	1500	0	3400	0	0	0			
Other permit purchase (principal paid)	925	83	0	724	0	3038	500	0	0	0	0	0			
Other	180	200	0	143	452	60	138	0	667	0	0	0			
Expected Costs on July 30, 1994 (e)	232	150	130	139	268	536	329	346	847	100	100	200			
Estimated total costs (f)															
Variable costs															
Food	678234	7101	5471	218349	158900	94016	41642	13438	38713	1146	7736	22901	690,806	596,840	1,287,646
Fuel	951389	10646	8273	150771	112126	47742	25485	8102	20764	2522	5083	7287	969,708	379,882	1,349,590
Boat or camp supplies	574779	5542	3309	118088	125715	47409	14084	27642	27310	459	20997	10410	583,631	392,114	975,745
Equipment repair	1577337	56723	2689	141555	154287	114910	33550	17746	31674	2980	3868	2602	1,636,749	503,174	2,139,923
Other supplies	396462	5716	138	81903	17391	32575	7229	325	14072	573	0	0	402,315	154,668	556,383
Fixed Costs															
Mooring and storage	467239	5716	2256	31853	24625	14160	347			·	·	[illegible]	[illegible]	75,348	[illegible]
Insurance	1915119	13163	5791	227954	116357	106581	30436	7531	25227	2980	0	4164	1,934,073	521,230	2,455,303
Services like accountants or lawyers	439622	3984	1241	169763	40591	88933	25014	8439	10277	573	276	729	444,846	344,595	789,442
Licenses, fees & association dues	398738	4503	1820	103859	88174	62231	25344	12798	20835	459	3315	3643	405,061	320,658	725,719
Property taxes	481416	7448	5240	153445	62428	41570	12001	11296	21568	2063	0	416	494,103	304,788	798,891
Interest expenses	1331259	15588	0	197655	82437	38871	40051	16619	51805	0	38678	0	1,346,847	466,116	1,812,963
Cook Inlet permit principal paid	3795633	0	0	293968	86580	10425	17351	0	28718	0	0	0	3,795,633	437,042	4,232,674
Other permit purchase (principal paid)	515534	433	0	96641	0	108842	5784	0	0	0	0	0	515,967	211,267	727,233
Other	100540	1039	0	19035	27429	2132	1590	0	5631	0	0	0	101,579	55,817	157,397
Expected Costs on July 30, 1994	129339	779	538	18610	16291	19195	3803	1798	7155	115	111	208	130,656	67,286	197,942

(a) See estimates in Table H-1
(b) See Table H-2 for calculation of weights.
(c) Based on responses to survey question A-13.
(d) Based on responses to survey question A-9.
(e) Based on responese to survey question B2A.
(f) Calculated by multiplying average costs per operation by average weight.
ISER file: Survey-Costs.

Table H-6. Cook Inlet Permit Holder Survey Analysis:
Average Expected Harvest per Operation and Estimated Expected Total Harvest, 7/30/94

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Average expected harvest, 7/30/94 (lbs)	5250	6000	3917	11641	11140	19395	26281	28150	22357	2000	30000	91000			
Estimated expected total harvest, 7/30/94 (d)	2925580	31176	16201	1553312	676408	694824	303998	146197	188839	2293	33153	94728	2,972,957	3,693,752	6,666,709

(a) See estimates in Table H-1.

(b) See Table H-2 for calculation of weights.

(d) Calculated by multiplying number of interviews times weight times average expected harvest, 7/30/94.

ISER file: Survey-7/30/94 Harvest

Table H-7. Cook Inlet Permit Holder Survey Analysis: Average Value of Equipment and Property per Operation and Estimated Total Value of Equipment and Property

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Average value of equipment and property (c)	134,464	74,333	214,000	168,314	165,434	344,885	440,000	402,250	350,885	45,500	1,000,000	100,000			
Total value of equipment and property ($000) (d)	$74,937	$386	$885	$22,459	$10,045	$12,356	$5,090	$2,089	$2,964	$52	$1,105	$104	$76,208	$56,264	$132,472

(a) See estimates in Table H-1.

(b) See Table H-2 for calculation of weights.

(c) Based on responses to survey question A-5.

(d) Calculated by multiplying average value of equipment and property per operation by average weight, and dividing by 1000.

ISER file: Survey-Equipment Value.

Table H-8. Cook Inlet Permit Holder Survey Analysis: Number of Fishermen

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2 858	1 732	1 379	3 925	2.249	1.706	1 446	1 298	1 207	1 146	1 105	1 041			
Estimated total operations (c)	557	5	4	133	61	36	12	5	8	1	1	1	567	258	825
Number of interviews with crew size of: (d)															
0	14			3		1									
1	95			2											
2	60	1	1	10	5	2									
3	18	1		7	5	2									
4	6		1	5	5	1		1							
5	1	1	1	3	1	2									
6				3	3	3	1								
7					2	5	1			1					
8				1	2	3	3		1						
9									4						
10								1	1						
11					1										
12						1	1	1							
13								1							
14					1										
16							2		1		1	1			
(no data available)	1	0	0	0	2	1	0	0	0	0	0	0			
Number of fishermen represented by survey interviews															
Heads of operations (e)	195	3	3	34	27	21	8	4	7	1	1	1			
Other workers paid as owners (f)	18	0	2	7	16	23	18	6	10	6	0	0			
Crew (g)	280	10	9	97	112	90	63	33	60	1	16	16			
TOTAL	493	13	14	138	155	134	89	43	77	8	17	17			
Average number of fishermen per operation															
Heads of operations	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
Other workers paid as owners	0.1	0.0	0.7	0.2	0.6	1.1	2.3	1.5	1.4	6.0	0.0	0.0			
Crew	1.4	3.3	3.0	2.9	4.1	4.3	7.9	8.3	8.6	1.0	16.0	16.0			
TOTAL	2.5	4.3	4.7	4.1	5.7	6.4	11.1	10.8	11.0	8.0	17.0	17.0			
Estimated total fishermen (h)															
Heads of operations	557	5	4	133	61	36	12	5	8	1	1	1	567	258	825
Other workers paid as owners	51	0	3	27	36	39	26	8	12	7	0	0	54	155	[illegible]
Crew	801	17	12	381	252	154	91	43	72	1	18	17	830	1028	1858
TOTAL	1409	23	19	542	349	229	129	56	93	9	19	18	1451	1442	2893

(a) See estimates in Table H-1.
(b) See Table H-2 for calculation of weights
(c) Calculated by multiplying number of interviews times weight.
(d) Based on responses to permit holder survey question A10. Responses include all persons in operation other than the head of the operation
(e) Equals number of permit holder survey respondents.
(f) Equals number of persons paid "as an owner of the operation," based on responses to permit holder survey question CD1, shown in Table H-9.
(g) Equals number of persons other than head of the operation (from permit holder survey question A10) minus the number of persons paid "as an owner of the operation."
(h) Calculated by multiplying estimated total operations by average number per operation.
ISER file: Survey-Crew Share.

Table H-9. Cook Inlet Permit Holder Survey Analysis: Crew Payment

	Drift Net Fishery			East-Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Method of payment (number of responses) (c)															
Owner	18		2	7	16	23	18	6	10	6			6.1%	13.1%	10.1%
Share	223	6		71	77	58	46	24	50	1	12	16	73.3%	62.5%	67.1%
By Pick		2		2	2	2		2	1				0.4%	1.7%	1.1%
Hourly	1			1		1	1						0.3%	0.6%	0.5%
Per day	7		1	8	7	13	1		4				2.4%	6.4%	4.7%
Per season	7			5	4	7	3		2				2.3%	4.0%	3.3%
Family member	20		1	3	12			2					6.6%	3.5%	4.8%
Other	13		7	0	10	7	6	3	0				5.3%	4.0%	4.5%
Don't know, didn't work, no answer or missing	9	2	0	7	0	2	6	2	3	0	4	0	3.3%	4.2%	3.8%
Total (d)	298	10	11	104	128	113	81	39	70	7	16	16	100%	100%	100%
Deductions before calculating crew share (number of responses) (e)															
No deductions	85	1	3	17	16	14	5	1	3		1				
Food	31			7	4	2		1	1	1					
Fuel	51	1		6	3	2			2	1	1				
Crew supplies	12			2	1	1		2	1						
Crew transportation	2			1		1		1							
Other (f)	48	2		9	8	6	3	2	3						
Did not pay by crew share															
No answer	3	1										1			
Total number of responses	195	1	3	34	27	21	8	4	7	1	1	1			
Percent with no deductions (h)	44%	100%	100%	50%	59%	67%	63%	25%	43%	0%	100%	0%	44.5%	53.6%	49.3%
Percent with one or more deductions (h)	56%	0%	0%	50%	41%	33%	38%	75%	57%	100%	0%	100%	55.5%	46.4%	50.7%

(a) See estimates in Table H-1. (b) See Table H-2 for calculation of weights. (c) Based on responses to survey question CD1 (crew data sheet). Percentages in totals column are weighted by estimated total crew in operations of each size (d) Total is total number of crew for whom data are available. One crew member was interviewed for each operation; the same information was assumed for other crew members for that operation. (e) Based on responses to permit holder survey question A11. Some operations deduct more than one type of expense before calculating crew share; thus total may exceed number of responses. (f) "Other" is mostly aquaculture tax. (g) Based on responses to permit holder survey question CD2a (crew data sheet). (h) Percentage is only for crew paid by crew share.
ISER file: Survey-Crew Share.

Table H-10. Cook Inlet Permit Holder Survey Analysis: Crew Earnings

	Drift Net Fishery			East Side Set Net Fishery									Total		
Number of permits in operation	1	2	3	1	2	3	4	5	6	7	8	11	Drift net	Set net	Total
Estimated number of permits fished in 1994 (a)													580	514	1094
Number of survey interviews	195	3	3	34	27	21	8	4	7	1	1	1	201	104	305
Average weight (b)	2.858	1.732	1.379	3.925	2.249	1.706	1.446	1.298	1.207	1.146	1.105	1.041			
Average crew size (o)	1.4	3.3	3.0	2.9	4.1	4.3	7.9	8.3	8.6	1.0	16.0	16.0			
Estimated average crew share based on reported crew shares															
Average crew share/person (g)	13.5%	20.8%	10.0%	10.9%	9.9%	11.6%	9.9%	10.7%	8.3%	8.3%	1.0%	2.5%			
Estimated total crew share (h)	19.4%	69.4%	30.0%	31.0%	41.2%	49.9%	77.7%	88.2%	71.0%	8.3%	16.0%	39.7%			
Estimated total revenues (i)	$19241	$175	$132	$4323	$3171	$2306	$1267	$680	$1126	$30	$345	$260	$19548	$13508	$33057
Estimated total crew earnings (j)	$3738	$121	$40	$1338	$1306	$1151	$985	$600	$799	$2	$55	$103	$3899	$6340	$10239
Estimated average total crew share (k)													19.9%	46.9%	31.0%
Estimated average crew share based on reported crew earnings															
Average earnings/crew member (l)	$3277	$3912	$1505	$3102	$2503	$3966	$5091	$6455	$7979	$2600	$3258	$8510			
Average total crew earnings/operation (m)	$4705	$13040	$4515	$8850	$10383	$16997	$40092	$53254	$68391	$2600	$52128	$136160			
Estimated total crew earnings (n)	$2622	$68	$19	$1181	$630	$609	$464	$277	$578	$3	$58	$142	$2709	$3941	$6649
Estimated total revenues (i)	$19241	$175	$132	$4323	$3171	$2306	$1267	$680	$1126	$30	$345	$260	$19548	$13508	$33057
Total crew earnings as % of total revenues	13.6%	38.7%	14.1%	27.3%	19.9%	26.4%	36.6%	40.7%	51.3%	10.0%	16.7%	54.5%	13.9%	29.2%	20.1%

(a) See estimates in Table H-1. (b) See Table H-2 for calculation of weights. (c) Based on responses to survey question CD1 (crew data sheet). (d) Total is total number of crew for whom data are (g) Based on responses to permit holder survey question CD2a (crew data sheet). (h) Average crew share/person times number of crew. For multi-permit operations with large crew sizes, the person interviewed is less likely to be typical of the crew as a whole; this is the likely reason for the very high shares calculated for drift net operations with 5 or 6 permits. Note also that this share does not account for deductions before crew share is paid. (i) Based on responses to permit holder survey question A-18; see Appendix H, Table H-4. (j) Estimated total crew share times estimated total revenues. (k) Estimated by dividing estimated total crew earnings by estimated total revenues. Note that this share does not account for deductions; thus actual average share is lower, as indicated by estimates on last line of table. (l) Based on responses to permit holder survey question CD3 (crew data sheet). Excludes responses of persons paid as permit owners. (m) Calculated by multiplying average crew size times average earnings/crew member. (n) Number of permits times average weight times average total crew earnings/operation/1000. (o) Excludes persons paid as permit owners. See estimates in Table H-8. ISER file: Survey-Crew Share.

Appendix I

The Alaska Input-Output Model
and
The Cook Inlet Salmon Economic Impact Model

Appendix I. The Alaska Input-Output Model and The Cook Inlet Salmon Economic Impact Model

Chapters VIII and IX of this study present estimates of changes in economic impacts of the sport and commercial fisheries resulting from changes in management. To estimate economic impacts for these chapters, we used a simple model which we refer to as the "Cook Inlet Salmon Economic Impact Model," which relates changes in sport and commercial fishing expenditures to direct and total economic impacts on the Alaska economy.

The Cook Inlet Salmon Economic Impact Model was derived from an input-output model of the Alaska Economy known as the "Alaska Input-Output Model" or the "Alaska IO Model." The Alaska IO Model was originally developed by ISER for a study, funded by the ADF&G Division of Sport Fish, of the statewide economic value and economic impacts of sport fishing. ISER has subsequently used the model to examine economic impacts of several other industries.

This appendix provides an overview of the Alaska IO Model and how it was used to develop the Cook Inlet Salmon Economic Impact Model.

Model Outputs

The Alaska IO Model measures three kinds of economic impacts for each of 36 sectors of the Alaska economy: employment, payroll, and output. *Output* is the gross receipts of businesses in the sector, except for the retail and wholesale trade sectors. For the retail and wholesale trade sectors, output is the gross margin—gross receipts minus the cost of goods sold. *Payroll* is the total labor income of households earned in the sector, not including benefits.

Employment is defined as the number of annual average jobs in the sector. This reflects the seasonality of some jobs as well as the variations in the number of hours worked in a week across different jobs. For example, the average annual hours worked in a typical retail trade job will usually be less than a typical utility job. Formally, this definition of employment differs slightly from the definition of full-time-equivalent (FTE) employment.

Direct, Indirect and Induced Impacts

The Alaska IO Model calculates direct, indirect and induced impacts (output, payroll, and employment) for each of 36 sectors of the Alaska economy.

Direct impacts are output, payroll and expenditures which result directly from the initial expenditures. Direct impacts on output include only that portion of the initial expenditures which are made in Alaska, so they net out purchases made in other states or by mail order catalog. For retail or wholesale expenditures made in Alaska for products manufactured outside Alaska, direct impacts on output include only retail and wholesale trade margins, as well as that portion of the transport margin which is produced within Alaska. Direct impacts on payroll include only payroll within Alaska generated directly by the initial expenditures. Similarly, direct impacts on employment include only employment in Alaska generated directly by the initial expenditures (for example, employment on commercial fishing vessels, in processing plants, in stores which sell gear to commercial fishermen, or in stores selling bait to sport fishermen).

Indirect impacts are the output, employment, and payroll generated throughout the economy in the process of providing goods and services to businesses that sell goods or services to sport fishermen, commercial fishermen or the processing industry. Examples include the local accountant that provides tax preparation services to a sporting goods store or to a commercial fish trucking firm.

Induced impacts are the output, employment, and payroll generated within Alaska by the spending of household income produced by fishing related expenditures. For example, induced impacts would include the additional economic activity generated within Alaska when the employees in the bait shop or commercial fishermen or processing workers spend their wages.

The Alaska IO Model calculates indirect and induced impacts simultaneously. Total impacts are the sum of the indirect, induced and direct impacts. The ratio of total impacts to direct impacts is referred to as the "economic multiplier."

The economic multiplier is different for every activity but Alaska multipliers tend to be small relative to other states because of the lack of a manufacturing sector in Alaska. Virtually all foods must be imported into the state and this represents a "leakage" of purchasing power out of the economy. When this purchasing power leaks out of the economy it is no longer available to recirculate in Alaska to generate jobs and income.

The total economic impact measured by the Alaska IO Model excludes any economic effects that might result from changes in state and local government spending.

Alaska Input-Output Model Construction

The Alaska IO Model was custom designed to take account of unique characteristics of the Alaska economy. The starting point for the creation of an Alaska direct requirements table was the most recent version (June 8, 1993) of the RIMS II model for Alaska published by the U.S. Department of Commerce, Bureau of Economic Analysis. This model is a 39-industry input-output model for the state of Alaska which is constructed from the national input-output matrix using region specific location quotients. (For further information about the RIMS II model, see *Regional Input-Output Modeling System (RIMS II): Estimation, Evaluation, and Application of a Disaggregated Regional Impact Model and Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)* both from the Bureau of Economic Analysis.)

Several adjustments to the BEA table were made to make the model conform more closely to the industrial composition of the Alaska economy. The first was to aggregate several industrial sectors in the BEA model that are very small in the Alaska economy into more aggregate categories. This includes several manufacturing industries that have very little Alaska employment such as apparel, printing and publishing, rubber and leather products, etc. This aggregation was done using Alaska data on employment and wages in those industries.

The second adjustment was to disaggregate several industrial sectors in the BEA model that are particularly important in the Alaska economy. For example the aggregated BEA category of agriculture-forestry-fisheries was disaggregated into three separate industries. This was done using the detailed national input-output tables of the U.S. Department of Commerce Bureau of Economic Analysis, which include a much finer level of detail than the BEA RIMS II model. Alaska employment and wage data were used to weight the national data in this disaggregation procedure.

The aggregation and disaggregation of sectors of the BEA model resulted in a 36-sector model (with options for adding four additional industries). The model sectors are listed in Table I-1.

Table I-1
Alaska Input-Output Model Sectors

1	Agriculture & AFF Services
2	Forestry
3	Fishing
4	Crude Petroleum & Natural Gas
5	Other Mining
6	New Constructions
7	Maintenance & Repair
8	Food & Kindred Products
9	Paper & Allied Products
10	Chemicals and Petroleum Processing
11	Lumber and Wood Products
12	Other Manufacturing
13	Railroads
14	Local & Interurban Transit
15	Motor Freight & Warehousing
16	Water Transportation
17	Air Transportation
18	Pipelines
19	Transportation Services
20	Communication
21	Electric, Gas, Water & Sanitary
22	Wholesale Trade
23	Retail Trade
24	Finance
25	Insurance
26	Real Estate
27	Hotels, Lodging, Amusements
28	Personal Services
29	Business Service
30	Eating & Drinking
31	Health Services
32	Miscellaneous Services
33	Federal Government Ent
34	State & Local Government Ent
35	Households
36	State & Local Government
37	X2 (optional additional industry)
38	X3 (optional additional industry)
39	X4 (optional additional industry)
40	X5 (optional additional industry)

ISER file: I-O Model Sectors.

The third adjustment was to incorporate Alaska-specific data into the direct requirements table using survey information and secondary sources. These data were used both to adjust the composition of purchases for industries in Alaska that have different structures from their national counterparts and to create entirely new industries that have no counterparts in the national tables.

The fourth adjustment was to adjust the model for the Alaska-specific relationships between output and value added and output and payroll for those industries that do not conform to the national pattern. For example, profit and indirect business taxes, two components of value added, are a much larger share of output of the petroleum industry in Alaska than they are for the national economy. Alaska specific information comes from the ISER gross state product accounts to make the adjustment.

The fifth adjustment was the incorporation of 1994 Alaska-specific wage rates by industry into the calculations which determine employment and payroll.

Details of the adjustments described in this section are on file at the Institute of Social and Economic Research.

Calculation of Economic Impacts

Using the Alaska IO Model to calculate economic impacts associated with the sport or commercial fisheries normally involves three steps:

1. Estimate a *change-in-expenditure-by-commodity vector.*

2. Convert the *change-in-expenditure-by-commodity vectors into a change-in-final-demand vector* using a *commodity-by-industry matrix.*

3. Estimate changes in economic impacts using the change-in-final-demand vector as an input to the Alaska IO model.

As we discuss in the final part of this appendix, the linearity of the Alaska IO Model allowed us to condense steps 2 and 3 for the purposes of this study, by calculating coefficients that directly relate changes in expenditures for any commodity to the Alaska IO Model outputs. We refer to these coefficients as the "Cook Inlet Salmon Economic Impact Model."

Change-in-Expenditure-by-Commodity Vectors

A goal of this study was to examine changes in economic impacts of the sport and commercial fisheries resulting from changes in management. The starting point in this analysis was to estimate *change-in-expenditure-by-commodity vectors* for different types of "commodities" (types of goods and services) in the sport and commercial fisheries. Chapters VIII and IX describe the methods used to estimate these changes in expenditures.

For the sport fishery, the expenditures most likely to change as a result of changes in fishery management are trip-related expenditures by sport fishermen. Types of expenditures or "commodities" include both goods and services, including guide services.

For the commercial fishery, expenditure changes would include all changes in all purchased inputs as well as changes in crew payments and income to permit holders (which are technically also "expenditures" of the commercial fishery). Expenditure changes also include any changes in purchased inputs for processors—excluding the cost of fish, which are already included as changes in harvester expenditures and crew and permit holder payments.

Commodity-by-Industry Matrix

Each of the change-in-expenditure-by-commodity vectors describes the total change in expenditures by sport anglers or commercial sector businesses. Before this information can be used by the Alaska IO model, it is necessary to convert changes in expenditures by *commodity* to changes in expenditures for each of the 36 *sectors* or industries of the Alaska IO Model, and to make other adjustments for various leakages out of the economy. This is done using a *commodity by industry matrix.*

The main purpose of the commodity-by-industry matrix is to convert expenditures by commodity (or service) to the expenditure categories of Alaska IO Model, which is based on major sectors or industries. For example, one change-in-expenditure commodity category (for the sport fishing industry) is fishing tackle. Since there is no fishing tackle industry in the input-output model it is necessary to assign fishing tackle to an appropriate industry. We based these industry assignments to the extent possible upon tables developed by the U.S. Department of Commerce, Bureau of Economic Analysis for this purpose.

A second purpose of the commodity-by-industry matrix is to split manufactured commodity expenditures among the appropriate manufacturing sector, and the trade and transportation sectors that add value to the commodity between the manufacturer and consumer. For example, when a sport angler purchases a fishing rod in Anchorage the retailer keeps a portion of the purchase price to cover his costs and profit. He pays the rest to his wholesale supplier. The wholesaler purchases the rod from the factory (usually outside Alaska), and also pays the shipper to transport the rod from the factory to Alaska. The difference between the purchase price and the price at the factory consists of three margins—transportation, wholesale, and retail. These margins all represent industry activity associated with the purchase of the rod.

The allocation of commodity expenditures among manufacturing and to the various margins was done using data on margins from the U.S. Department of Commerce, Bureau of Economic Analysis. The assumptions about the share of the wholesale margin spent in Alaska, the share of manufacturing within Alaska, and the share of the transportation margin spent in Alaska, are estimates made by the authors of this study.

Details of the commodity-by-industry assignments, including documentation of the sources used for these assignments, are on file at the Institute of Social and Economic Research.

Passing the change-in-expenditure-by-commodity vectors through the commodity-by-industry matrix produces a change-in-final-demand vector. This vector represents the changes in expenditures by industry and is the vector of inputs into the Alaska Input-Output model.

The total expenditures measured by the final demand vector are less than the vector of expenditures by commodity for two reasons. First, some expenditures are made out of state, for example, when a sport angler purchases a reel through a catalog or when a commercial harvester purchases a net in Seattle. Second, a large share of commodity purchases directly leak out of the state because of the absence of a manufacturing sector within the state.

Regional Economic Impacts Within Alaska

The Alaska IO Model is configured into four regions of Alaska: Southcentral, Southeast, Southwest, and Arctic-Yukon-Kuskokwim. The economic impacts of the Cook Inlet commercial fishery and the Kenai River sport fishery are overwhelmingly concentrated in the Southcentral region, which includes the Kenai Peninsula Borough, Anchorage, the Mat-Su Borough, Prince William Sound, and the Copper River Basin. For this reason, we do not report model results for by region.

Cook Inlet Salmon Economic Impact Model

The Alaska IO Model is linear in the economic impacts resulting from a given change in expenditures for a given commodity. For example, the economic impacts projected by the model of a $1000 change in expenditures by sport fishermen for guide services are always the same, regardless of the total level of expenditures for guide services or other commodities. Similarly, the economic impacts projected by the model of a $1000 change in resident crew income for commercial fishermen are always the same, regardless of the total level of crew payments or other commercial fishing expenditures.

The linearity of the model makes it possible to greatly simplify its application to examining the economic impacts of a change in the management of Kenai River salmon, for two reasons. First, we do not need to calculate the "total" economic impacts of the sport or commercial fishery. Instead, we can use the model to directly examine how changes in expenditures result in *changes* in output, payroll and employment.

Secondly, the linearity of the Alaska IO Model allows us to calculate coefficients that directly relate changes in expenditures for any commodity to the Alaska IO Model outputs. For this study, we used the commodity-by-industry matrix and the Alaska IO Model to calculate, separately for each commodity, the economic impacts of a $1000 change in expenditures of that commodity. We refer to these coefficients, shown in Tables I-2 and I-3, as the "Cook Inlet Salmon Economic Impact Model."

Given the change-in-expenditure-by-commodity vector for any given scenario, we were able to use the Cook Inlet Salmon Economic Impact Model to directly calculate changes in economic impacts for that scenario. This method produces the identical results as using the Alaska IO Model to calculate economic impacts, but simplifies the calculations involved.

The Cook Inlet Salmon Economic Impact Model is entirely derived from the Alaska IO Model and produces identical results. Its utility derives from the fact that it simplifies the use of the Alaska IO Model for analysis of the effects of changes in expenditures in the sport and commercial fisheries. In addition, it permits easy comparison of how expenditures for different "commodities" have different impacts upon the Alaska economy—the result of differing direct "leakages" from the Alaska economy as well as differing indirect and induced impacts.

Table I-2. Cook Inlet Salmon Economic Impact Model: Sport Fishing Economic Impacts per $1,000 of Expenditures

	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
Type of Expenditure	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Food	$547	$333	$880	$191	$89	$280	0.0104	0.0035	0.0139
Lodging	$1,000	$656	$1,656	$304	$174	$478	0.0195	0.0066	0.0261
All other trip-related expenditures	$588	$394	$982	$251	$104	$355	0.0131	0.0041	0.0172
Commercial transport	$1,000	$692	$1,692	$257	$167	$424	0.0073	0.0064	0.0136
Fuel	$606	$505	$1,112	$136	$96	$232	0.0062	0.0032	0.0094
Air charter	$1,000	$521	$1,521	$257	$128	$385	0.0166	0.0051	0.0217
Boat charter	$1,000	$521	$1,521	$257	$128	$385	0.0166	0.0051	0.0217
Guide services	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Personal transportation, repair	$1,000	$702	$1,705	$519	$209	$728	0.0224	0.0085	0.0309
Personal transportation, parts	$506	$374	$879	$210	$99	$309	0.0107	0.0038	0.0145
Boats, new investment	$225	$130	$355	$84	$35	$118	0.0040	0.0014	0.0054
Boat maintenance	$718	$503	$1,220	$371	$150	$521	0.0160	0.0061	0.0221
Plane maintenance	$347	$243	$590	$180	$72	$252	0.0077	0.0030	0.0107
Vehicles, new investment	$25	$19	$44	$11	$5	$16	0.0006	0.0002	0.0008
Vehicle maintenance	$214	$150	$363	$111	$45	$155	0.0048	0.0018	0.0066

ISER file: Sport Analysis.

Table I-3. Cook Inlet Salmon Economic Impact Model: Commercial Fishing Economic Impacts per $1,000 of Expenditures

Type of Expenditure	Alaska Output/Sales			Alaska Payroll			Alaska Employment		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
HARVESTER EXPENDITURES									
Fuel	$606	$504	$1,110	$135	$96	$231	0.0061	0.0032	0.0094
Food	$352	$245	$597	$147	$65	$211	0.0076	0.0025	0.0102
Boat or camp supplies	$269	$129	$399	$83	$35	$118	0.0032	0.0013	0.0046
Equipment repair	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Other supplies	$531	$357	$889	$203	$95	$298	0.0093	0.0037	0.0129
Payments to resident crew	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident crew	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
Payments to resident permit holders	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident permit holders	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
PROCESSOR EXPENDITURES									
Utilities	$1,000	$798	$1,798	$80	$144	$224	0.0015	0.0040	0.0055
Supplies	$269	$129	$399	$83	$35	$118	0.0032	0.0013	0.0046
Services	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Tendering	$1,000	$692	$1,692	$257	$167	$424	0.0073	0.0064	0.0136
Instate shipping	$1,000	$685	$1,685	$257	$171	$428	0.0077	0.0064	0.0141
Maintenance	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Depreciation	$1,000	$467	$1,467	$254	$135	$389	0.0055	0.0053	0.0108
Administration	$1,000	$700	$1,700	$517	$209	$726	0.0223	0.0085	0.0308
Overhead	$1,000	$606	$1,606	$428	$166	$594	0.0093	0.0066	0.0159
Payments to resident workers	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident workers	$200	$119	$319	$60	$32	$92	0.0036	0.0012	0.0049
Payments to resident owners	$0	$809	$809	$0	$218	$218	0.0000	0.0091	0.0091
Payments to non-resident owners	$0	$0	$0	$0	$0	$0	0.0000	0.0000	0.0000

Source: Calculated using the Alaska Input-Output Model and the Cook Inlet Commercial Fishery Commodity by Industry Matrix.
Documentation on file at ISER. ISER file: Commercial Analysis.

Appendix J

Analysis of Processor Interviews

Appendix J. Analysis of Processor Interviews

This appendix presents the results of interviews with personnel at nine processing plants on the Kenai Peninsula. We begin with the interview questions and then discuss what we learned.

A UAA student intern at the Institute of Social and Economic Research with an extensive background in commercial fishing conducted interviews with processors for this study. The student contacted Kenai Peninsula processing companies first by letter and then interviewed company representatives by telephone in November and December of 1994. In each case, she asked to speak to the person most familiar with the finances and operations of the company. Most of the interviews were with the company presidents or accountants at the following companies:

Inlet Salmon, Dba: Fisherman's Packing (Kenai)
Pacific Star Seafoods, Inc. (Kenai)
Royal Pacific Fisheries (Kenai)
Salamatof Seafoods, Inc. (Kenai)
Dragnet Fisheries Co., Inc. (Kenai)
Wards Cove Packing Co. (Kenai)
Trans-Aqua International, Inc. (Kasilof)
Cook Inlet Processing (Nikiski)
Icicle Seafoods, Inc., Seward Fisheries (Homer)
Icicle Seafoods, Inc., Seward Fisheries (Seward)

Interview Questions

I am working on a study that the University is doing for the Alaska Department of Fish and Game of the economic value of Cook Inlet Salmon. The study is looking at economic values associated with both commercial and sport fishing. I'm working on the part of the study that is trying to understand the economic impacts associated with salmon processing.

One of the specific questions that the Department of Fish and Game has asked us to analyze is what the economic impact would be of reallocating 100,000 or 200,000 sockeye from the commercial to the sport harvest. Mainly we want to understand about two kinds of economic impacts of salmon processing:

1. Labor hired from the Kenai Peninsula and elsewhere in Alaska
2. Other expenditures made on the Kenai and elsewhere in Alaska.

All information will be kept in confidence and only used to develop estimates of economic impact per 100,000 fish.

1. About how much of each species of salmon did you process this past year?

   [If reluctant, then ask for a range.]

2. What percent does salmon represent of your total revenues?

   [If salmon is less than 90%, ask what are the other major species processed and about what percent they represent of total revenues.]

3. How do you ship your salmon to market?

   [Get details if possible.Where are barges loaded? If by truck, what size trucks? Ask what company does the shipping? Is the company Alaskan owned?]

4. This past year, how many employees were hired to process salmon at the peak of the season?

5. What percent are from the Kenai Peninsula? What percent are from other parts of Alaska?

6. How many administrative employees do you usually have on the Kenai Peninsula in the summer vs.the winter?

7. How many are from the Kenai Peninsula and how many are from other parts of Alaska?

8. Now I'd like to ask about how your employment might be affected if the allocation of Cook Inlet Salmon to commercial fishermen were reduced by having shorter or fewer openings at the peak of the run. If total Cook Inlet harvest was reduced by 100,000 lbs or 3.3% on an average year how would that affect the number of workers hired?

   [Probe: would you hire fewer workers if you knew that the sport allocation was higher? Or would you have the same number of workers but just give them less time working? Or would the effect not be big enough to notice?]

9. Would it effect the wages earned by workers? By how much?

10. Would 100,000 fewer fish harvested affect the number of administrative employees or their wages? By how many? By how much?

11. What kinds of other expenditures do you make on the Kenai Peninsula for your processing business? (i.e. utilities, food purchases, fuel for tenders, supplies)

12. Can you estimate how much you spend on the Kenai Peninsula that is specifically associated with processing salmon?

13. If the commercial fishermen were allocated 100,000 fewer fish, how would this affect your salmon processing expenditures on the Kenai?

14. Now I'd like to ask the same questions about salmon processing expenditures that you make in other parts of Alaska beyond the Kenai, for example in Anchorage. Can you estimate how much you spend in other parts of Alaska that is specifically associated with processing salmon?

15. If the commercial fishermen were allocated 100,000 fewer fish, how would this affect your salmon processing expenditures in other parts of Alaska?

16. Finally, can you tell me something about the ownership of this plant: Specifically, are the owners Alaskans or do they live somewhere else?

17. Can you give me any other thoughts about the specific economic impacts of the salmon processing industry on the Kenai, and how it might be affected if the allocation to sport fishermen were increased by 100,000?

Interview Results

The nine companies interviewed reported processing 34 million pounds of salmon in 1994, including 19 million pounds of red salmon , compared with an estimated Cook Inlet harvest of 21 million pounds. Thus it appears likely that these nine companies processed most of the Cook Inlet red salmon harvest in 1994.

Three of the nine companies processed between 1 and 2 million pounds of salmon in 1994, four of the companies processed between 2 and 5 million pounds, and two of the companies processed more than 5 million pounds. Red salmon accounted for between 57% and 82% of the total volume of salmon processed by these companies in 1994.

Salmon represented more than 90% of total revenues for five of the companies, 75% of total revenues for two companies, and 60% and 50% of total revenues for the remaining two companies. Some of the companies process fish flown in from other parts of Alaska Other species processed include halibut, herring, black cod and crab. Three companies stated that between 70 and 75 percent of their expenditures were associated with processing salmon; four stated that more than 95% of their expenditures were associated with processing salmon.

Transportation of Salmon to Market

Most frozen salmon is shipped in 50 pound boxes stacked into standard size (40 foot) freezer vans. When the vans are full, they are driven to Anchorage by processing company drivers or a trucking company. Trucking companies used to truck salmon to Anchorage include Sealand, Totem Ocean Trailer Express (TOTE), Lyden, Hoskin, H&S Trucking, Maersk, Airland, N.Y.K. and American President Lines. At the Port of Anchorage, the vans are driven onto a ship or barge and transported to domestic and international markets.

Fresh salmon is shipped in 50 pound boxes stacked on pallets wrapped in shrink-wrap. One company reported that about 10% of the chum salmon are trucked fresh in refrigerated vans to Anchorage and then shipped by air or trucked down the Alcan to market. Another company reported successful production of fresh red fillets which are air-freighted to domestic markets.

Employment

The nine processors reported a combined peak total of 1762 seasonal employees hired to process salmon. Three plants reported peak total employment of between 75 and 125; four plants reported total peak employment between 125 and 300, and two plants reported total peak employment between 300 and 400. Kenai Peninsula residents accounted for 43% of reported peak seasonal employment, while residents of other parts of Alaska accounted for 11% of reported peak seasonal employment. Thus, non-residents accounted for slightly under half of reported peak seasonal employment. The share of Kenai Peninsula residents in reported peak seasonal employment ranged from as low as 5% to as high as 80 percent. For the five largest processors with the highest reported volume of salmon processed, this share ranged from 40% to 75%.

The nine processors reported total summer administrative employment on the Kenai Peninsula of 68, with winter administrative employment of 44. Of these administrative employees, 49 were Kenai Peninsula reisidents and 7 were residents of other parts of Alaska.

The final version of this chapter will include additional information for the Alaska Department of Labor about seasonal fish processing employment and earning trends on the Kenai Peninsula, and how these have been historically been related to the size of the salmon harvest.

Salmon Processing Expenditures

Interviewees stated that processing expenditures, in addition to wages, included utilities (natural gas, electricity, phone), as well as taxes, landfill fees, dock fees, crane fees, food, fuel, and supplies. Most of these expenditures, which the exception of processing and packaging supplies,are made on the Kenai Peninsula or in Anchorage. Most of the interviewees were not able to provide specific information about monetary expenditures in each category.

"What kinds of other expenditures do you make on the Kenai Peninsula for your processing business?"

- Electrical supplies, mechanical supplies for trucks and plant, utilities, food, coffee, fuel, everything except boxes and raingear.
- Natural gas, electricity, phone, food for managers cafeteria, fuel, maintenance and cleaning supplies, just about everything we use to operate is bought on the Kenai Peninsula or Anchorage.
- Borough taxes, fish, fuel, food, maintenance parts, landfill fees for trash, gravel, electricity for the plant and five buying stations, rent for meeting rooms in Homer, phones, dock fees, crane fees to City of Homer, gravel.
- Utilities, fuel, food, office supplies, everything except processing and packaging supplies (salt, boxes etc.) which are purchased out-of-state.
- Almost all supplies, fuel, repair parts, food, everything except packaging for the fish.
- Parts, fuel, supplies, food.
- Maintenance parts and lubricants, supplies (coffee cups, gloves, cleaners etc.). We buy wholesale fuel and retail it from the dock and contract out the snack shop.
- 80% of everything except for boxes and other packaging materials.
- Food, utilities, fuel, remodeling materials for bathrooms, addition on engineers shop and bunkhouse (all materials purchased in Kenai).

Can you estimate how much you spend per year in other parts of Alaska that is specifically associated with processing salmon?

- 30% of expenditures are made in Anchorage.
- About 30% of all purchases are made in other parts of Alaska.
- We spend about $2000 to $3000 per year in Anchorage plus supplies and wages for our accounting office in Anchorage.
- We do not spend money in other parts of Alaska.
- We do not spend money in other parts of Alaska.
- We buy about 10% of our supplies at COSTCO in Anchorage, 60% in Kenai and the rest we bring up from Seattle.
- About 50% of all expenditures are made in Anchorage.
- 20% of everything except for boxes and packaging.
- We buy almost everything on the Kenai Peninsula.

Processor Ownership

Six of the nine companies, including the top five in reported volume of salmon processed in 1994, are owned by Alaskans. The remaining three are owned by Washington State residents or persons who live in Washington for most of the year.

Can you tell me something about the ownership of this plant. Specifically, are the owners Alaskans or do they live elsewhere?

- Private corporation established in 1977, owned by two Alaskans.
- Privately owned by two Anchorage residents.
- The owners are primarily Alaskan.
- Privately owned by a Kenai resident.
- Private corporation. The three owners are Kenai Peninsula residents.
- Closely held corporation. Most major stockholders are Kenai Peninsula residents.
- Alaska corporation. The two owners live in Seattle eight months out of the year and in Alaska the other four.
- There are several owners all are outside the State of Alaska. It is an American corporation but the owners are not all American.
- Plant owners are all Washington State residents. Owned by a Washington-based closely held corporation.

Effects of a Reduction in Cook Inlet Commercial Harvests

In order to examine the potential effects of a reallocation of Kenai River red salmon on the commercial processing industry, we asked interviewees several questions about how processing employment and expenditures might be affected if the Cook Inlet commercial red salmon harvest were reduced by 100,000 fish by having shorter or fewer openings at the peak of the run. Note that most of our study scenarios imply a significantly higher reduction in the commercial harvest than 100,000 fish, in part due to a higher increase in the escapement target (200,000 for most scenarios) and in part because the reduction in the commercial harvest might exceed the increase in the escapement target.

The answers to the questions show that not all processors perceive the effects of an increased sportfish escapement target in the same way. Reflecting the way that the question was phrased, some reasoned that because the the reduced harvest would be a relatively small share of the total harvest, the effects would be minimal. Some who clearly opposed any reallocation argued that the economic effects would be significant. While the different answers do not provide the basis for a precise determination of the effects of a reduction in commercial harvests on the processing industry, they suggest several general conclusions:

1. In most years, 100,000 fish would represent a relatively small share of the total volume of salmon processed by Kenai Peninsula processors. For those processors who also process salmon brought in from other areas of Alaska, the percentage reduction in processing would be even smaller.

2. In response to a commercial harvest reduction, most processors would probably cut back on processing industry working hours and overtime pay rather than the number of employees hired.

3. In any given year, lower commercial harvests affect primarily variable costs, such as labor and packaging expenditures, with little impact on fixed costs such as plant maintenance or administration. Thus the short-term economic impacts of lower commercial harvests would probably be less than proportional to the reduction in harvests.

4. In the long-term, a reduction in commercial harvests might cause some processing operations to go out of business, reducing fixed costs. Thus the long-term economic impact might be proportional to the reduction in harvests.

If total Cook Inlet harvest was reduced by 100,000 fish (3.3% of the total catch in an average year) how would that affect the number of workers hired, the number of hours worked and their wages?

- We would hire the same number of workers and possibly cut back on number of hours worked. The cut would be very little, if at all.
- We would hire fewer workers and we would probably cut back on the hours of overtime worked. I don't know by how much.
- We would hire the same amount of workers but their hours would be cut by about one half of one percent.
- We would hire the same number of workers and they would work the same number of hours. Since only 30% of our total production is from Cook Inlet, the impact would be minimal. But we are unique to the area in this way. Wages would stay about the same as we would replace those fish with fish from somewhere else in the state.
- A reduction of 100,000 fish would have very little effect on employees or wages. We would cut back overtime by approximately 6 hours per employee.
- We would probably have the same number of workers but just give them fewer hours. This would cause problems because we are having trouble keeping employees happy now, with not enough overtime. We would eventually go under if we cut back too much.
- Most workers make their profit by overtime pay. This would greatly reduce the overtime.
- The effect would be far greater than what you could ever estimate. The long term effect is my biggest concern.
- It seems like a very small percent of my take of the run but I would need more time to figure out the numbers. If we cut back on number of employees the cuts would be made to in state workers. We would still bring up the same number from out of state.

Would 100,000 fewer fish harvested affect the number of administrative employees (office staff) or their wages? By how many? By how much?

- No effect.
- Wages would probably be reduced by 5%.
- Wages would be reduced by a little.
- No effect.
- Wages may possibly be affected in the long run.
- Wages would be reduced but don't know by how much.
- Wages would be reduced by some.
- No effect.
- No effect.

If the commercial fishermen were allocated 100,000 fewer fish, how would this affect your salmon processing expenditures on the Kenai?

- Every expenditure would decrease: food, fuel, taxes etc...
- I would spend less on many things in proportion to the amount of fish/hours lost (i.e. maintenance, gloves, food).
- This would lower my spending about $1000 to $3000.
- 100,000 fish would equal about 100,000 pounds for this plant which is about a half a day's work. We would probably replace that fish with fish from elsewhere. So, no it would not have an effect.
- It depends on the circumstances. If the run was very low then the effect would be much larger.
- My expenditures in general would drop less than 1%.
- Fixed costs would not be affected. Variable costs would be affected proportional to the number of fish lost. Can't place a dollar amount on it.
- Most expenditures would go down some but not necessarily in proportion to loss of fish. Fixed costs per unit goes up which lowers our profit.
- Probably would not have much of an effect. Season to season spending depends on the prior season.

How would a lower allocation of 100,000 fish to commercial fishermen affect your expenditures in other parts of Alaska?

- 100,000 is a small portion, expenditures would be affected, but not by much.
- Fewer fish would affect these expenditures proportionally to the amount of fish lost.
- Fewer fish would have a minimal effect on these expenditures.
- Our Anchorage expenditures would probably drop about 1% with a 100,000 fish cut in commercial allocations.
- This spending would probably drop in proportion to number of lost with the lower allocation.
- These expenditures would decrease, but not necessarily in proportion to the amount of fish lost.
- No effect.
- No effect.
- No effect.

Can you give me any other thoughts about the economic impacts on the Cook Inlet processing industry if the allocation of red salmon to sport fishermen was increased by 100,000 fish?

- Most direct effect will be on overtime wages, truckers transporting the fish and profitability. Although salmon is only 75% of our revenues, sockeye is 90% of our profitability. We have to process pinks and chum even though they don't bring a profit, we can't just throw them out. Processing sockeye is where we make up for it.
- As far as the effect on processors goes, two of the Kenai Peninsula plants will show a different effect than the others because we both take lots of fish from all over the state. Impacts of changes in the Cook Inlet are minimal. Processors who depend solely on Cook Inlet fish will show greater effects. As it is, a processor can barely survive on just Cook Inlet fish. It would be almost impossible to keep a crew on just Cook Inlet fish because they wouldn't get enough hours.
- This reallocation would hurt the tenders as well as the processors. The impact would be enormous on the processors and cause severe cut-backs.
- The economic impact would be felt 100% locally. Our out-of-state expenditures and employment would probably remain the same.

Invited to offer other comments about a reallocation of Kenai River fish to anglers, several processors expressed opposition to the proposal, arguing that escapement was too high and that sport fishermen did not need or could not use more fish.

Other comments offered by processors about increasing Kenai River escapement :

- I am a sport fisherman and I think the Kenai River already has plenty of fish. I don't see the need for more when escapement is already adequate.
- There are already two King runs and a coho run that are not used commercially. They are strictly sport fishing runs. We need to reallocate some of these fish to commercial use before we reduce the commercial sockeye runs. Besides, sockeye are not a good sport fish, they don't bite. I also have concern for the ecology of the river. It was over-escaped by 300,000 reds last year. On the economic side, we put over 15 million dollars into the Homer economy last year alone. Tourism doesn't do half that!
- I don't like the precedent that is being set by the way reallocation is decided. The river habitat is what will suffer as more people will be using it. The river needs limited entry as it is. Not more fish. This will only make it worse.
- Peak escapement for sockeye was 700,000 last year. But 1,000,000 actually went up the river. The sport fishermen had an extra 300,000 reds but still did no better than usual so 100,000 more would be a waste of a resource. The commercial fishermen can make better use of these fish because they are more efficient. Fewer salmon will be wasted. Also over escapement damages the river habitat.
- 100,000 commercial fish is worth about $400,000. Sports fishermen have more than they can catch already, so this money would mostly be lost to the economy.
- It would be impossible to let only 100,000 more fish up the river at the peak of the season. You cannot turn the "faucet" on and off that quick. Both the sport fishermen and commercial fishermen must learn to work together, with the science of resource management as a tool for deciding allocation. A greater attempt to eliminate the politics should be made.

Cook Inlet Salmon Production

This section supplements information in Chapter VI on Cook Inlet salmon production in the 1990s. It helps provide perspective on the importance of the salmon processing sector.

Table J-1 lists registered buyers and processors of Upper Cook Inlet fishery products over the years 1992-94. During these years, 47 different companies bought fishery products. Of these, eighteen companies bought fishery products in all three years.

Table J-2 provides an overview of Cook Inlet salmon production from 1991 through 1994. (We use the term "harvests" to refer to salmon delivered by fishermen to processors, and we use the term "production" to refer to salmon products.) The total volume and value of salmon production varies widely from year to year, reflecting changes in harvests and prices. In 1992, the total wholesale value was $175 million, almost three times the wholesale value in 1991.

Sockeye salmon usually accounts for at least half and sometimes more than three-quarters of the total volume of salmon processed by Cook Inlet processors and a somewhat higher share of the total value. Most sockeye salmon are frozen. Between 1991 and 1994, frozen sockeye accounted for about 51 percent of the total volume of Cook Inlet salmon production and 84 percent of the total volume of sockeye salmon production. Smaller shares of sockeye are canned (less than 10 percent) or sold fresh (7 percent). Salmon roe is also a valuable product, representing about 8 percent of the total value of sockeye production.

Table J-1. Buyers and Processors of Upper Cook Inlet Fishery Products, 1992-1993

Buyer/processor (a)	Plant site	1992	1993	1994
Alaska Gourmet	Anchorage	x		x
Alaska Smoked Salmon	Anchorage			x
Carlson Seafoods	Kasilof	x	x	x
Coal Point Trading	Homer			x
Cook Inlet Processing*	Kenai	x	x	x
D & G Enterprises	Eagle River	x		
Deep Creek Custom Packing	Ninilchik	x	x	x
Dragnet Fisheries*	Kenai	x	x	x
Ed's Kasilof Seafoods	Kasilof	x		
Fishhawk Fisheries	Kenai	x	x	x
Great Pacific Seafoods	Anchorage			x
Icicle Seafoods*	Homer	x	x	x
Icicle Seafoods*	Seward	x	x	x
Inlet Fisheries Inc.*	Soldotna	x	x	x
Int'l Seafoods of Ak.	Kodiak	x		
J. D. Ventures	Wasilla	x		
Kachemak Fisheries	Homer	x	x	x
Kachemak Fish Packers	Homer		x	x
Katch Seafoods Inc.	Homer		x	x
Keener Packing	Kasilof	x	x	
Kenai Custom Seafoods	Kenai	x		
Kenai Packers	Kenai	x	x	
King Crab Inc.	Kodiak	x		
Laona Processing	Anchorage		x	
North Alaska Fisheries	Wasilla		x	x
Pacific Alaska Seafoods	Nikiski	x	x	x
Pacific Gold Seafoods	Kenai	x		
Pacific Star Seafoods*	Kenai			x
Phoenix Fisheries Inc.	Anchorage	x		
Prime Alaska Seafoods	Anchorage	x		
Quality Fresh Inc.	Anchorage		x	x
R & J Enterprises	Anchorage	x	x	x
Royal Pacific Fisheries*	Kenai	x	x	x
Sahalee of Alaska	Anchorage			x
Salamatof Seafoods*	Kenai	x	x	x
Salty Inc.	Homer			x
Samer-I Sea Foods	Homer	x		
Sea Hawk Seafoods	Valdez	x		
Seasonal Seafoods	Kasilof	x	x	x
Silvertip Fish	Anchorage	x	x	
Smoke'n Alaska Seafoods	Seward			x
Snug Harbor Seafoods	Kenai	x	x	x
The Smoke House	Seward			x
Trans Aqua International*	Kasilof	x	x	x
Wards Cove Packing*	Kenai	x	x	x
Whitney Foods	Anchorage/Kasilof	x	x	x
10th and M Seafoods	Anchorage	x		x

* Interviewed by ISER for this study. See Appendix J for interview questions and results.

(a) Includes only buyers with plants.

Source: Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Upper Cook Inlet Commercial Fisheries Annual Management Reports, 1992-94. Includes only buyers with plants. ISER file: Byuers/processors.

Table J-2. Cook Inlet Salmon Production, 1991-1994

	1991	1992	1993	1994	Average, 91-94
Number of companies processing sockeye salmon (b)			27	28	
Volume of salmon production (lbs)					
Sockeye					
Frozen	11,140,605	40,270,844	21,403,912	14,695,650	21,877,753
Canned	(a)	2,641,169	(a)	(a)	(a)
Fresh	1,562,619	1,674,213	1,948,334	1,663,075	1,712,060
Other	73,179	88,119	(a)	(a)	(a)
Total, excl. roe	12,776,403	44,674,345	26,263,052	16,956,686	25,167,622
Sockeye roe	352,684	1,740,402	937,833	709,653	935,143
Total sockeye	13,129,087	46,414,747	27,200,885	17,666,339	26,102,765
All other species, all products	16,504,164	16,004,275	10,688,273	23,884,334	16,770,262
Total volume, all salmon species and products	29,633,251	62,419,022	37,889,158	41,550,673	42,873,026
Value of salmon production ($)					
Sockeye					
Frozen	22,997,407	124,382,277	43,526,416	41,947,140	58,213,310
Canned	(a)	9,495,410	(a)	(a)	(a)
Fresh	4,576,684	4,329,760	4,161,104	2,940,359	4,001,977
Other	220,194	441,700	(a)	(a)	(a)
Total, excl. roe	27,794,285	138,649,147	54,717,051	46,332,055	66,873,135
Sockeye roe	1,970,097	9,793,210	6,106,672	4,404,114	5,568,523
Total sockeye	29,764,382	148,442,357	60,823,723	50,736,169	72,441,658
All other species, all products	30,351,899	26,571,468	17,116,751	34,071,749	27,027,967
Total value, all salmon species and products	60,116,281	175,013,825	77,940,474	84,807,918	99,469,625
Share of production volume					
Sockeye					
Frozen	37.6%	64.5%	56.5%	35.4%	51.0%
Canned	(a)	4.2%	(a)	(a)	(a)
Fresh	5.3%	2.7%	5.1%	4.0%	4.0%
Other	0.2%	0.1%	(a)	(a)	(a)
Total, excl. roe	43.1%	71.6%	69.3%	40.8%	58.7%
Sockeye roe	1.2%	2.8%	2.5%	1.7%	2.2%
Total sockeye	44.3%	74.4%	71.8%	42.5%	60.9%
All other species, all products	55.7%	25.6%	28.2%	57.5%	39.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Share of production value					
Sockeye					
Frozen	38.3%	71.1%	55.8%	49.5%	58.5%
Canned	(a)	5.4%	(a)	(a)	(a)
Fresh	7.6%	2.5%	5.3%	3.5%	4.0%
Other	0.4%	0.3%	(a)	(a)	(a)
Total, excl. roe	46.2%	79.2%	70.2%	54.6%	67.2%
Sockeye roe	3.3%	5.6%	7.8%	5.2%	5.6%
Total sockeye	49.5%	84.8%	78.0%	59.8%	72.8%
All other species, all products	50.5%	15.2%	22.0%	40.2%	27.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Average wholesale prices for sockeye products ($/lb)					
Frozen	$2.06	$3.09	$2.03	$2.85	$2.66
Canned	(a)	$3.60	(a)	(a)	(a)
Fresh	$2.93	$2.59	$2.14	$1.77	$2.34
Other	$3.01	$5.01	(a)	(a)	(a)
Total, excl. roe	$2.18	$3.10	$2.08	$2.73	$2.66
Sockeye roe	$5.59	$5.63	$6.51	$6.21	$5.95
Total sockeye, incl. roe	$2.27	$3.20	$2.24	$2.87	$2.78

(a) Data are confidential because less than 4 processors produced this product. (b) As reported by ADFG.

Source: Alaska Department of Fish and Game, data reported by processors in Commercial Operator Annual Reports (for more detail, see Appendix G, Table G-9). ISER file: CI sockeye prod analysis.

Salmon represented more than 90 percent of total revenues for five of the nine companies we intrviewed, 75 percent of revenues for two, and 60 percent and 50 percent of revenues for the remaining two companies. Some of the companies process fish flown in from other parts of Alaska. Other species processed include halibut, herring, black cod, and crab. Three companies stated that between 70 and 75 percent of their expenditures were associated with processing salmon; four stated that more than 95 percentof their expenditures were associated with processing salmon.

Processors reported that most frozen salmon is shipped in 50-pound boxes stacked into standard (40-foot) freezer vans. When the vans are full, they are driven to Anchorage by the processing companies themselves or by trucking companies. Processors mentioned nine trucking companies used to transport salmon to Anchorage. At the Port of Anchorage, the vans are driven onto ships or barges and transported to domestic or international markets (primarily Japan). One company reported successful production of fresh red fillets that are air-freighted to domestic markets.

Appendix K

Summary of Technical Approach Using Discrete Choice Methods for Estimating Net Economic Benefits

Appendix K. Summary of Technical Approach to Using Discrete Choice Methods for Estimating Net Economic Benefits

The cost-benefit portion of the Cook Inlet salmon allocation study relies on discrete choice methods to estimate net values of changes in catch rates and other measures of fishing quality that might result from a change in fisheries management. The two principal approaches use variations on the Random Utility Model and dichotomous choice contingent valuation. This appendix summarizes the general technical approach for one of these methodological tools -- the Random Utility Model (RUM) -- and briefly discusses how RUM models will be used to derive willingness to pay (WTP) or other forms of net economic benefits. The appendix contains three sections. First we summarize the random utility model used for sport and personal use fishing. Next we discuss how we extend RUM to estimate the net benefits of a job in commercial fishing. Finally, we discuss how we build an analogous model to estimate Producers Surplus in commercial fishing operations.

Random Utility Model for Sport and Personal Use Fishing

We rely on applications of the Random Utility Model (RUM) (Domemcich and McFadden, 1975) to estimate consumers surplus in sport fishing and personal use fishing. The RUM has been widely used with survey data to estimate willingness to pay for sport fishing and other non-market amenities (Bockstael, McConnell, and Strand, 1989; Morey, Shaw, and Rowe, 1991) When applied to non-market valuation of recreational activities, RUM is often called the *travel-cost model*, because it relies on variations in travel costs to identify willingness to pay.

The RUM assumes that each person faces a set of choices at some point in time and selects the alternative that is expected to provide the highest utility. For sport and personal use fishing, the alternatives are fishing trips to specific locations (possibly for different target species) during a time interval. We will be modeling fishing choices during weekly time intervals to the extent data permit, and monthly intervals otherwise.

We model, therefore, a person who faces a set of N fishing alternatives during each time period. Indirect utility, W_{ij}, for individual i in period t is achieved from the choice of the alternative j that has the maximum utility at the time:

$$W_{it} = \max_j W\left(y_{it} - c_{ijt}, X_{it}, Z_{jt}\right),$$

where y_i is income and c_{ijt} is the cost of the fishing trip. The vector X_i represents a set of characteristics of individuals that might affect their fishing behavior, such as angler experience, preference for certain types of fishing experiences, and ownership of boats and cabins. The vector Z_{jt} includes the set of characteristics of fishing sites that might affect their desirability to anglers. Utility of each alternative may contain a random component that represent factors that are known to the individual at the time they make their chioice but which cannot be observed or predicted in advance.

McFadden (1982) defines the characteristics required for indirect utility, *W*, in order for a RUM model to be consistent with utility maximization. One such functional form that permits some flexibility of substitution among alternatives that is often used in applied studies is the nested multinomial logit model, based on the Generalized Extreme Value (GEV) distribution. With two levels of nesting in the choice structure, we may write the probability that the angler selects the *j*th alternative on a *given* fishing trip as

$$p(V_{ijt}) = \frac{e^{V_{ijt}}}{S_{it}},$$

where

$$S_{it} = \sum_{k=1}^{N} e^{V_{ikt}}.$$

We estimate the equation for $p(V)$ from observing how variations in the choice of the fishing activity are associated with variations in observations on X and Z. For computational purposes, V is ordinarily assumed to be linear in its parameters. The probability that the angler actually takes n trips (or number of trips grouped into m categories) in time period t, π_{imt}, is similarly estimated as

$$\pi_{imt} = \frac{e^{U_{imt}}}{R_{it}},$$

where

$$U_{imt} = U[I_{it}, X_i, t].$$

I_{it} represents the *inclusive value* for the site choice equation, equal to $\ln(S_{it})$, and R_{it} is given by

$$R_{it} = \sum_{m} e^{U_{imt}}.$$

Measures of economic welfare such as consumers surplus may be derived from discrete-choice models of demand in analogous ways to derivations from continuous demand models (Small and Rosen, 1981). Consumer's surplus for the option to fish at site j under a given scenario s of assumptions about quality of fishing at each site is defined as

$$CS_{it}^{s} = \int_{c_{ijt}^{s}}^{\infty} p\left(V\left(y_i - c_{ijt}, X_{it}, Z_{jt}^{s}\right)\right) dc_{ijt}$$

where $p\left(V\left(y_i - c_{ijt}, X_{it}, Z_{jt}^s\right)\right)$ represents the demand function for trips to site j in period t and c_{ijt}^s represents the trip cost under scenario s. Welfare effects of changes in fishing quality may be estimated by comparing estimated consumer surplus in two scenarios with different fishing quality.[1] When the marginal utility of income is constant, such as in a single-stage RUM logit model, the integral above may easily be derived analytically as the inclusive value, plus a constant of integration, divided by the marginal utility of money. In the single-stage logit model, minus one times the coefficient on trip cost provides an estimate of the marginal utility of money. That is why we may speak of the inclusive value as an index of willingness to pay.[2]

In more complex RUM models involving a nested choice structure, the marginal utility of money may vary across branches of the decision tree. In this instance, a formula for the integral of the demand function cannot be derived analytically, and numerical integration is required to evaluate the change in welfare. This is the case for the frequent anglers in the current study. Performing repeated numerical integrations to estimate changes in WTP for numerous study scenarios is possible but impractical. Instead, we use an approximation used by Jones and Stokes (1991) for a similar model, given by the following formula:

$$WTP_{ijt}^{1} - WTP_{ijt}^{2} = \frac{1}{\beta}\left[q_{it}^{1}\ln\left(S_{it}^{1}\right) - q_{it}^{2}\ln\left(S_{it}^{2}\right)\right],$$

where q_{it}^s represents the expected number of trips in period t in scenario s (derived from estimates of π_{imt}), and β equals the marginal utility of income (-1 times the coefficient on trip cost, c_{ij}, in the site-choice equation). This formula includes the simplifying assumption that characteristics remain the same in any two comparison scenarios for all sport and personal use fisheries not affected by management of Kenai River sockeye. Changes in Kenai salmon fishing opportunities will change the estimates of V for those sites, which also affects S, the measure of overall quality of fishing opportunities. That will affect π_{imt}, so that q_{it}^1 will in general differ from

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[1]Small and Rosen (1981) show that under the assumption of weak complementarity between quantity demanded (fishing trips to Kenai River sites, for example) and the measures of quality that change (Kenai sonar), one may use a simpler formula for the change in welfare based on integrating demand over the change in quality. Weak complementarity implies that there is no value to taking another fishing trip to the site if the quality variable is zero, and no value to improving site quality if there are no trips to that site. The functional form for the travel cost model we estimated (see Appendix A) does not satisfy weak complementarity. For example, the Kenai sockeye sonar count could be zero, but the fishing could still be good for other species, creating potential value for Kenai fishing trips. For this reason, we rely on the difference between the total estimated WTP in the two scenarios to estimate the change in net value.

[2]The constant marginal utility of income characteristic of the RUM model implies that the change in compensated demand equals the change in Marshallian demand, so the various common measures of welfare are equivalent. (See McConnell (1995) for a further discussion of this point.)

q_{it}^2. We simply add up the change in willingness to pay for all anglers and time periods to obtain the total estimated change in net benefits.

Willingness to pay for guided sport fishing. Several options are available for treating guide services in sport fish willingness to pay (WTP). Each carries with it some methodological problems. If we exclude guided fishing trips from the analysis entirely, we bias the estimation of willingness to pay against specific sites that have relatively more guided fishing activity -- i.e., the Kenai River. If we include guided fishing trips in the data but exclude guide and charter costs from fishing trip costs, then we understate the cost of the trip. Jones and Stokes (1987, 1991) appear to have taken the second approach in both their studies.

A serious problem with the Jones and Stokes approach is that it leaves the analyst without any information to predict how guide expenditures might change if people alter their fishing activities. A rationale for their approach, however, is that if one includes guide costs, the site-selection results may be biased if one excludes potential guide costs at substitute sites. Predicting guide costs for alternative sites is difficult, but not impossible.

We assume that sport fishing and guide services are *close complements,* especially for inexperienced anglers. We included the cost of guide and charter services as a separate component of fishing trip costs to be explained. We estimated predictive equations for guide expenditures at sites where guide services are available, assuming guide costs depend on angler characteristics such as skill and income, fishing trip variables such as number of anglers and fishing hours, and on site characteristics. The equations were estimated using a censored regression (tobit) procedure to account for censoring of the observations at zero (guide expenditures cannot be negative). The regression results are shown in Appendix A.

With this procedure, the RUM model automatically counts anglers' willingness to pay for guide services as part of the consumer surplus for sport fishing. A separate willingness to pay for guiding cannot be identified. However, total consumers surplus should more accurately reflect WTP for sport fishing -- since guide consumer's surplus cannot be earned unless the household goes fishing. Under this protocol, changes in site selection and participation predicted by the travel-cost model will predict changes in guide expenditures in the same way that they already predict changes in transportation and food and lodging costs.

Extension of RUM for Workers Satisfaction Bonus in Commercial Fishing

Given a set of potential N alternative jobs that an individual has the opportunity to select, we model the indirect utility that person i derives from the jth alternative as,

$$W_{ij} = W\left(k_i + y_{ij}, X_i, Z_j\right),$$

where k_i is non-work income and y_{ij} is work income. The time subscript t is omitted for ease of exposition, but the time period of reference is the fishing season. For the WSB analysis, X represents a set of variables for characteristics of individuals that might affect their preferences for different types of jobs. The Z variables now measure job characteristics such as rate of pay, hours, working conditions, etc., that we think people might value in any given job. Data for the X variables, the Z variables -- characteristics of specific job alternatives for respondents -- and preferences for job alternatives will be collected from 1994 commercial fishing permit holder and crew surveys.

The theoretical framework for calculating the total net benefits of a job is similar to that of RUM. Given an indirect utility W, we model the probability of choosing the jth job as

$$p_{ij} = \frac{e^{W_{ij}}}{S_i},$$

where

$$S_i = \sum_{k=1}^{N} e^{W_{ik}} .$$

We estimate the equation for $p(W)$ from observing how variations in individual's job choices -- either historical or hypothetical -- are associated with individual characteristics X and job characteristics Z. Cook Inlet set net or drift net operations are considered as different jobs for permit holders, captains and crew. Some job characteristics such as pay and hours may vary under different scenarios. Other Z variables such as the physical and social environment of the job remain the same in all scenarios.

The total net benefits conferred by a particular job opportunity j paying an income of y_1 in scenario s are calculated by

$$WTP_{ij}^{s} = \int_{-\infty}^{y_s} p\left(W\left(k_i + y_{ij}, X_i, Z_j^{s}\right)\right) dy_{ij}$$

For the logit model, this integral evaluates to

$$WTP_{ij}^{s} = \frac{1}{\beta}\left[\ln\left(S_i^{s}\right) - \ln\left(S_i^{s}{}'\right)\right]$$

where $S_i^{s}{}' = S_i^{s} - e^{W_{ij}^{s}} = \sum_{k=1}^{j-1} e^{W_{ik}^{s}} + \sum_{k=j+1}^{N} e^{W_{ik}^{s}}$, and β equals the marginal utility of income, measured by the coefficient on work income, y_{ij} in the equation for W. The formula essentially measures the difference between the value of all available job opportunities and the value of all job opportunities excluding job j.

The total willingness to pay measured above takes into account the job's relative earnings as well as the non-monetary benefits. It represents the increment in welfare that person i derives from having the opportunity to work in job j. If the job is eliminated, the WTP amount represents a loss of welfare to society. If the job continues, it has a social opportunity cost given by the accounting identity:

$$OC_{ij} = y_{ij} - WTP_{ij}.$$

The Workers Satisfaction Bonus (WSB) is usually defined to represent only the non-monetary benefits of a job. It should be clear, however, that the worker also derives benefits from being able to earn more money in a particular job than in any other available alternatives. The WTP measure takes into account the WSB, but will be higher (or lower) than WSB if the monetary earnings in job j are higher (or lower) than in substitute jobs. If one needs an estimate of the strictly non-monetary portion of the benefits of job *j*, one evaluates the above formula for WTP_{ij}^1 with work income, *y*, set equal to y_{ij} for all jobs.

Changes in Kenai commercial salmon fishing revenue and operations will change estimates of *W* for Cook Inlet salmon fishing job alternatives. This affects *S*, the measure of overall quality of the individual's job opportunities. If we assume that the Cook Inlet salmon fishing job (job *j*) is the only one that changes between the two scenarios, the change in WTP is estimated as:

$$WTP_i^1 - WTP_i^2 = \frac{1}{\beta}\left[\ln\left(S_i^1\right) - \ln\left(S_i^2\right)\right],$$

A portion of the change in WTP between the two scenarios may be due to a change in non-monetary benefits. Since earnings in scenario 1, y_{ij}^1, differ from y_{ij}^2, it appears that one can produce two estimates of the change WSB: one evaluating the formula for $WTP_i^1 - WTP_i^2$ at $y = y_{ij}^1$ for all jobs, and one applying $y = y_{ij}^2$. However, the constant marginal utility of income assumption in RUM assures that these two estimates will be identical.

Estimates of WTP and WSB for commercial fishing jobs using the above method are sensitive to the perceived quality of alternative jobs. However, the portfolio of alternative jobs included in the estimation affects the estimated change in WSB relatively little under different scenarios affecting the commercial fishery, provided that the set of alternatives contain the best substitute job. The best substitute job will be elicited by asking survey respondents what job they would try to obtain, if any, if the entire Cook Inlet salmon fishery -- sport, personal use, and commercial -- were shut down due to low run size levels.

Alternative jobs elicited from survey respondents that are hypothetical and not actually available can be included as alternatives in order to estimate the parameters of $W\left(k_i + y_{ij}, X_i, Z_j\right)$. To estimate the WSB, however, one uses only actual substitute jobs. That is, if there are *r* actual substitutes and *N-r* hypothetical alternatives, the formula for WSB should substitute $\overline{S}_i$ and $\overline{S}_i'$ for S and S', respectively, where

$$\overline{S}_i^s = \sum_{k=1}^{r} e^{W_{ik}^s}$$

and

$$\overline{S}_i^s{}' = \overline{S}_i^s - e^{W_{ij}^s} = \sum_{k=1}^{j-1} e^{W_{ik}^s} + \sum_{k=j+1}^{r} e^{W_{ik}^s}$$

Extension of RUM for Producers Surplus in Commercial Fishing

The analogy of RUM on the production side can be called the Random Profit Model (RPM). The basic approach is to use observations on the choices of firms among discrete alternative activities to estimated a profit function for the set of activities. While RUM analyzes a tradeoff between observed travel costs and unobserved utility, RPM measures a tradeoff between observed revenues and unobserved costs. We assume that firms maximize profits.

Given a set of N potential alternative productive activities that a commercial fisher can select during time period t, we model the value of the profits from the activity as

$$V_{ijt} = V\left(y_{ijt} - k_i, X_i, Z_{ijt}\right) = y_{ijt} - k_i - C\left(X_i, Z_{ijt}\right),$$

where k_i represents fixed costs that do not depend on which, if any, fishing activities are undertaken, y_{ijt} is gross revenue from fishery j in time t, and C_{ijt} is the (variable) cost of fishing that activity. The choices available include all those fisheries that are open during the time period for which access is unrestricted and the individual owns a boat with the appropriate gear, or for which the individual owns a limited entry permit. The option not to fish in any Alaska commercial fishery is an additional alternative in each period . The time period measures a realistic choice horizon for the decision on whether or not to participate in particular fishery openings.

For this model, X represents a set of characteristics of Cook Inlet salmon permit holders and the boats and gear they own that might affect their ability to earn profits in different activities. Z is a set of exogenous variables affecting fishing costs (cost-shift variables) including characteristics of fisheries. The Z variables may vary among individuals as well as among fisheries. Data for fisheries participation, revenues from participation, and most X variables are derived from Alaska Department of Fish and Game landings, vessel license and permit data.

We model the probability that the ith commercial fisher chooses the jth activity in period t as

$$p_{ijt} = \frac{e^{\beta V_{ijt}}}{S_{it}},$$

where

$$S_{it} = \sum_{k=1}^{N} e^{\beta V_{ikt}} .$$

We estimate the equation for V as a multinomial logit from observed variation in choice of activity j, associated with variation in revenues, y, and in the X and Z variables that affect costs. The parameter β is estimated as the coefficient on revenues, y. Separate equations will be estimated for set net and drift net permit holders.

To measure the operating profits (producers surplus) derived from fishery j (Cook Inlet salmon fishing) over a time horizon T, available in, for example, scenario s, one measures:

$$PS_{ij}^{s} = \int_{-\infty}^{y_s} p\left(V\left(y_{ijt} - k_i, X_i, Z_{ijt}^{s}\right)\right) dy_{ijt}$$

For the logit model, this formula evaluates to

$$PS_{ij}^{s} = \frac{1}{\beta}\sum_{t=1}^{T}\left[\ln\left(S_{it}^{s}\right) - \ln\left(S_{it}^{s\prime}\right)\right]$$

where

$$S_i^{s\prime} = S_i^{s} - e^{\beta V_{ij}^{s}} = \sum_{k=1}^{j-1} e^{\beta V_{ik}^{s}} + \sum_{k=j+1}^{N} e^{\beta V_{ik}^{s}} .$$

The time horizon, T, represents the period over which the profit equation has been estimated. Ordinarily, T refers to the salmon fishing season -- the period within which a permit owner's intent to fish for Cook Inlet salmon might affect his or her decision to participate in some other fishery. However, the equation can be estimated over any time period. We will also investigate a simplified version of the model in which the choices are only whether or not to participate in the Cook Inlet fishery fish, estimated as a binomial logit over a number of years. In this instance, revenues vary with prices as well as quantities, and the cost shift variables include time series cost-shift factors such as fuel prices.

Changes in run sizes and management regulations in various scenarios will change estimates of V for the Cook Inlet salmon fishing activities, while scenarios with different prices may affect V estimated for all fishing alternatives. These changes affect S, the measure of overall maximum expected profit from the full set of available activities. If we compare two scenarios that differ only with respect to Cook Inlet salmon fishing (activity j), the difference in producers surplus is estimated as

$$PS_i^{\,1} - PS_i^{\,2} = \frac{1}{\beta}\sum_{t=1}^{T}\left[\ln\left(S_{it}^{\,1}\right) - \ln\left(S_{it}^{\,2}\right)\right],$$

Estimates of producers surplus from the Random Profit Model, unlike those estimated from direct elicitation of marginal costs and revenues from permit owners, provide a subjective evaluation of expected costs and revenues for alternative activities. This means that they include an estimate of permit holders' WSB for Cook Inlet salmon fishing relative to other fisheries, and in a cruder form, between Cook Inlet salmon fisheries and non-fishing jobs. The WSB estimate is less precise for non-fishing jobs because it does not include specific job characteristics in the analysis.

Theoretically, one can integrate the Random Profit Model with estimation of WSB based on the Random Utility framework if alternative jobs determined from the survey are added to the list of alternative activities. Estimation of such an equation is impractical, however, due to differences in the way that data will be obtained for the two analyses. Consequently, we used the estimates from the Random Profit Model to model how changes in operations would affect net benefits of permit holders, including WSB, during the course of a fishing season. A separate WSB analysis described above was used, however, to estimate the change in net value of crew members, whose WSB will not in general be included in the estimates for permit holders.

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Appendix L

Comparison with Related Studies

APPENDIX L: COMPARISON WITH RELATED STUDIES

A number of studies have been done in Alaska on economic contributions of the sport or commercial fishing industries. None of these studies have had the same specific objectives as this study: to compare the economic effects of specific changes in management on both the sport and commercial fisheries. However, other studies have used methods similar to those used in this study to estimate net economic value or economic impacts associated with Alaska sport or commercial fisheries.

The following studies of Alaska fisheries are the most comparable in terms of methodology and scope:

Jones and Stokes Southeast Study: Jones & Stokes Associates, Inc. 1991. *Southeast Alaska Sport Fishing Economic Study.* Final Research Report. December 1991. (JSA 88-028.) Sacramento, CA. Prepared for Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section.

Jones and Stokes Southcentral Study: Jones and Stokes Associates, Inc. 1987. *Southcentral Alaska Sport Fishing Economic Study.* Prepared for Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section.

E3 Consulting Kenai River Study: E3 Consulting. 1994. *A Socioeconomic Assessment of Kenai River Fish Production on the Regional Economy.* Prepared for the Kenai Peninsula Borough.

McDowell Seafood Industry Study: The McDowell Group. 1989. *Alaska Seafood Industry Study: An Economic Profile of the Seafood Industry in Alaska.* Prepared for the Alaska Seafood Industry Study Commission.

ISER Commercial Fishing Industry Study. Matthew Berman and Teresa Hull. 1987. The Commercial Fishing Industry in Alaska's Economy. University of Alaska Anchorage, Institute of Social and Economic Research.

We briefly compare each of these studies with ISER's Cook Inlet study in terms the questions addressed, methods used, data sources, and economic findings. This is only a summary comparison, for the purpose of providing readers with a general understanding of similarities and differences between the ISER Cook Inlet study and a few other Alaska studies which are most directly comparable. A detailed comparison would require examining numerous technical details relating to study objectives, definitions, data collection, model structure and model assumptions. Many other studies of Alaska sport and commercial fisheries, as well as fisheries in other states and countries, could also be included in a more detailed review and comparison. Some of the other Alaska studies are listed at the end of this appendix.

Study Objectives

Jones and Stokes Southeast Study

The Jones and Stokes Southeast Study was completed in 1991 for the Research and Technical Services Section of the Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section. The executive summary of the report described the goals of the report as follows:

The primary goal of the study was to develop appropriate economic data and models for evaluating management alternatives affecting sport fisheries in Southeast Alaska. Specific study objectives are to:

- *estimate spending by resident and nonresident anglers and related economic impacts on the Southeast and state economies associated with freshwater and saltwater sport fishing in Southeast Alaska during 1988;l*

- *estimate nonmarket values by harvest area associated with freshwater and saltwater sport fishing activities of resident and nonresident anglers in 1988; and*

- *develop a computer modeling system capable of evaluating changes in market and non-market values associated with sport fishery enhancement programs, resource allocation proposals, and land use planning alternatives.*

Jones and Stokes Southcentral Study

The Jones and Stokes Southcentral Study was completed in 1987 for the Research and Technical Services Section of the Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section. Chapter 1 of the report described the goals of the report as follows:

This study has two primary analytical objectives:

(1) to estimate expenditures of sport anglers by water body fished and species sought, and the economic impact of total angler spending on sport fishing in southcentral Alaska at four levels: Kenai Peninsula, Anchorage area, rest of Alaska, and outside of Alaska; and

(2) To estimate nonmarket values (or consumer's surplus) of sport fishing by water body fished and species sought. These values are the benefits to anglers over and above the expenditures they make to participate in sport fishing.

In addition to these primary objectives, the study also examines:

- *the factors that influence the decision to sport fish and that determine the number of sport fishing trips taken by resident anglers;*

- *The role that site attributes such as facilities available, crowding, and fishing conditions play in the selection of sport fishing sites;*

- *the economic value of catching additional king salmon on the Kenai River; and*

- *the change in economic values resulting from closing the Kenai River to king salmon sport fishing during the last week in July.*

E3 Consulting Kenai River Study

The E3 Consulting Kenai River Study was completed in 1994 for the Kenai Peninsula Borough. According to the executive summary, the study

... examines the importance of the Kenai River chinook and sockeye salmon runs to the Borough economy and effects of the Borough economy of dramatic declines in run strength. The magnitude of the declines are hypothetical but are designed to indicate the magnitude of loss which could be expected due to declines in fish production or return to the Kenai River. . . Two different scenarios are examined: changes to the chinook recreational fishery on the Kenai River and changes to the sockeye recreational fishery on the Kenai River and commercial landings of Kenai River origin sockeye. . . . The changes examined were limited to the Borough economy. It is not possible to reliably use the results from this study for allocational purposes since the scenarios do not offer comparative results.

McDowell Seafood Industry Study

The McDowell Seafood Industry Study was completed in 1989 for the Alaska Seafood Industry Study Commission, a group of more than 25 state agencies and commercial fishing industry organizations. According to the foreword, the report had two purposes:

The first is to quantify the impacts of the state's largest private basic industry on the economy of Alaska... The second purpose is to describe this complex and diverse industry to the Alaskan public.

ISER Commercial Fishing Industry Study

The ISER commercial fishing industry study was completed in 1987. According to the introduction:

This paper discusses the importance of the commercial fishing industry to Alaska's economy. . . . We measure economic effects primarily in terms of employment and income.

Comparison with Objectives of ISER Cook Inlet Study

The most obvious difference in objectives between the ISER Cook Inlet study and other studies is that the ISER Cook Inlet study looks at both the sport and commercial fisheries. Most other studies have looked at only the sport fishery or only the commercial fishery. Of those studies discussed in this appendix, only the E3 Consulting Kenai River study looked at both fisheries. However, the purpose of the E3 Consulting Study was not to compare the economic effects of allocation between the sport and commercial fisheries, but rather to get a sense of how a major reduction in run size might affect both fisheries.

A second difference is that most other studies had the primary objective of assessing total economic value or total economic impacts associated with sport or commercial fisheries, rather than the change in economic value or impacts associated with a change in fishing conditions. Although the Jones and Stokes studies included case studies of changes in economic value and impacts associated with closing specific sport fisheries for a period of time, these case studies were not the primary objective of the Jones and Stokes studies. In contrast, the primary purpose of the ISER study was to examine economic effects of relatively small changes in harvest levels (compared to long-term average harvests) in specific sport and commercial fisheries.

A third important difference is that none of the studies attempted to measure the net economic value of the commercial fishery. The E3 Consulting Kenai River, McDowell Seafood Industry and ISER

Commercial Fishing studies focused only on economic impacts of the commercial fishery.

Table L-1. Selected Economic Studies of Alaska Fisheries: Major Study Goals

Study	Major Study Goals
ISER Cook Inlet Study	Assess how letting more sockeye into the Kenai River would affect: Net economic value of the sport fishery Net economic value of the commercial fishery Economic impacts of the sport fishery Economic impacts of the commercial fishery
Jones and Stokes Southeast Study	Estimate the total economic impact and total economic value associated with southeast Alaska sport fishing, by site and species Develop models capable of evaluating changes in net economic value and economic impacts of sport fishery management alternatives As a model application, estimate how closing the Juneau area king and coho fishery for 5 weeks would affect net economic value and economic impacts
Jones and Stokes Southcentral Study	Estimate total expenditures associated with southcentral sport fishing. Estimate non-market values associated with southcentral sport fishing, by site and species. Estimate effects of site characteristics and other factors in sport angler trip decisions. Estimate changes in net economic value and economic impacts associated with closing the Kenai River king fishery for one week.
E3 Consulting Kenai River Study	Describe how chinook and sockeye runs affect the Kenai Peninsula Borough economy. Assess how the Borough economy be affected by significant run declines.
McDowell Seafood Industry Study	Quantify economic impacts of the commercial fishing industry statewide and by region.
ISER Commercial Fishing Industry Study	Estimate employment and income impacts of the commercial fishing industry, by region.

Surveys

The sport fishing analysis in both the ISER Cook Inlet study and the Jones & Stokes studies was based on surveys of resident and non-resident anglers. ISER surveyed resident anglers by telephone, while Jones & Stokes surveyed anglers by mail.

To collect data for the Cook Inlet commercial fishing analysis, ISER conducted major telephone surveys of Cook Inlet commercial fishing permit holders and crew. The E3 Consulting study was based in part on data from a small survey of commercial fishermen reported in another study (Coughenower, *Central Kenai Peninsula Commercial Fishing Study*). Neither the McDowell Seafood Industry Study nor the ISER Commercial Fishing Industry collected survey data from commercial fishermen. However, the McDowell Seafood Industry Study was based in part on a mail survey of Alaska seafood processors.

Table L-2. Selected Economic Studies of Alaska Fisheries: Comparison of Surveys

Study	Surveys
ISER Cook Inlet Study	Telephone surveys of resident anglers (statewide & southcentral) Mail survey of non-resident anglers Telephone survey of commercial fishing permit holders Telephone survey of commercial fishing crew
Jones and Stokes Southeast Study	Mail survey of Southeast Alaska resident anglers Mail survey of non-resident anglers Mail survey of southeast Alaska sport-fishing related businesses
Jones and Stokes Southcentral Study	Mail survey of Southcentral Alaska resident anglers Mail survey of non-resident anglers Mail survey of Southcentral Alaska sport-fishing related businesses
E3 Consulting Kenai River Study	(none)
McDowell Seafood Industry Study	Mail survey of Alaska seafood processors
ISER Commercial Fishing Industry Study	(none)

Study Methods

The Jones & Stokes studies used the same three methods as the ISER Cook Inlet study to assess net economic value and economic impacts of the sport fishery: travel cost, contingent valuation, and input-output. Although there were many specific technical differences between the Jones & Stokes methods and the ISER methods, the general theoretical approach was essentially the same.

Travel Cost Analysis

The travel cost model used in the ISER Cook Inlet study was very similar to that used in the Jones & Stokes Southeast Study. For both studies, anglers faced a two-part weekly choice structure: whether to go fishing, and (for those who fished) where to fish. The Jones & Stokes Southcentral Study decision tree structure was more complex, with separate steps to estimate first a target species, followed by different site decisions for each target species. Estimation of this more complex decision structure for the Southcentral study proved very difficult. Unlike the Jones & Stokes studies, the ISER Cook Inlet study also developed a separate model for infrequent anglers with a monthly rather than weekly participation decision.

Table L-3. Selected Economic Studies of Alaska Fisheries: Comparison of Methods

	Sport Fishery Analysis			Commercial Fishery Analysis				
	Net economic value assessment		Economic impact assessment	Net economic value assessment			Economic impact assessment	
Study	Travel cost model	Contingent valuation	Input-output model	Observed choices method	Contingent valuation	Job ranking method	Input-output model	Economic base model
ISER Cook Inlet Study	X	X	X	X	X	X	X	
Jones and Stokes Southeast Study	X	X	X					
Jones and Stokes Southcentral Study	X	X	X					
E3 Consulting Kenai River Study			X				X	
McDowell Seafood Industry Study								X
ISER Commercial Fishing Study								X

ISER file: Other studies-methods.

Contingent Valuation Analysis

The ISER Cook Inlet study included a contingent valuation analysis of residents' willingness to pay for better sockeye fishing on the Kenai River. The Jones and Stokes Southeast study included a contingent valuation analysis of the change in net economic value associated with increasing king salmon harvest opportunities in southeast Alaska. The Jones and Stokes Southcentral resident survey included contingent valuation questions intended for use in estimating the value of the Kenai River king salmon fishery. However, because of a descriptive error in the survey, the results of the contingent valuation analysis were not presented in the study report.

The Jones and Stokes Southcentral study also included a discrete-response contingent valuation survey to estimate net economic value to non-residents of sport fishing in Alaska. Non-residents were asked whether they would have made their most recent trip to Alaska if the cost had been higher by varying amounts. Responses were used to estimate the probability of visiting Alaska given different incremental costs. Based on these probabilities, the study estimated the median and mean values of nonresidents' net willingness to pay for sport fishing in Alaska. The median and mean values of $217 and $332 for all non-residents were "consistent with the results from the travel cost model which implies a mean value of $305 per trip for sport fishing in south central Alaska."

Contingent Behavior Analysis

An important issue for the ISER Cook Inlet study was how time spent by non-resident fishermen in Alaska might change in response to a change in sport fishing opportunities. The answer to this question is important for assessing potential economic impacts of management changes. The ISER study developed rough estimates for changes in the number of days spent in Alaska by non-resident fishermen, based on contingent behavior questions about whether and how different bag limits would have affected the time they spent in Alaska. Neither of the Jones and Stokes studies addressed the issue of potentical changes in time spent in Alaska by non-resident fishermen.

Commercial Fishery Net Economic Value Analysis

None of the other studies reviewed in this appendix attempted to assess net economic value of the commercial fishery. ISER has previously used the observed choices method as part of a cost-benefit analysis of groundfish management alternatives for the North Pacific Fishery Management Council (see NPFMC, 1992, listed at the end of this appendix).

Economic Impact Analysis

The ISER Cook Inlet Study economic impact analysis used the Alaska Input-Output Model, designed at ISER for analysis of the Alaska economy. The ISER Alaska I-O model is based on the BEA Regional Interindustry Modeling System II (RIMS II) method, but makes a number of additional adjustments, as described in Appendix I. We used the I-O model in combination with a commodity by industry matrix to allocate sport fishing expenditures to industries within the Alaska I-O model. Sport fish expenditure data were based primarily on angler surveys.

Jones & Stokes used the BEA's RIMS II method to construct the I-O model for their study of the economic impacts of sport fishing in Southeast Alaska, but made fewer adjustments to the coefficients than we did. Jones and Stokes' Southcentral I-O study adjusted the BEA's national I-O table using an earlier version of RIMS to develop input-output models for the Anchorage area, the Kenai Peninsula, the rest of Alaska, and outside Alaska. Both studies used angler and business surveys to make additional adjustments for the principal industries serving recreational anglers.

The E3 Consulting Kenai Peninsula Study examined only economic impacts on the Kenai Peninsula Borough economy. Expenditure data for the recreational fishery were based primarily on information collected for the Jones and Stokes Southcentral study as well as ADF&G harvest data and expenditure data reported in the Central Kenai Peninsula Commercial Fishing Study (Coughenower, 1989). The E3 study used the Alaska Fisheries Economic Assessment Model (AFEAM), an input-output model developed originally for the Alaska Sea Grant program for the purpose of assessing economic impacts of commercial fisheries. AFEAM is based on the U.S. Forest Services IMPLAN model, which uses a different procedure from RIMS II for adjusting the national input-output table (see Jensen, 1992).

Table L-4 compares the estimated statewide economic effects per dollar of sport angler spending implied by the ISER Cook Inlet study and the Jones & Stokes studies. In the ISER Cook Inlet study and the Jones & Stokes Southeast study, each dollar of angler expenditures had roughly similar impacts on Alaska output, earnings and jobs. In the Jones and Stokes Southcentral Study, economic impacts per dollar of combined resident and non-resident expenditures were roughly twice as high as for resident expenditures in the ISER Cook Inlet Study, and roughly 50 percent higher than for non-resident expenditures in the ISER Cook Inlet Study. However, the Jones & Stokes Southcentral study estimated economic impacts for all southcentral fisheries, not just the Kenai River.

Sport Fishing Net Economic Value and Impacts

Both of the Jones and Stokes studies focused primarily on the *total economic value and total economic impacts* associated with sport fishing sites and species, while the ISER study focused on the *change in economic value and economic impacts* associated with a change in the number of fish (and thus the quality of the sport fishing experience) at particular sites.

Estimates of total economic value--or average economic value per day or trip or fish harvested--are not directly comparable with estimates of changes in net economic value from all sites such as were developed for the ISER Cook Inlet study. This is because changes in fishing conditions at any particular site may affect the net economic value of not only that site but also at other sites, due to reallocation of trips among sites.

More specifically, if part or all of the fishing at any particular site were to disappear, some of the anglers who would have fished that site may instead fish at other, remaining sites. Similarly, if fishing improves at a particular site, some of the additional fishing at that site may represent fishing reallocated from other sites.

Although they focused primarily on assessing total economic value and total economic impacts, both Jones and Stokes studies included case studies of the economic effects of changing specific sport fishing opportunities. These are the parts of the analysis that are most directly comparable to the ISER Cook Inlet study sport fishery analysis.

The Jones & Stokes Southeast study examined the change in economic value and economic impacts associated with closing the king and silver salmon fishery in the Juneau Area (Doty's Cove to Point Retreat) for a five week period during the summer. The study summarized the results of this analysis as follows:

Closing site E-1 (Juneau Marine: Doty's Cove to Point Retreat) in the Juneau area from July 7 through August 10 ... for king and silver salmon fishing by resident anglers ... results in an estimated reduction of 1,902 trips (.26 trips per household multiplied by 7,314 households) and $1.4 million ($191.88 per household multiplied by 7,314 households) in net WTP...

Table L-4. Selected Economic Studies of Alaska Fisheries: Comparison of Estimated Economic Impacts per Dollar of of Sport Angler Spending

Study	Type of expenditure	Expenditures in Alaska	Estimated Total Statewide Economic Impact			Estimated Statewide Economic Impact per $ of Spending			Reference pages in study
			Output	Earnings	Jobs	Output/$	Earnings/$	Jobs/$ mill.	
ISER Cook Inlet	Change in resident expenditures, Kenai River	$557,341	$435,535	$138,387	6.5	$0.78	$0.25	11.7	Tables VII-5a, 5b
	Change in resident expenditures, other sites	-$448,671	-$395,155	-$120,984	-5.7	$0.88	$0.27	12.7	Tables VII 5a, 5b
	Change in non-resident expenditures, Kenai River	$2,141,961	$2,896,855	$974,925	45.1	$1.35	$0.46	21.0	Table VII-12
Jones & Stokes Southeast	Total resident expenditures, SE sport fishing	$38,880,593							7-5 (Table 7-3)
	Total non-resident expenditures, SE sport fishing	$22,384,461							7-9 (Table 7-6)
	Total expenditures, SE Sport Fishing	$61,265,054	$65,958,660	$22,479,750	948.1	$1.08	$0.37	15.5	7-35 (Table 7-24)
	Change in resident expenditures, Juneau king. coho salmon fishery	-$55,500	-$56,740	-$21,491	-0.8	$1.02	$0.39	14.4	8-15, 8-20
Jones & Stokes Southcentral	Total resident expenditures, SC sport fishing	$72,400,000							4-3 (text)
	Total non-resident expenditures, SC sport fishing	$20,800,000							4-3 (text)
	Total expenditures, SC Sport Fishing	$93,200,000	$206,178,000	$65,276,000	2840.0	$2.21	$0.70	30.5	4-15 (Table 4-10)

ISER file: Other studies-Effects/$.

Due to a reduction in participation of about 1.8%, Juneau area resident anglers would spend about $55,500 less at angler-serving businesses in Southeast Alaska. This result does not explicitly consider the possibility of substitute spending, however, for other goods and services unrelated to sport fishing. If some residents make other such purchases in lieu of sport fishing, the impacts... would be attenuated.

Without substitute spending, the $55,500 impact on Southeast Alaska angler-serving businesses would reduce employment at these businesses by the equivalent of less than one full-time job, and earnings would decrease by about $15,000... Total employment impacts would be equivalent to less than one full-time job and total earnings impacts would be about $21,000.

The Jones & Stokes Southcentral study analysis of the effects of closing the Kenai River fishery for a week was computationally more difficult due to the more complex travel cost model structure that was used:

The procedures for estimating the impact on the overall level and allocation of sport fishing activity by resident anglers are straightforward in principle but computationally demanding in practice... (One effect) is to reduce the overall attractiveness of sport fishing during that week, and, hence, the total number of fishing trips . . . The other effect is to reallocate the (reduced) number of trips to other subspecies of salmon . . . and other macrospecies of fish. It is relatively easy to estimate the reduction in the weekly number of fishing trips for resident anglers . . . It is more difficult to estimate the reallocation of trips to other species and subspecies . . . (pages 9-3, 9-4).

Tables L-5 compares the estimated changes in angler trips and the estimated changes in net economic value for the ISER Cook Inlet Study and the Jones and Stokes studies. Table L-6 compares estimated changes in resident angler expenditures and economic impact. For all three studies, the estimated changes are of similar orders of magnitude.

In the ISER Cook Inlet study, the net change in fishing trips was 16 percent of the change in Kenai River trips. In both Southcentral studies, the net change in trips was 20 percent of the changes in the specific fishery for which fishing opportunities were changed. Thus all three studies estimated that one consequence of changes in resident fishing opportunities would be a substantial reallocation of resident sport fishing effort.

Table L-5. Selected Economic Studies of Alaska Fisheries: Comparison of Estimated Change in Sport Fishing Net Economic Value After Accounting for Redistribution of Sport Angler Trips

Study	Fishery	Net change in angler trips	Net change in trips as % of gross change for fishery for which conditions changed	Change in net economic value	Source pages in study
ISER Cook Inlet	Kenai River trips	4,045			
Study	Trips to other sites	-3,399			
	Net change	646	16%	$1,345,291	Table VI-5
Jones & Stokes	Juneau area king/silver fishery (a)	-9,435			8-16
Southeast Study	Trips to other sites (b)	7,533			(see notes)
	Net change (c)	-1,902	20%	-$1,400,000	8-15
Jones & Stokes	Kenai King Salmon trips, week 13	-3,543			9-6 (Table 9-3)
Southcentral Study	Trips to other sites, week 13	2,847			9-6 (Table 9-3)
	Net change	-696	20%	-$482,200	9-1

(a) Change in angler trips to Juneau area calculated from Table 8-8 on pages 8-16 to 8-18 of Jones and Stokes Study. (b) Calculated as difference between net change in trips and change in Juneau area trips. Could not be calculated directly from Table 8.8 due to the fact that changes in trips were rounded to zero for many less frequently visited sites. (c) Calculated from figure reported on page 8-15 of Jones & Stokes study. ISER file: Other studies-net ec value.

Table L-6. Selected Economic Studies of Alaska Fisheries: Comparison of Estimated Economic Impacts of Net Changes in Resident Expenditures After Accounting for Redistribution of Sport Angler Trips

Study	Fishery	Net change in angler trips	Change in resident angler expenditures	Estimated statewide economic impacts of changes in resident expenditures			Source pages in study
				Output	Earnings	Jobs	
ISER Cook Inlet	Kenai River trips	4,045					Table VI-5
Study	Trips to other sites	-3,399					Table VI-5
	Net change	646	$108,669	$40,380	$17,404	0.8	Table VII-5b
Jones & Stokes	Juneau area king/silver fishery (a)	-9,435					
Southeast Study	Trips to other sites (b)	7,533					
	Net change (c)	-1,902	-$55,500	-$56,740	-$21,491	-0.8	8-15, 8-20
Jones & Stokes	Kenai King Salmon trips, week 13	-3,543					9-6 (Table 9-3)
Southcentral Study	Trips to other sites, week 13	2,847					9-6 (Table 9-3)
	Net change	-696	-$100,700				9-8 (Table 9-4)

(a) Change in angler trips to Juneau area calculated from Table 8-8 on pages 8-16 to 8-18 of Jones and Stokes Study. (b) Calculated as difference between net change in trips and change in Juneau area trips. Could not be calculated directly from Table 8.8 due to the fact that changes in trips were rounded to zero for many less frequently visited sites. (c) Calculated from figure reported on page 8-15 of Jones & Stokes study. ISER file: Other studies-net ec impact.

Commercial Fishing Economic Impacts

None of the studies which looked at economic impacts of commercial fishing presented results which are directly comparable with those of the ISER Cook Inlet study. The E3 Consulting Kenai River study combined the estimated economic impacts of a decline in the sockeye run on both the sport and commercial fisheries. The McDowell Seafood Industry Study and the ISER Commercial Fishing Industry Study did not estimate economic effects specifically for the sockeye fishery or for the Kenai Peninsula Borough.

Other Studies

Listed below are several additional studies which included analysis of economic effects of Alaska sport or commercial fisheries.

Boyce, John. 1993. Estimating Commercial Fishing Costs in Alaska. *Marine Resource Economics*, Volume 8, No. 4. Estimates harvesting costs for nine commercial salmon fleets in Alaska based on participation rates.

Coughenower, D. Douglas. 1989. *Central Kenai Peninsula Commercial Fishing Study.* Alaska Sea Grant Program Marine Advisory Bulletin No. 39. Examined the economic impact of commercial fishing on the city of Kenai and the central Kenai Peninsula. Estimated employment attributable to commercial fishing and fish processing.

Jensen, William S. 1992. "Evaluating the Economic Impact of Natural Resource Harvests," in North Pacific Fishery Management Council , *Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea/Aleutian Islands and the Gulf of Alaska.* Describes the methodology for constructing the Alaska Fisheries Economic Assessment Model (AFEAM).

Jones and Stokes Associates, Inc. 1987. *Juneau Area Sport Fishing Economic Study.* Prepared for Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section. Estimated expenditures, non-market values, and economic impacts associated with Juneau area sport fisheries.

Knapp, Gunnar; Matt Berman; Steve Colt; Eric Larson, Teresa Hull, Alexandra Hill, and Elizabeth Tower. 1993. *Economic Impacts of the Copper River Highway.* Prepared for the Alaska Department of Transportation and Public Facilities by University of Alaska Institute of Social and Economic Research. Included a travel cost analysis of how construction of the Copper River highway would affect sport fishing trips to the Cordova area.

Layman, Craig. 1994. The Economic Value of the Recreational King Salmon Fisheries of the Gulkana and Klutina Rivers, Alaska. Masters thesis, University of Alaska Fairbanks. Uses a travel cost model to estimate consumer demand for sport fishing. Incorporates contingent behavior questions about number of trips anglers would take if management conditions changed into the travel cost analysis.

McDowell Group. 1989. The Economic Impacts and Condition of the Alaska Salmon Troll Fleet. Prepared for the Alaska Trollers Association. Includes estimates of economic impacts of the Southeast Alaska troll fishery.

NPFMC. 1992. *Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for the Exclusive Area Registration Proposal in the Bering Sea/Aleutian Islands* *and the Gulf of Alaska* . Prepared for North Pacific Fishery Management Council by University of Alaska Anchorage Institute of Social and Economic Research. Used observed choices method to model changes in net economic benefits in the groundfish fishery.

Pacific Associates. 1994. The Economic Impact of the Shoreside Processing Industry Upon Alaska During 1992. Prepared for the Pacific Seafood Processors Association. Includes estimates of direct economic impacts of the Kenai/Cook Inlet processing industry.