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Economic Benefits Accruing to Sport Fisheries on the Lower Kennebec River from the Provision of Fish Passage at Edwards Dam or from the Removal of Edwards Dam

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ECONOMIC BENEFITS ACCRUING TO SPORT FISHERIES ON THE LOWER KENNEBEC RIVER FROM THE PROVISION OF FISH PASSAGE AT EDWARDS DAM OR FROM THE REMOVAL OF EDWARDS DAM[1]

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EXECUTIVE SUMMARY

ECONOMIC BENEFITS ACCRUING TO SPORT FISHERIES ON THE LOWER KENNEBEC RIVER FROM THE PROVISION OF FISH PASSAGE AT EDWARDS DAM OR FROM THE REMOVAL OF EDWARDS DAM

The overall objective of the research reported herein is to estimate the monetary values anglers place on improved sport fisheries on the lower Kennebec River, from Milstar Dam in Waterville to Chops Point at the Head of Merrymeeting Bay. The objectives for this research, as amended in the August 1990 contract between the University of Maine and the Maine Department of Marine Resources, are:

1. Estimate the economic benefits of improved sport fisheries in the lower Kennebec River watershed with fish passage provided at Edwards Dam in Augusta, Maine; and

2. Estimate the economic benefits of improved sport fisheries in the lower Kennebec River watershed with removal of Edwards Dam in Augusta, Maine.

Providing fish passage or removing Edwards Dam will result in costs borne by the owners of Edwards Dam and the citizens of Maine. Estimation of the benefits accruing to sport fisheries from either of these changes can be used in trade-off analyses designed to determine whether providing fish passage or removing Edwards Dam is economically feasible.

The values to be estimated are what economists refer to as Hicksian surplus measures of value; the maximum payment an individual would make to have fisheries improved from the status quo to the improved level of quality. That is, the payment is the amount of money that makes the person indifferent between having improved fisheries and less income available versus the existing fisheries and having full income available.

In the current study we estimate values for two changes from the status quo: 1) provision of fish passage and 2) removal of the dam. The provision of fish passage will enhance sport fishing for selected species. Removal of the dam will result in a larger enhancement of fisheries than simply providing fish passage. Fish passage is never 100 percent effective in providing upstream or downstream passage. Thus, fish mortality is expected to be higher for the fish passage condition. In addition, some species of fish do not use fishways (e.g., striped bass), and will not benefit from simply providing fish passage. The increase in the fishable riverine habitat without the dam is expected to be more desirable than the loss of reservoir fishing behind the dam. There are limited stretches of free flowing rivers that are fishable in Maine. In contrast, dams on all of Maine's major rivers provide for many substitute opportunities for reservoir fishing. In fact, anglers can simply move above Milstar Dam in Waterville and fish a reservoir environment on the

Kennebec River. Given the above considerations, we propose that fishing quality with the provision of fish passage is less than fishing quality with removal of Edwards Dam. In turn, we hypothesize that the economic benefit of improving fishing by the removal of Edwards Dam exceed the economic benefit from simply providing fish passage.

Hicksian surplus was estimated using contingent valuation (Cummings, Brookshire and Schulze, 1986; Mitchell and Carson, 1989). This is a direct questioning technique used to reveal the dollar value people place on the object being evaluated. Contingent valuation has been applied to evaluate a number of nonmarket commodities, one of which is sport fishing. Studies to validate contingent valuation estimates, by concurrently employing contingent valuation and conducting actual cash transactions, reveal that contingent valuation can accurately estimate values for users of a resource (Dickie, Fisher and Gerking, 1987; Heberlein and Bishop, 1986; Welsh, 1986). Furthermore, recent research indicates that users of a resource can evaluate changes in the quality of the resource that they have not experienced (Bishop et al., 1987; Boyle, Welsh and Bishop, 1991). Finally, contingent valuation is an accepted method of estimating values for water resource projects (Water Resources Council, 1983) and in natural resources damage assessment (Desvousges, Dunford and Domanico, 1989). For these reasons, contingent valuation was selected as the appropriate technique for estimating values from improved sport fisheries on the lower Kennebec River.

In the study, a sample of anglers holding a Maine inland fishing license, evaluated two separate scenarios for improving sport fisheries on the lower Kennebec River: 1) provision of fish passage; and 2) removal of Edwards Dam. These scenarios were described in terms of effects each option would have on five species of fish: Atlantic salmon, striped bass, rainbow smelt, American shad and brown trout. In the current study we used an "open-ended" questioning format to ask the contingent valuation questions for Scenario I and Scenario II. The "open-ended" question directly asks respondents to state the maximum they would pay for the change being evaluated. Respondents' answers to the question are interpreted as individual statements of the value where they would be indifferent between the proposed change and the status quo. Respondents' answers to the contingent-valuation question are averaged across the sample to derive an estimate of the mean value per person for all individuals in the group affected by the proposed change.

Economic valuation data were collected by administering a mail survey to three independent samples of anglers who held a Maine inland fishing license: 1) resident anglers from communities adjacent to the lower Kennebec River, 2) resident anglers from all other communities within Maine, and 3) nonresident anglers. Of the 313,000 individuals who held a 1988 Maine fishing license, 12,771 were adjacent anglers, 202,166 were nonadjacent anglers and 98,063 were nonresident anglers. From

among these license holders, a total of 810 anglers were randomly selected with each subsample containing 270 anglers. The final response rate to the mail survey, including responses to the mail survey after a telephone prompt and telephone interview, was 72 percent for adjacent anglers, 60 percent for nonadjacent anglers and 67 percent for nonresidents.

Mean Hicksian surplus for the provision of fish passage at Edwards Dam ranges from $5.59 for nonresident anglers to $15.81 for adjacent anglers. All three estimates are significantly different from zero. In turn, provision of fish passage will significantly affect the values anglers hold for fishing the lower Kennebec River. Furthermore, the adjacent and nonadjacent means are not significantly different at the 10 percent level. Nor are the nonadjacent and nonresident means significantly different at the 10 percent level. However, the adjacent mean is significantly larger than the nonresident mean at the 10 percent level. An important result is that 41 percent of adjacent community respondents, 60 percent of other community respondents and 70 percent of nonresidents answered zero to the open-ended valuation question for Scenario I, indicating that they do not place any value on the improved fisheries resulting from the provision of fish passage at Edwards Dam.

Moving to Scenario II, the open-ended means range from $10.45 for nonresidents to $15.97 for respondents from adjacent communities. Estimated mean Hicksian surplus is not significantly different across the three subsamples for Scenario II. In addition, 45 percent from the adjacent sample, 62 percent of the nonadjacent sample and 67 percent of the nonresident sample said they would not pay anything for improved sport fisheries proposed under Scenario II.

The most important implication of these findings is a comparison of the results for Scenario I with the results for Scenario II. That is, the difference in the Hicksian surplus estimates between Scenarios I and II provides estimates of the additional sport fishing benefits accruing to individuals in each sample from the additional increment in fishing quality provided by the removal of Edwards Dam. Pair-wise comparisons of the open-ended means for each of the three subsamples indicate the Hicksian surplus estimates for Scenario I are not significantly different from the Hicksian surplus estimates for Scenario II at the 10 percent level. Thus, the null alternative of our second hypothesis can not be rejected, the angling benefits from removing the dam do not exceed the angling benefits from providing fish passage. In addition, self-reported participation rates are not significantly different between Scenario I and Scenario II. These findings lead us to conclude that providing fish passage and removing Edwards Dam each provide exactly the same sport fishing benefits to licensed Maine anglers. Furthermore, we interpret this finding to imply that the marginal value of the additional increase in sport fishing quality provided by removal of the dam is $0, i.e. the marginal value accruing to the differences in sport fishing quality as described

in Scenario II versus Scenario I. We suspected that one reason for this finding might be that the average age of respondents was 43 years of age. Improved sport fisheries would be realized between 1999 and 2020. Over this period of time, the average age of respondents would progress to 73 years of age in 2020, and it is likely that the average respondent may no longer fish in Maine. In turn, we stratified our sample by age. One group contained anglers less than 40 years of age and the other group contained anglers 40 years of age and older. For both of these subsamples, we found that the Hicksian surplus estimates for Scenario I were not statistically different from the Hicksian surplus estimates for Scenario II at the 10 percent level.

Using the estimated means from Scenario I and assigning a value of $0 to individuals who did not respond to the survey, we propose that the aggregate annual benefit of improving sport fisheries in the lower Kennebec River via increased management and provision of fish passage is $1.49 million per year ($0.12 million for adjacent anglers, $1.06 million for nonadjacent anglers and $0.31 million for nonresidents) regardless of whether fish passage is provided or Edwards Dam is removed. A 90 percent confidence interval on this aggregate figure provides a low estimate of $0.81 million and a high estimate of $2.18 million.

Anglers responding to the survey are primarily interested in Atlantic salmon and brown trout, both of which use fishways. In turn, angling benefits for Atlantic salmon and brown trout could be realized whether fish passage is provided or the dam is removed. Rainbow smelt and striped bass do not use fishways. However, our results indicate only moderate angler interest in rainbow smelt, and angler interest in this species may be satisfied by the current rainbow smelt fishery in the lower Kennebec River. Angler interest in striped bass is somewhat stronger than it is for rainbow smelt, but lower than angler interest in Atlantic salmon and brown trout. We suspect that anglers did not respond to the increase in striped bass fishing quality due to removal of the dam because of the large minimum length on striped bass. Currently, the minimum length for keeping striped bass is 36 inches and it is unlikely that this regulation will change even if a native population of striped bass is established in the lower Kennebec River. Finally, American shad use fishways, but anglers expressed very little interest in an American shad fishery. We conclude, therefore, that most of the $1.49 million benefit estimate accrues to improved Atlantic salmon and brown trout fishing, and this component of the benefit estimate is realized regardless of whether fish passage is provided or the dam is removed.

The finding that anglers are indifferent between providing fish passage at Edwards Dam and removing the dam is fairly robust. That is, we considered angler preferences in three different dimensions. First, anglers were asked qualitative questions regarding each option. Second, anglers responded to a contingent-valuation question for each option. Finally, anglers reported their predicted participation in the lower Kennebec

River sport fishery under each option. This convergent validity, three different types of evaluations providing similar statistical results, strongly indicates anglers are indifferent between the provision of fish passage at Edwards Dam or removing the dam itself. The only exception is the sample of anglers from adjacent communities. These anglers, in responding to the qualitative evaluation questions, expressed a preference for fish passage over dam removal.

The benefit estimate of $1.49 million must be interpreted as being conservative because we did not survey anglers who marine sport fish and who do not hold a Maine inland fishing license. That is, anglers are not required to hold an inland fishing license when fishing below the head of tide on Maine's coastal brooks, streams and rivers. In turn, anglers fishing the lower Kennebec below Edwards Dam are not required to purchase a fishing license. Unfortunately, there is no uniform list from which to draw a sample of anglers who currently fish the lower Kennebec River and who do not hold a Maine fishing license. In an attempt to address this issue, we over sampled resident anglers from communities adjacent to the lower Kennebec River. This strategy provided a subsample of anglers who currently fish the lower Kennebec River. We found that these anglers who do fish the lower Kennebec River are also indifferent between the provision of fish passage or the removal of Edwards Dam. We suspect this finding is likely to be true of all anglers who marine sport fish in Maine; some will value improved sport fishing on the lower Kennebec, but as a group they will be indifferent between fish passage or dam removal.

An additional aspect of our sampling scheme is that we sampled resident and nonresident anglers who currently fish in Maine and who do not fish the lower Kennebec. We propose that anglers currently fishing in Maine are the individuals most likely to take advantage of improved sport fishing on the lower Kennebec River. These anglers demonstrate a moderate interest in fishing the lower Kennebec River, but are indifferent between the provision of fish passage and the removal of Edwards Dam.

Our basic interpretation is that improved sport fishing on the lower Kennebec River can provide a specialized fishery for a select group of anglers. In fact, if improved sport fisheries were put forward as a referendum vote of all Maine anglers, and approving the referendum implied that all anglers would share in the cost of improving these fisheries, our results indicate that the referendum would be soundly defeated. This is true, however, of most sport fisheries in that only a small proportion of all anglers fish any given fishery. In the current example, one must ask whether the benefits of improved sport fishing are worth the costs to the citizens of Maine from the provision of this fishery. Given that anglers appear to be indifferent between the provision of fish passage and the removal of Edwards Dam, the option with the largest positive, net present value should be selected. Net benefits -- benefits minus costs -- will be different between these alternatives due to different streams of

costs through time. Provision of fish passage includes the costs of constructing and maintaining a fishway. Whereas, removal of the dam requires a one time cost of removing Edwards Dam and includes the opportunity cost of replacing the electricity that would have been generated at the dam's power station. Fishery management costs will also be different according to whether fish passage is provided or the dam is removed. We should also note that any fish passage option that accomplishes the fishery management objectives in our first scenario would be consistent with the annual benefit estimate of $1.49 million. A fish passage system, that meets these objectives, should be selected to minimize costs and to meet the biological needs of the species using the fishway.

One final issue is worth noting, we did not consider the economic impact of improved sport fishing on the lower Kennebec River. This was done because we are considering the benefits of improved fisheries from a state-wide perspective. We expect that resident angler participation in an improved sport fishery in the lower Kennebec River will result in anglers switching from fishing other locations in Maine to fishing the lower Kennebec. For example, an Atlantic salmon angler may fish the lower Kennebec rather than the lower reaches of the Penobscot River. Thus, money spent by resident anglers in communities along the lower Kennebec River is likely to result in reduced angler expenditures in other communities in Maine. The Maine economy, as a whole, has not gained, rather angler expenditures are redistributed within the state. This treatment of angler expenditures (direct economic impact) is consistent with the federal guidelines for evaluating water resource projects (Water Resources Council, 1983). Finally, nonresident expenditures, although representing new money in Maine's economy, are likely to be relatively small. In the 10 to 30 years it will take to establish improved sport fisheries on the lower Kennebec River, we do not see nonresident angler participation exceeding the roughly 300 nonresident anglers who currently fish the Penobscot River for Atlantic salmon each year. In fact, some nonresident anglers may actually switch from the Penobscot River to the lower Kennebec River. If this type of substitution occurs, the resulting nonresident expenditures along the lower Kennebec River can not be considered new money in Maine's economy.

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Introduction

A 1987 "Agreement Between the State of Maine and the Kennebec Hydro Developers Group" stipulates that fish passage will be provided on the Kennebec River, above Augusta, and on the Sebasticook River by May 2000. This agreement will allow fish to migrate to the upper reaches of the Kennebec and into the Sebasticook and Sandy rivers. The agreement, however, does not include Edwards Dam in Augusta, the first dam on the mainstream of the Kennebec River. For the agreement to become fully functional from a fisheries management perspective, fish passage must be provided at Edwards Dam to allow anadromous species to migrate upstream to spawning grounds and to allow indigenous species to move between the riverine environment and estuary below the dam at the head of Merrymeeting Bay.

The overall objective of the research reported herein is to estimate the monetary values anglers place on improved sport fisheries on the lower Kennebec River, from Milstar Dam in Waterville to Chops Point at the Head of Merrymeeting Bay (Figure 1).[1] The objectives for this research, as amended in the August 1990 contract between the University of Maine and the Maine Department of Marine Resources, are:

1. Estimate the economic benefits of improved sport fisheries in the lower Kennebec River watershed with fish passage provided at Edwards Dam in Augusta, Maine; and

2. Estimate the economic benefits of improved sport fisheries in the lower Kennebec River watershed with removal of Edwards Dam in Augusta, Maine.

Providing fish passage or removing Edwards Dam will result in costs borne by the owners of Edwards Dam and the citizens of Maine. Estimation of the benefits accruing to sport fisheries from either of these changes can be used in trade-off analyses designed to determine whether providing fish passage or removing Edwards Dam is economically feasible. In the remainder of this report we present the procedures used to meet the valuation objectives and the valuation estimates for each objective.

Specification of Values to be Estimated

The economic value of any item -- improved sport fishing here -- is a direct extension of the preferences of individuals who place a monetary value on the object. That is, if no one will pay even a very small amount for improved sport fishing on the lower Kennebec River, then an economist might propose that such a change would not have any economic value, i.e., the

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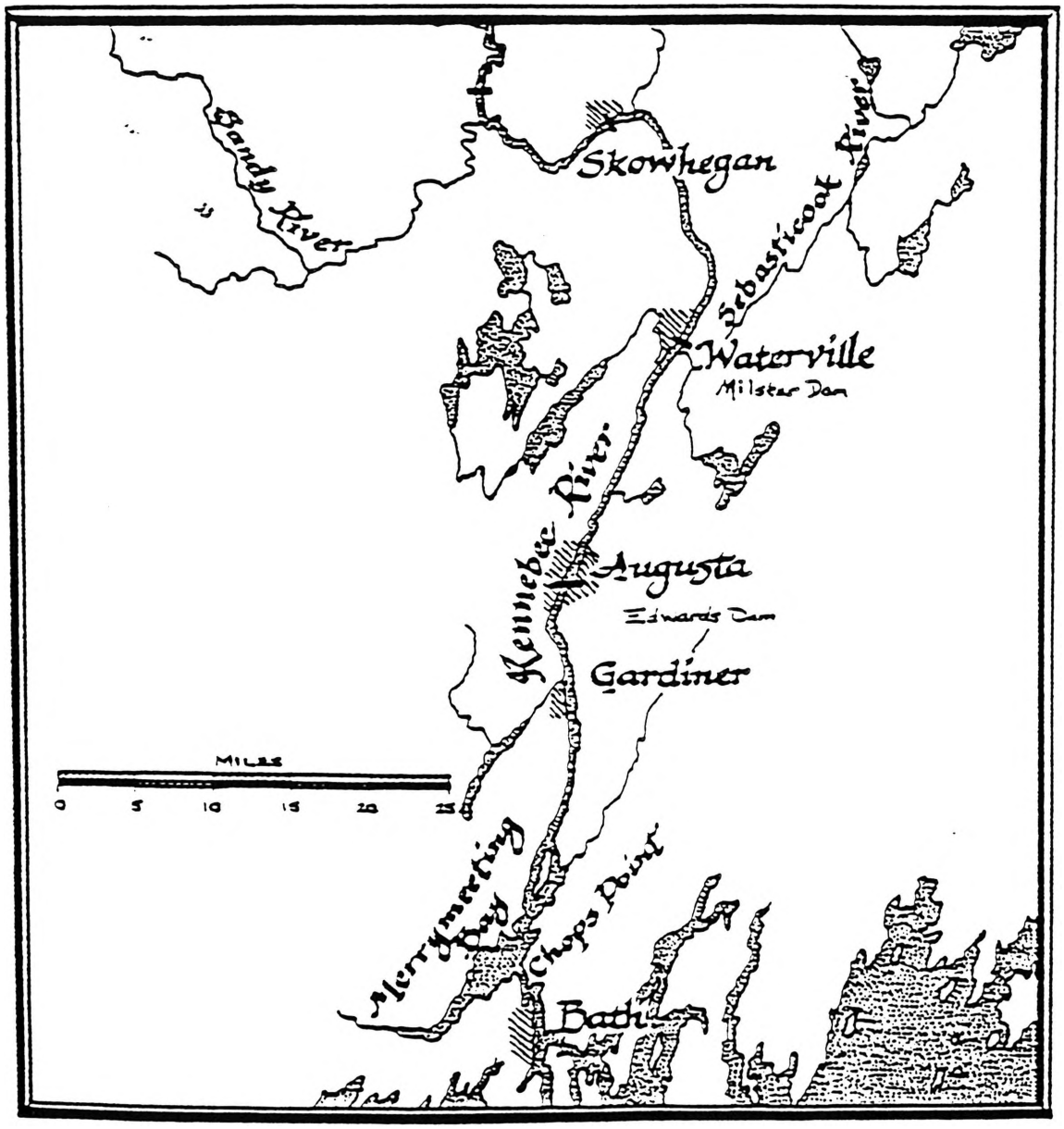
[1] Milstar Dam is the next dam on the Kennebec River above Edwards Dam; Chops Point marks the confluence of the Androscoggin and Kennebec rivers in Merrymeeting Bay.

Figure 1. Map of the Lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay.



marginal benefit of improved sport fisheries is $0. Conversely, if one or more people place a positive dollar value on improved sport fishing on the lower Kennebec River, the aggregate economic value of this improvement is derived by adding the values of all individuals who place a positive value on the improvement. Aggregate value, therefore, is enhanced when larger numbers of people place a value on improved fishing and/or when individuals place higher values on improved fishing.

For the current research, improved sport fisheries in the lower Kennebec River is the object of valuation. The increments being evaluated are movements from the status quo of sport fishing on this section of the river to: 1) angling after fish passage is provided at Edwards Dam; and 2) angling after Edwards Dam has been removed. The first change will affect sport fishing in that catch rates should be enhanced for selected species of fish. The second change will enhance catch rates for a larger number of species and will change the characteristics of fishing above the dam. That is, removal of the dam will allow small crafts to maneuver upstream and fishing will be changed from a reservoir environment to a riverine environment.

The literature on the economic valuation of sport fishing suggests three primary motivations for people placing a dollar value on fish stocks (Bishop, Boyle and Welsh, 1987; Randall, 1987). First, a logical presumption is that individuals currently fishing the Kennebec River might pay a positive amount to improve fishing. This is a value for a marginal increase in fishing quality, which is commonly referred to as a "marginal use value." Second, anglers who do not currently fish the lower Kennebec River may also pay some positive amount to have sport fishing improved. That is, these anglers who do not currently fish the lower Kennebec may find fishing desirable after fish stocks are enhanced, and they also place a marginal use value on improved fishing. Third, individuals who do not currently fish the lower Kennebec River and who will never fish the lower Kennebec may still value improved fisheries. This type of value is what economists commonly refer to as "existence value" (Krutilla, 1967; Randall and Stoll, 1983).

The basic premise of existence value is that even if all use opportunities are precluded -- use being fishing in the current example -- some individuals may still place a monetary value on improvements in fish stocks. Consider Atlantic salmon as an example. The Kennebec River watershed once supported a substantial population of Atlantic salmon. Due to the construction of dams, which preclude upstream passage to spawning grounds, and perhaps diminished water quality and extensive fishing effort on a declining stock, Atlantic salmon were extirpated from the Kennebec River watershed. Some people, who may or may not be anglers, may derive satisfaction from the knowledge that Atlantic salmon are restored to the watershed even if the salmon stock is not sufficient to support any type of fishing. The value these individuals attach to salmon restoration would be an existence value.

In short, we propose that individuals may hold two types of values for improved fisheries on the lower Kennebec River; a use value and an existence value. Furthermore, it is possible for any given person to hold both a use value and an existence value for improved fisheries on the lower Kennebec River (Boyle and Bishop, 1987). Anglers currently fishing this section of the river may hold both use and existence values, while individuals who will never fish the lower Kennebec may hold only existence values. Others who will never fish the river and do not care about the fish stocks in the river would not place any value on improved fisheries.

In the current study we will estimate the total value that an individual places on improved fisheries on the lower Kennebec River (Randall 1987). We estimate values from this perspective because use values and existence values, estimated singularly, can not be assumed to be additive and the existing literature does not provide a clear set of guidelines for aggregating these component estimates to obtain an estimate of total value for policy analyses (Boyle and Bishop, 1986).

The values we estimate can be defined as:

$$V(P_f, P, I-\theta; q', r) = V(P_f, P, I; q, r) \qquad (1)$$

where $V(\cdot)$ is an indirect utility function, P_f is the price of a fishing trip to the lower Kennebec River, P is a vector of prices for other goods and services an individual consumes, I is income, θ is the value the individual places on improved sport fisheries, q' is the quality of fishing after the improvement, q is the status quo of fishing quality ($q'>q$), and r is a vector of other quality attributes. The indirect utility function is a representation of the satisfaction an individual derives from consuming or using a variety of goods and services, with fishing being a publicly provided service. Satisfaction is expressed in terms of the constraints the individual faces when choosing among various goods and services; the cost of purchasing the items (prices), available income, and the exogenous quality of the goods and services.

The value to be estimated is what economists refer to as a Hicksian surplus measure of value.[2] It is the maximum payment an individual would make to have fisheries improved from the status quo (q) to the improved level of quality (q'). That is, θ is the amount of money that makes the person indifferent between having improved fisheries and less income available (q', I-θ) versus the existing fisheries and having full income available (q, I). Indifference is designated by the equal sign in equation (1). The left-hand side of the equation represents satisfaction

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[2] For a more general discussion see Boyle, Trefts and Hesketh (1988).

with improved fisheries (q') and the appropriate reduction in income (I-θ), and the right-hand side of the equation represents the status quo of fisheries (q) and full income (I) is available.

In the current study we estimate values for two changes from the status quo: 1) provision of fish passage; and 2) removal of the dam. The provision of fish passage will enhance sport fishing for selected species. In turn, we hypothesize:

$$Ho: \bar{\theta}(\text{passage}) \leq 0$$

versus

$$Ha: \bar{\theta}(\text{passage}) > 0$$

where $\bar{\theta}$(passage) is the estimated mean value for the change from the status quo to the provision of fish passage.

Removal of the dam will result in a larger enhancement of fisheries than simply providing fish passage. Fish passage is never 100 percent effective in providing upstream or downstream passage. Thus, fish mortality is expected to be higher for the fish passage condition. In addition some species of fish do not use fishways (e.g., striped bass), and will not benefit from simply providing fish passage.

The increase in the fishable riverine habitat without the dam is expected to be more desirable than the loss of reservoir fishing behind the dam. There are limited stretches of free flowing rivers that are fishable in Maine. In contrast, multiple dams on all of Maine's major rivers provide for many substitute opportunities for reservoir fishing. In fact, anglers can simply move above Milstar Dam in Waterville and fish a reservoir environment on the Kennebec River. In turn, we propose that q'(passage) is less than q'(without dam). In turn, we hypothesize that:

$$Ho: \bar{\theta}(\text{passage}) \leq \bar{\theta}(\text{without dam})$$

versus

$$Ha: \bar{\theta}(\text{passage}) > \bar{\theta}(\text{without dam})$$

where $\bar{\theta}$(without dam) is the mean value for the change from the status quo to removing the dam.

Procedures

Data to address the research objectives was collected by conducting a survey of anglers holding a Maine inland fishing license. The survey is designed to collect three types of data:

1. Angling and socioeconomic characteristics of respondents;

2. Respondents' current use of the lower Kennebec River; and

3. Respondents' evaluations of providing fish passage at Edwards Dam or removing Edwards Dam.

Angling and socioeconomic characteristics collected include: 1) when respondents first fished in Maine; 2) how often they fish; 3)what type of water they fish most often; and 4) the species of fish they try to catch (Appendix A).

Fishing effort data was collected for two sections of the lower Kennebec River: fishing from Milstar Dam in Waterville to Edwards Dam in Augusta; and fishing from Edwards Dam downstream to Chops Point at the head of Merrymeeting Bay. This split was made because Edwards Dam prevents anglers from moving freely between these two sections of the river and a Maine fishing license is required to fish above the dam. Furthermore, a reservoir fishing experience is available upstream from the dam, while anglers fish a riverine/estuarine environment downstream. These differences limit an angler's ability to fish both stretches of the river on the same day, affect how they fish the river, and dictate the species anglers are able to catch. Within this section of the survey we asked anglers how frequently they fish, what species they try to catch, the economic value they currently place on fishing the lower Kennebec, and to identify problems they perceive when fishing this section of river (Appendix A).

Evaluations of the two scenarios for enhancing sport fisheries were accomplished by having respondents answer questions providing qualitative ratings of the proposed changes, by having them provide estimates of how much they might fish the lower Kennebec if either of the changes were implemented, and by asking anglers to reveal the values they place on the proposed changes (Appendix A).

To insure that the survey questions were understandable to respondents, the questionnaire was pretested with a sample of 50 licensed anglers. Responses to this pretest survey and follow-up telephone conversations with pretest respondents were used to remove any difficulties respondents might have encountered when answering the survey questions.

Scenario Design

In order to have anglers provide informed evaluations of improved fisheries, it was necessary to include written descriptions (scenarios) in the survey explaining the effects of the proposed changes. The effects of providing fish passage or removing the dam were described in terms of changes in the stocks of Atlantic salmon, striped bass, rainbow smelt, American shad and brown trout.

At the outset of the study a number of species were identified as being potentially affected by the provision of fish passage at Edwards Dam or the removal of the Edwards Dam (KRC, 1986). Over 30 species of fish were identified in the KRC report entitled "The Fisheries Resources of the Kennebec River," with 11 being considered for evaluation in the present study. The list of 11 species was reduced to the five listed above based on three factors:

1. impact of passage or dam removal on species;

2. potential of species to contribute to a sport fishery; and

3. level of public interest in the species.

The six species eliminated from further consideration are alewives (low sport fishery potential), American eel (low sport fishery potential), Atlantic and shortnose sturgeon (rare and endangered status, respectively, makes potential for sport fishery low in the near future), largemouth bass (no consensus on the effects of passage or dam removal, and multiple substitute fishing opportunities), and smallmouth bass (no effect of passage or dam removal, and multiple substitute fishing opportunities) (Boyle et al., 1989).

To begin the evaluations, we provided respondents with background information regarding the issue of fish passage at Edwards Dam. The text for this component of the survey is replicated below:

> Historically, the Kennebec River supported abundant populations of Atlantic salmon, striped bass, American shad, rainbow smelt and alewives. The populations of these species, and other native species of the Kennebec River, declined as dams were built, blocking upstream and downstream passage to spawning and feeding grounds, and as the water quality of the Kennebec River declined due to industrial and municipal discharges. However, over the past 20 years the water quality of the Kennebec River has improved to a level where it is again able to support many species of fish. In fact, the Maine departments of Marine Resources and Inland Fisheries and Wildlife have implemented programs to increase fishery resources in the Kennebec River.

In 1987, the owners of several major dams on the Kennebec River agreed to provide permanent upstream and downstream fish passage on the Kennebec River and its tributaries. However, Edwards Dam in Augusta, which is the first dam on the Kennebec River, was not part of the agreement, and no fish passage exists at Edwards Dam. The first dam subject to the agreement is Milstar Dam in Waterville. Unless fish passage is provided at Edwards Dam, the agreement among dam owners to provide permanent fish passage further upriver is irrelevant.

Two options are available that would provide access to upstream spawning and feeding habitat on the Kennebec River. One option is to build fish passage facilities at Edwards Dam in Augusta. According to fishery biologists, fish passage facilities would provide access to upstream habitat for some fish species, but not for others. Another option would be to remove Edwards Dam entirely from the lower Kennebec River. This would provide access up to Milstar Dam in Waterville for all species. Either of these actions could help to improve sport fishing in the lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay. However, the effects of each of these actions may be quite different.

Three types of information are provided in this statement: a brief history of fisheries management on the Kennebec River; the issue regarding fish passage at Edwards Dam; and the two options to be evaluated (fish passage and removal of the dam). These statements were presented concisely so they fit on one page of the survey.

A number of assumptions underlie the information we provided respondents.

1. The water quality in the Kennebec River will not be degraded below its current level (See Gagnon, 1989). A substantial reduction in water quality could potentially neutralize any gains made in fisheries management via the provision of fish passage or removing the dam. Given existing water quality legislation and the current political environment, we believe maintaining the current level of water quality in the Kennebec River a reasonable assumption.

2. Improved fisheries can only be accomplished with the provision of fish passage or the removal of the dam and increased fisheries management efforts. In the introductory statement we tell respondents that programs currently exist to enhance fisheries in the

Kennebec and we include the need for fisheries management in species-specific scenario descriptions of the effects of fish passage or the removal of Edwards Dam.

3. As noted in the introduction, upstream passage will be provided beyond Waterville according to the Kennebec Hydro Developers agreement with the Maine Attorney General's Office.

4. Jurisdictional boundaries of Departments of Marine Resources and Inland Fisheries & Wildlife will be ignored. Solving this issue is a cost which can be counted against the benefit estimates of improved sport fisheries.

5. Hatchery stock for the Kennebec River is not a binding constraint on improved sport fisheries. Expanding hatchery stock or shifting the emphasis of existing hatchery programs are costs that can be counted against the benefit estimates of improved sport fisheries.

Using these assumptions, we estimate the economic values that licensed Maine anglers hold for improved sport fisheries on the lower Kennebec River.

The next step was to explain the effects of providing fish passage in terms of the five species identified above. Background information on the species specific information presented to respondents can be found in Appendix B. Scenario I, describing the effects of fish passage, was presented to respondents in the following manner.

SCENARIO I

FISH PASSAGE AT EDWARDS DAM AND ENHANCED MANAGEMENT EFFORTS BY THE DEPARTMENTS OF MARINE RESOURCES AND INLAND FISHERIES AND WILDLIFE, AND THE ATLANTIC SALMON COMMISSION, WOULD HAVE THE FOLLOWING EFFECTS ON THE SPECIES LISTED BELOW THAT ARE FOUND IN THE LOWER KENNEBEC RIVER.

Atlantic Salmon - Fish passage at Edwards Dam and at the other dams on the Kennebec River up to Abenaki Dam in Madison would allow Atlantic Salmon to enter the lower reaches of the Sebasticook and Sandy rivers. Substantial Atlantic salmon spawning habitat would be open in the lower Kennebec River watershed by the year 2002. Providing fish passage and stocking Atlantic

salmon would allow for an Atlantic salmon stock that could begin to support a sport fishery by the year 2020.

Striped Bass - Striped bass generally do not use fishways so providing fish passage at Edwards Dam would not have a significant effect on the population of striped bass in the lower Kennebec River. Consequently, the sport fishery for striped bass would be unchanged in the lower Kennebec River.

Rainbow Smelt - Rainbow smelt generally do not use fishways so providing fish passage at Edwards Dam would not have a significant effect on the population of smelt in the lower Kennebec River. Consequently, the sport fishery for smelt would be unchanged in the lower Kennebec River.

American Shad - Currently American shad are stocked in the lower Kennebec River by the Department of Marine Resources near Waterville, and in the Sebasticook River, with plans to increase stocking through 1999. Fish passage at Edwards Dam would make additional habitat available to American shad and could substantially increase the lower Kennebec River's population of American shad. A sport fishery for American shad would be ongoing by 1999 in the lower Kennebec River.

Brown Trout - Fish passage at Edwards Dam would not produce a significant increase in the number of wild brown trout in the fishery. However, fish passage at Edwards Dam would permit stocked brown trout to freely access the productive waters of the lower Kennebec River estuary. This would allow for brown trout to grow faster and larger. Fish passage would also allow the brown trout to migrate to inland waters where they would be available to anglers.

Fish passage at Edwards Dam would provide the opportunity to create sport fisheries for Atlantic salmon and American shad on the lower Kennebec River. Striped bass and rainbow smelt, which generally do not use fishways, would be unaffected by the provision of fish passage. Fish passage would enhance the growth rate of brown trout, which is a stocked species in the lower Kennebec River. Thus, this scenario is not tied to a specific type of fishway. Rather, the resulting benefit estimate is applicable to any type of fish passage that accomplishes the fishery management objectives listed here.

After reading Scenario I, respondents were asked a valuation question to estimate Hicksian surplus for the provision of fish passage. The valuation question was followed with a question asking whether they would fish the Kennebec if the proposed fisheries management improvements were implemented. If anglers indicated they would fish, they were then asked to estimate the number of fishing trips they would make to the river each year (Appendix A).

The format for presenting Scenario II -- removal of Edwards Dam -- is similar to Scenario I except the information presented changes.

SCENARIO II

REMOVING EDWARDS DAM AND ENHANCED MANAGEMENT EFFORTS BY THE DEPARTMENTS OF MARINE RESOURCES AND INLAND FISHERIES AND WILDLIFE, AND THE ATLANTIC SALMON COMMISSION, WOULD HAVE THE FOLLOWING EFFECTS ON THE SPECIES LISTED BELOW THAT ARE FOUND IN THE LOWER KENNEBEC RIVER.

Atlantic Salmon - Removal of Edwards Dam would reduce mortality rates for Atlantic salmon migrating upstream and downstream and would open up substantial salmon spawning habitat in the lower Kennebec River. However, an Atlantic salmon stock that could begin to support a sport fishery would still start in 2020. Removal of Edwards Dam could also increase riffle habitat on the river, creating more fishing sites for Atlantic salmon fishing.

Striped Bass - The removal of Edwards Dam will increase the amount of striped bass spawning habitat in the lower Kennebec River from 20 to 38 miles. The removal of the Edwards Dam, combined with the ongoing striped bass restoration program, will result in a substantial population of native striped bass. The lower Kennebec River could become a premier striped bass fishing river in New England by 2004.

Rainbow Smelt - The removal of the Edwards Dam would significantly increase the amount of rainbow smelt spawning habitat in the lower Kennebec River. This should result in better fishing opportunities in the winter smelt fisheries below Edwards Dam. The increased number of smelt will also provide a significant food base for game species such as striped bass and brown trout.

American Shad - Removal of Edwards Dam would reduce mortality rates for shad migrating downstream and adults moving upstream. This should significantly increase the number of adult shad returning to the river. However, the sport fishery for shad will probably still start around 1999.

Brown Trout - Removal of Edwards Dam would reduce mortality of juvenile brown trout moving downstream and would provide greater access to the estuary where growth is faster. With increased management the quality of the brown trout fishery on the lower Kennebec River would be enhanced. The primary limiting factor for this fishery would be the lack of suitable spawning habitat below Waterville. For this reason natural reproduction would not be significant and the fishery would require stocking each year where hatchery fish are stocked, allowed to grow,and then caught.

In this scenario, the Atlantic salmon fishery still starts in the year 2020, but removal of the dam creates more fishable water. The fishery for American shad is essentially unchanged from Scenario I. A striped bass fishery would be ongoing by the year 2004. Rainbow smelt numbers would be increased by the provision of access to more spawning habitat and the existing winter ice fishing for smelt on the lower Kennebec would be enhanced. Brown trout numbers and size will be enhanced over merely providing fish passage.

Scenario II is followed with the same set of questions as followed Scenario I. After completing the questions associated with Scenario II, respondents were asked to rate each of the five species in the scenarios, individually, as to their importance in the respondents' decision to fish the lower Kennebec River (Appendix A).

Estimation of Hicksian Surplus

Two methods of valuation are commonly employed to estimate sport fishing values, travel cost and contingent valuation (Anderson and Bishop, 1986). Travel cost uses data on fishing trips and the costs per trip to estimate a demand function for fishing trips to a specific site. However, travel cost was not selected because it is best suited to the estimation of use values where anglers have collectively experienced the levels of fishing quality being evaluated. In the current application, no one will have experienced the proposed changes in fishing quality on the lower Kennebec River resulting from the provision of fish passage at Edwards Dam or removal of the dam itself.

Hicksian surplus, as defined in equation (1), was estimated using contingent valuation (Cummings, Brookshire and Schulze, 1986; Mitchell and Carson, 1989). This is a direct questioning

technique used to reveal the dollar value respondents place on the object being evaluated. Contingent valuation has been applied to evaluate a number of nonmarket commodities, one of which is sport fishing. Studies to validate contingent valuation estimates, by concurrently employing contingent valuation and conducting actual cash transactions, reveals that contingent valuation can accurately estimate values for users of a resource (Dickie, Fisher and Gerking, 1987; Heberlein and Bishop, 1986; Welsh, 1986). Furthermore, recent research indicates that users of a resource can evaluate changes in the quality of the resource that they have not experienced (Bishop et al., 1987; Boyle, Welsh and Bishop, 1991). Finally, contingent valuation is an accepted method of estimating values for water resource projects (Water Resources Council, 1983) and in natural resources damage assessment (Desvousges, Dunford and Domanico, 1989). For these reasons, contingent valuation was selected as the appropriate technique for estimating values for improved sport fisheries on the lower Kennebec River.

In the current study we used an "open-ended" questioning format to ask the contingent valuation questions for Scenario I and Scenario II.[3] The "open-ended" question directly asks respondents to state the maximum they would pay for the change being evaluated (Figure 2). Respondents' answers to the question are interpreted as individual statements of the value specified in equation (1) such that they would be indifferent between having the proposed change and the status quo. Respondents' answers to the contingent-valuation question are averaged across the sample to derive an estimate of the mean value per person for all individuals in the group affected by the proposed change.

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[3] We also asked respondents to answer what is referred to as a "dichotomous-choice", contingent-valuation question. This questioning format asks respondents whether they would pay a fixed dollar amount, and has received substantial theoretical support in the economics literature (Hoehn and Randall, 1987; Hanemann, 1984). For simplicity in exposition, we do not discuss this questioning format in the text.

Figure 2. Open-Ended Contingent Valuation Question for Scenario I

Suppose that a nonprofit corporation was formed that operates similar to the Nature Conservancy. This nonprofit corporation would raise funds and work to improve sport fishing on the lower Kennebec River. These efforts would be undertaken in cooperation with the Departments of Marine Resources and Inland Fisheries and Wildlife, and the Atlantic Salmon Commission. However, due to limited agency funds, the objectives of Scenario I on the previous page would not be accomplished without the actions of the nonprofit corporation. The primary task of the nonprofit corporation would be to accomplish the objectives of Scenario I (provide fish passage at Edwards Dam and accomplish the sport fishery goals set out on the previous page for Atlantic salmon, shad and brown trout). All funds for this nonprofit corporation would be raised by selling supporting memberships to private citizens like yourself.

If this nonprofit corporation contacted you and asked you to purchase a supporting membership, with all funds being used to accomplish the objectives of Scenario II, what is the **most** you would pay for an annual supporting membership? (If you would not pay anything please enter zero) (FILL IN THE BLANK)

$_____ Is the **most** that I would pay for a supporting membership

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Sampling

The survey was administered by mail to samples of residents and nonresidents holding a Maine inland fishing license. Developing the sampling frame for this study was extremely problematic. The first step is to ask who would be affected by changes in sport fisheries associated with providing fish passage at Edwards Dam or removing the dam itself. Anglers currently fishing the lower Kennebec River are the individuals most likely to be directly affected by either of the proposed changes.

A Maine fishing license is required to fish above the head of tide on all of Maine's coastal rivers. Edwards Dam is the head of tide mark on the Kennebec River and anglers may fish below the dam without purchasing a Maine fishing license. Therefore, a Maine fishing license is required to fish above the dam, and anglers who fish above the dam could be identified via a survey of anglers holding a Maine fishing license. However, given that the section of river between Edwards Dam and Milstar Dam is only about 15 miles, resident anglers fish close to home, and most anglers primarily fish lakes and ponds in Maine, an extremely large sample would be required to identify a usable

sample of current users, e.g., an identified sample of current users exceeding 50 anglers.

To develop a representative sample of anglers fishing the Kennebec River below Edwards Dam, on-site interviews need to be conducted with anglers fishing this section of river. On-site interviews would need to be conducted throughout the fishing season, and would need to be conducted on week days, weekends and holidays. Names and addresses would be collected, forming a sampling frame from which a representative sample of anglers could be selected to receive a mail survey. The cost of conducting on-site interviews would have exceeded our entire study budget, so we did not undertake this step.

Furthermore, anglers who fish the lower Kennebec River represent only one group of individuals potentially affected by the proposed changes. Anglers who do not currently fish the lower Kennebec River may find the fishing desirable after one of the changes is implemented. In addition, individuals who place an existence value on improved fish stocks may also be omitted by only sampling anglers who currently fish the lower Kennebec. We propose that anglers who hold a Maine fishing license represent the group of anglers who do not currently fish the lower Kennebec who are most likely to be substantially affected by the provision of fish passage or removal of the dam. In turn, we administered our survey to random samples of licensed resident and nonresident anglers. This sampling frame, although not representing all individuals who may be affected, is likely to provide a good picture of the benefits accruing to improved sport fisheries on the lower Kennebec resulting from either of the changes at Edwards Dam.

Our results will not provide data on how individuals who currently fish for marine sport fish in Maine and do not hold a Maine fishing license will respond to improved sport fishing on the lower Kennebec River. Nor will we be able to use our data to make statements about how individuals who do not currently fish in Maine might respond to improved sport fishing on the lower Kennebec River.

Using samples of residents and nonresidents holding a Maine inland fishing license also presents several practical advantages. Obviously, the development of the sample from license records is relatively inexpensive. In addition, 37 percent of resident license holders and 12 percent of nonresident license holders do fish Maine's coastal waters where an inland fishing license is not required (Boyle, Phillips and Reiling, 1989; Phillips, Boyle and Reiling, 1990). Thus, some, but probably not all, of the people currently fishing the Kennebec River below Edwards Dam do hold a Maine inland fishing license.

Within the samples of resident and nonresident licensed Maine anglers we desired to compare responses from anglers who fish the Kennebec River with those who did not fish the Kennebec River. We knew from a previous mail survey that resident anglers primarily fish waters close to their home (Boyle et al., 1990b). Resident anglers traveled an average of 47 miles to their most

popular fishing area, 49 miles to their second most popular fishing area and 42 miles to their third most popular fishing area. Additionally, for all three fishing areas, 50 percent or more of the anglers traveled 20 miles or less. These results indicate a relatively large sample of resident anglers is required to identify a usable subsample of respondents who currently fish the lower Kennebec River.

A subsample of anglers currently fishing the lower Kennebec River is desirable because we want to know whether anglers' evaluations of improved fisheries vary according to whether the individuals currently fish this section of the river. To address this issue with a limited budget, we developed two independent samples of licensed resident anglers. One sample, referred to hereafter as "adjacent anglers," includes only licensed anglers from communities adjacent to the lower Kennebec River from Milstar Dam in Waterville to Chops Point at the head of Merry Meeting Bay.[4] The second sample includes licensed anglers selected from all other Maine communities not adjacent to the lower Kennebec River (hereafter denoted as "nonadjacent anglers"). This strategy of oversampling from adjacent communities could not be duplicated for licensed nonresident anglers. A nonresident license allows the angler to fish all inland waters open to fishing in Maine, but the license record does not reveal where within the state the angler actually fishes. In turn, we did not have prior data allowing us to develop a stratified sample of nonresident anglers based on a hypothesized predilection to fish the lower Kennebec.

Empirical Results

As noted above, the survey of licensed anglers was administered to three independent samples of anglers who previously fished in Maine: 1) resident anglers from communities adjacent to the lower Kennebec River, 2) resident anglers from all other communities within Maine, and 3) nonresident anglers. Of the 313,000 individuals who held a 1988 Maine fishing license, 12,771 were adjacent anglers, 202,166 were nonadjacent anglers and 98,063 were nonresident anglers (Table 1).[5] From among these license holders, a total of 810 anglers were randomly selected so that each subsample contained 270 anglers.

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[4] Communities adjacent to the study area are: Augusta, Bath, Bowdoinham, Dresden, Gardiner, Hallowell, Pittston, Randolph, Richmond, Sidney, Vassalboro, Waterville, Winslow and Woolwich.

[5] Licensed alien anglers and licensed junior anglers are not included in this figure and were not included in the sampling frame. These individuals represent 2 percent of all licensed anglers.

The survey was conducted during the summer of 1990. A letter was sent to all survey participants on June 20, 1990 informing them of the purpose of the study and asking them to watch for the survey in the mail in a few days. Questionnaires were mailed on June 26; then a postcard was sent on June 29 reminding anglers to return their surveys and thanking those who had already completed their surveys. Roughly three weeks after the first mailing of the questionnaires, on July 17, individuals who had not responded to the initial mailing were sent a second copy of the questionnaire and were encouraged to respond. About two weeks after the second mailing of the questionnaire, all remaining nonrespondents were sent a third copy of the questionnaire by certified mail and were once again encouraged to respond to the survey.

This process of administering a survey is called the Total Design Method and was developed to obtain a high survey response rate and to generate a data set which is representative of the population being surveyed (Dillman, 1978). This process of administering a survey generally yields response rates in excess of 70 percent. However, after the second mailing our survey response rate was less than 50 percent. In turn, we attempted to contact all remaining nonrespondents by telephone in early August and encourage them to respond. After the telephone contact, the overall response rate to the survey was still below 70 percent for all three sample groups. In our previous mail surveys of licensed Maine anglers we obtained average response rates of 79 percent for residents and nonresidents (Boyle, Phillips and Reiling, 1989; Phillips, Boyle and Reiling, 1990).

Table 1. Survey Response

	Adjacent	Nonadjacent	Nonresident
Number of Licensed Adult Anglers	12,771	202,166	98,063
Mail Survey Sample Size	270	270	270
Final Response Rate to the Mail Survey	72%	60%	67%
Telephone Follow-up:			
Attempted Contacts	50	55	55
Actual Contacts	39	47	35
Refusals	12	11	9
Already Completed Mail Survey	11	15	14
Completed Telephone Follow-up	16	21	12

Again, we attempted to interview 160 nonrespondents; 50 adjacent anglers, 55 nonadjacent anglers and 55 nonresidents by telephone between August 27 and September 5, 1991 to determine why they had not responded to the mail survey. We were able to contact 121 of these nonrespondents; 32 refused to participate in the telephone interview, 40 stated that they had already returned the mail survey or would return the mail survey and 49 completed the telephone interview.[6] Of the 49 individuals who participated in the telephone interview, 16 were adjacent anglers, 21 were nonadjacent anglers and 12 were nonresident anglers. When anglers were asked why they did not return the mail survey, nearly two-thirds stated that they do not fish the Kennebec River or had no interest in the survey (Appendix C). It seems, then, the lower than expected response rates, particularly for nonadjacent anglers are due in part to a low interest in improved sport fisheries on the lower Kennebec River, i.e. a low salience of the survey topic.

The final response rate to the mail survey, including responses to the mail survey after the telephone prompt and telephone interview, was 72 percent for adjacent anglers, 60 percent for nonadjacent anglers and 67 percent for nonresidents. Baumgartner and Heberlein (1984) found that a movement from a highly salent survey topic to a moderately salient survey topic reduced the average mail survey response rate from 77 percent to 66 percent, and a low salience further reduces the average response rate to 42 percent (See also Heberlein and Baumgartner, 1978). Given the effort we invested to get anglers to respond, we propose that improved sport fisheries on the lower Kennebec River had a salience below moderate.

Selected Characteristics of Respondents

The socioeconomic and angling characteristics of respondents are presented in Table 2. The average adjacent respondent is a 43 year old male with some education beyond high school and an average annual household income of $32,300. Similarly, the average nonadjacent respondent is a 42 year old male with some education beyond high school and an average annual household income of $31,200. Nonresident respondents have a higher level of education and earn a significantly higher annual household income than do resident anglers.

Turning to fishing experience in Maine, the average adjacent respondent started fishing in Maine during 1961 and 90 percent have fished in Maine more than half of the years since they started fishing in Maine. Seventy-four percent of adjacent respondents primarily fish lakes and ponds, with only seven percent stating they fish rivers in Maine. Similarly, the average nonadjacent respondent started fishing in Maine during

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[6] Individuals who stated they had returned the mail survey or would return the mail survey were not asked to continue with the phone survey

Table 2. Characteristics of Survey Respondents

Characteristic	Adjacent	Nonadjacent	Nonresident
Socioeconomic:			
Average Age	43	42	43
Sex (Percent Male)	78%	79%	87%
Average Education	Some Education Beyond High School	Some Education Beyond High School	Associate Degree
Average Household Income	32,300	31,200	50,000
Fishing Experience in Maine:			
Year First Fished	1961	1963	1972
Frequency Fished			
- Every Year	80%	77%	46%
More Than Half the Years	10	12	24
About Half the Years	3	6	7
Less Than Half the Years	7	4	11
First Year	0	1	12
Type of Water Most Often Fished			
Lakes/Ponds	74%	63%	78%
Streams/Brooks	11	20	9
Coastal/Marine	8	7	4
Rivers	7	11	10

1963 and 89 percent have fished in Maine more than half of the years. Most nonadjacent respondents primarily fish lakes and ponds and only 11 percent stated that they primarily fish rivers. In contrast, nonresident respondents started fishing in Maine during 1972 and fish less frequently in Maine than residents. However, similar to resident respondents, nonresident respondents primarily fish lakes and ponds, with only 10 percent primarily fishing rivers.

Given the overall response rate to the mail survey of less than 70 percent and the fact that our previous surveys of licensed anglers yielded average response rates of 79 percent, we asked whether respondents to the Kennebec River survey are representative of licensed resident and nonresident anglers in Maine. To do this, we compared the socioeconomic characteristics of respondents to the Kennebec River survey with the socioeconomic characteristics of respondents to a mail survey of 1988 licensed anglers in Maine where 83 percent of residents and 80 percent of nonresidents responded (Phillips et al., 1990).

The socioeconomic characteristics of resident and nonresident respondents to the Kennebec survey are not statistically different at the 10 percent level from those of respondents from the previous survey of licensed anglers. However, the samples do differ in terms of the frequency fished in Maine. We learned from the previous survey that 76 percent of resident anglers and 53 percent of nonresident anglers fish in Maine at least half the years since they began fishing in Maine. In contrast, approximately 90 percent of the resident respondents and 70 percent of the nonresident respondents to the Kennebec survey stated they fished at least half the years. This result seems to confirm the results of the telephone survey, where anglers who did not return the mail survey either had not fished the Kennebec River or were, in general, not active anglers. Considered from the opposite perspective, the more active (or avid) the angler, the more likely he or she was to complete and return the Kennebec River survey.

Anglers Fishing the Lower Kennebec River

As indicated above, few anglers primarily fish rivers in Maine and most anglers fish close to their home. It is not surprising, therefore, that few of the respondents stated that they fish the Kennebec River (Table 3). Forty three percent of the adjacent sample of anglers fish the Kennebec from Milstar Dam to Chop's Point, seven percent of nonadjacent respondents fish this section of river and only five percent of nonresident respondents fish the lower Kennebec. In total, there are 98 respondents in the adjacent sample, 17 respondents in the nonadjacent sample and 11 respondents in the nonresident sample who have fished the Kennebec River between Milstar Dam and Chop's Point. In turn, we can only characterize current fishing on the lower Kennebec River for anglers from adjacent communities, i.e. 17 and 11 observations are not sufficient to develop reliable statistical estimates.

Table 3. Anglers Who Have Fished the Kennebec River

	Adjacent	Nonadjacent	Nonresident
Before 1984			
Percent of Sample	5%	0%	2%
Number of Observations	12	0	5
Number of Anglers	608	0	1,691
Since 1984			
Percent of Sample	38%	7%	3%
Number of Observations	86	17	6
Number of Anglers	4,627	14,152	2,942
Total			
Percent of Sample	43%	7%	5%
Number of Observations	98	17	11
Number of Anglers	5,253	14,152	4,633

Lower Kennebec River Fishing by Adjacent Anglers

The average adjacent angler started fishing the section of the Kennebec River between Milstar Dam and Chops point during 1973 and 72 percent of adjacent anglers have fished this section of the Kennebec in more than half of the intervening years (Table 4). Of the adjacent anglers who fish this section of the Kennebec, 19 percent only fished the area between Milstar Dam and Edwards Dam, 57 percent only fished the area between Edwards Dam and Chops Point and 24 percent fished both areas of the river. Multiplying these percentages by the estimated number of adjacent anglers gives us an estimate of 1,539 adjacent anglers fishing the Kennebec between Milstar Dam and Edwards Dam, and 2,898 adjacent anglers fishing the Kennebec between Edwards Dam and Chops Point.

The five most popular fish species sought by adjacent anglers fishing between Milstar Dam and Edwards Dam, in descending order, are brown trout, largemouth bass, smallmouth bass, brook trout and chain pickerel (Table 5). The five most popular species sought by anglers fishing between Edwards Dam and Chops Point are striped bass, rainbow smelt, bluefish, Atlantic salmon and brown trout. Note that striped bass, rainbow smelt and Atlantic salmon, currently, only reside below Edwards Dam. In contrast, four of the top five species sought above Edwards Dam can also be found below the dam.

Table 4. Adjacent Anglers Fishing Experience on the Lower Kennebec River Since 1984

First Time Fished Milstar Dam to Chops Point	1973
Frequency Fishing Milstar Dam to Chops Point	
Every Year	58%
More than Half the Years	14
About Half the Years	9
Less than Half the Years	12
Anglers Fishing Only from Milstar Dam to Edwards Dam	19%
Anglers Fishing Only from Edwards Dam to Chops Point	57
Anglers Fishing Both from Milstar Dam to Edwards Dam and from Edwards Dam to Chops Point	24
Estimated Number of Licensed Anglers Fishing Per Year:	
Milstar Dam to Edwards Dam	1,539
Edwards Dam to Chops Point	2,898

Table 5. Species Sought by Adjacent Anglers Fishing the Lower Kennebec River Since 1984

Milstar Dam to Edwards Dam		Edwards Dam to Chops Point	
Brown Trout	59%	Striped Bass	71%
Largemouth Bass	38	Rainbow Smelt	46
Smallmouth Bass	38	Bluefish	37
Brook Trout	27	Atlantic Salmon	34
Chain Pickerel	16	Brown Trout	29
White Perch	14	Largemouth Bass	19
Landlocked Salmon	14	Smallmouth Bass	11
American Eel	3	White Perch	9
Yellow Perch	0	Shad	6
		Sturgeon	6
		Yellow Perch	6
		Alewife	6

Adjacent anglers who fished each section of the Kennebec River since 1984 were asked to indicate the average number of fishing trips they took per year. Anglers who fished from Milstar Dam to Edwards Dam took an average of 9.4 fishing trips, and anglers who fished below Edwards Dam took an average of 7.5 fishing trips (Table 6). The estimate of the total number of fishing trips on the Kennebec River between Milstar Dam to Edwards Dam is 14,467 (9.4 x 1,539) and the estimate between Edwards Dam and Chops Point is 21,735 (7.5 x 2,898). Note that these numbers do not denote days of fishing effort because anglers may fish one day or several days on any given fishing trip. It is important to recognize that these estimates of self-reported participation are likely to overstate true participation, but we can not discern the amount of bias (over estimate) in these figures (Chase and Harada, 1984; Westat, 1989).

Anglers were also asked to report their expenditures for an average fishing trip on the Kennebec River. To help respondents recall their expenses, a list of common fishing purchases was provided and anglers were asked to provide their expenditures within each category. These are trip-specific expenditures and do not include expenditures made for fishing equipment; most equipment expenditures are not likely to be incurred while fishing the river. This is done to estimate the direct economic impact on local communities from anglers while fishing the lower Kennebec River.

The average direct economic impact per angler per trip for those who fished above Edwards Dam is $9.31, and for anglers fishing below Edwards Dam, it is $16.68. The annual direct economic impact per angler fishing above Edwards Dam is $79.61, and it is $104.86 for fishing below Edwards Dam. The aggregate annual direct economic impact of adjacent anglers fishing above Edwards Dam is $122,520 (1,539 x $79.61), and the annual direct economic impact made by adjacent anglers fishing below Edwards Dam is $303,844 (2,898 x $104.86).[7]

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[7] Although it is an unlikely possibility, some anglers may fish above and below Edwards Dam on the same trip. Therefore, adding the two direct economic impact estimates may overstate the direct economic impact of sport fishing on the lower Kennebec River

The average Hicksian surplus for adjacent anglers who fish between Milstar Dam and Edwards Dam is $9.09 per trip, and for adjacent anglers who fish between Edwards Dam and Chops Point it is $9.41 per trip. The annual Hicksian surplus per angler for adjacent anglers fishing above Edwards Dam is $74.54, and for adjacent anglers fishing below Edwards Dam it is $76.61.[8]

Table 6. Effort, Economic Impact and Hicksian Surplus Estimates for Adjacent Anglers Who Fished the Lower Kennebec River Since 1984

	Milstar Dam to Edwards Dam	Edwards Dam to Chops Point
Average Number of Trips Per Angler	9.4	7.5
Average Economic Impact Per Trip[a]	$9.31	$16.68
Annual Economic Impact Per Angler	$79.61	$104.86
Total Annual Economic Impact	$122,520	$303,844
Average Surplus Value Per Trip	$9.09	$9.41
Annual Surplus Value Per Angler	$74.54	$76.61
Total Annual Surplus Value	$114,717	$222,016

[a] Includes expenditures on transportation, public transportation, food and beverages, lodging, guide fees, bait and other expenses.

[8] Annual Hicksian Surplus per angler is defined as:

$$V(P_f, P, I-\beta; q, r) = V(P_f^m, P, I; q, r)$$

where all terms are defined as in equation (1), except P_f^m, which is a price high enough such that the angler would chose not to fish the lower Kennebec River. That is, β is the payment which makes an angler exactly indifferent between fishing the lower Kennebec (left hand side of the equation) and not fishing this section of the river (right hand side of the equation). Hicksian surplus per trip is computed by taking the estimate for β and dividing it by the number of trips per year the angler takes to fish the lower Kennebec River

The aggregate annual surplus values for adjacent anglers fishing above Edwards Dam is $114,717 (1,539 x $74.54), and for fishing below Edwards Dam it is $222,016 (2,898 x $76.61).

Factors Affecting Adjacent Anglers Fishing Effort on the Lower Kennebec River

To determine what factors influence adjacent angler fishing effort on the lower Kennebec River, we asked anglers who have fished this section of river since 1984, to indicate 1) why they fish the river; 2) the primary factors that reduce their fishing effort on the Kennebec; and 3) the factors that would need to change to increase their fishing effort on the Kennebec River.

When adjacent anglers who fished between Milstar Dam and Edwards Dam were asked to indicate the most important reason for fishing this section of the river, most (35 percent) stated that it was convenient or close to home; the presence of brown trout was the second most important reason (29 percent). No other reason was cited by more than 10 percent of the respondents. Of those who fish below Edwards Dam, 26 percent indicated convenience/close to home as the primary reason for fishing this stretch of the river. Striped bass (13 percent) and bluefish (12 percent) were the second and third most important reasons, respectively, for fishing the Kennebec River below Edwards Dam.

To determine the factors that might limit fishing effort on the Kennebec, anglers from adjacent communities who fished the lower Kennebec River between Milstar Dam and Chops Point were asked to rate how 10 factors might reduce their fishing effort (Table 7). Response categories for each factor ranged from "no effect on fishing effort", to "reduce effort somewhat" and "reduce effort very much". The categorical responses were assigned weights of "0", "-1" and "-2", respectively. The mean rating of -1.037 for the top factor, poor water quality, is not significantly different at the 10 percent level from -1 (reduce effort somewhat). The mean rating for "no convenient stores/lodging" of -0.052 is not statistically different from 0 (no effect) at the 10 percent level. All other factors received absolute mean ratings that are statistically less than -1 (reduce effort somewhat) and significantly larger than 0 (no effect) at the 10 percent level.

Table 7. Ratings of Factors Reducing Fishing Effort by Adjacent Anglers Who Fished the Lower Kennebec Since 1984

Factor	Reduce Effort Very Much (-2)	Reduce Effort Somewhat (-1)	No Effect (0)	Mean Evaluation[a]
Poor Water Quality	31%	41%	28%	-1.037 (0.09) [80]
Poor Access for Shoreline Fishing	18	26	56	-0.615 (0.09) [78]
Not Likely to Catch Fish	14	30	56	-0.575 (0.08) [80]
Poor Boat Access	8	26	67	-0.410 (0.07) [78]
Undesirable Fish Species	6	27	66	-0.403 (0.07) [77]
Fishing Buddies Do Not Fish There	13	12	75	-0.377 (0.08) [77]
Crowding by Other Anglers	8	14	78	-0.299 (0.07) [77]
Too Far From Home	3	8	89	-0.132 (0.05) [76]
Not a Scenic Area	3	5	92	-0.108 (0.04) [74]
No Convenient Stores/Lodging	1	3	96	-0.052 (0.03) [77]

[a] Standard errors are in parentheses and item response rates (n) are in brackets.

When anglers were asked what factors need to change to increase their fishing effort on the lower Kennebec River, 42 percent of adjacent anglers who currently fish this section of the river indicated that water quality needs to improve. Twenty-eight percent of adjacent anglers indicated that the presence of more desirable fish species would increase their fishing effort.

Summing up, adjacent anglers who currently fish the lower Kennebec primarily do so because it is convenient. This finding corresponds to a finding from a previous study where we report that most anglers fish within 20 miles of their home (Boyle et al., 1990b). Improvements in water quality appear to be the key factor that would entice anglers from communities adjacent to the lower Kennebec River to fish the lower Kennebec River more frequently.

Factors Affecting Why Anglers Have Never Fished the Lower Kennebec River

The main reason anglers have not fished the lower Kennebec is that it is "not convenient" (Table 8). This reason ranks third for anglers from adjacent communities who have never fished the lower Kennebec and ranks first for all other respondents who have never fished this stretch of the river.

Table 8. Reasons Why Anglers Have Never Fished the Lower Kennebec River

Adjacent Anglers	
Poor Water Quality	27%
Prefer Lake Fishing	27
Not Convenient/Too Far	23
Nonadjacent Anglers	
Not Convenient/Too Far	51%
Poor Water Quality	14
No Knowledge of River	10
Nonresident Anglers	
Not Convenient/Too Far	36%
No Knowledge of River	26
Prefer Lake Fishing	19

Two reasons tied as the primary reason adjacent anglers do not fish the lower Kennebec River, poor water quality and a preference for lake/pond angling. The top three reasons given by nonadjacent anglers who do not fish the Kennebec River are, not

convenient/too far from home, poor water quality, and no knowledge of river. Nonresident angler reasons for not fishing the Kennebec River are; not convenient/too far from home, no knowledge of river, and prefer lake fishing.

Qualitative Evaluations of Fishery Management Objectives

After having respondents report on their fishing experience on the lower Kennebec River and before having respondents answer the contingent-valuation questions for each scenario, we asked respondents to evaluate nine attributes of fishing on the lower Kennebec, including the provision of fish passage or the removal of Edwards Dam. Five of the attributes correspond to each of the five species identified in the scenarios; American shad, Atlantic salmon, brown trout, rainbow smelt and striped bass. The other two attributes are more access for shore fishing and more access for boat launching.

Resident anglers from adjacent communities, who currently fish the lower Kennebec, rated the attributes on a scale ranging from "fish less each year" to "no effect" to "fish more each year". Fish less is assigned a rank of "-1", no effect receives a rank of "0", and fish more is ranked as "1".

Adjacent anglers who have fished the lower Kennebec since 1984 gave all nine attributes mean ratings between one (fish more each year) and zero (no effect). Increased brown trout stocking and a run of Atlantic salmon received the highest mean ratings, 0.79 and 0.78, respectively (Table 9). The development of a shad sport fishery received the lowest mean rating (0.12). It is also interesting to note that all mean ratings are significantly lower than one (fish more each year) and significantly larger than zero (no effect) at the 10 percent level. In addition, the mean rating for fish passage is significantly larger than the mean rating for removing Edwards Dam at the 10 percent level; seventy percent indicated they would fish more after fish passage while only 55 percent indicated they would fish more after removal of the dam.

Respondents who had not fished the lower Kennebec River since 1984 were asked to evaluate the same set of nine characteristics of fishing the river, but the response categories were changed. Response categories ranged from "no effect" (0) to "somewhat likely" to fish (1) to "very likely" to fish (2).

Adjacent anglers, who have not fished the lower Kennebec since 1984, gave the highest rating to a run of Atlantic salmon (Table 10). This mean rating for a run of Atlantic salmon of 1.28 is significantly larger than a rating of somewhat likely (1) at the 10 percent level. Boat launching, brown trout stocking, shoreline fishing and fish passage all received mean ratings that are not significantly different from somewhat likely (1) at the 10 percent level. Striped bass, dam removal, smelt and shad all received mean ratings significantly less than somewhat likely and significantly larger than no effect at the 10 percent level.

Table 9. Adjacent Anglers', Who Have Fished the Lower Kennebec River Since 1984, Ratings of Proposed Fishery Management Options

Fishery Management Options	Fish Less Each Year (-1)	No Effect (0)	Fish More Each Year (1)	Mean Evaluation[a]
Increase Brown Trout Stocking	1%	19%	80%	0.79 (0.05) [84]
Run of Atlantic Salmon	2	17	81	0.78 (0.05) [82]
Native Striped Bass Population	6	20	74	0.68 (0.07) [82]
Fish Passage at Edwards Dam	3	27	70	0.68 (0.06) [81]
More Access for Shoreline Fishing	3	47	50	0.47 (0.06) [78]
Larger Population of Smelt	5	47	48	0.43 (0.07) [79]
More Access for Boat Launching	5	53	42	0.37 (0.06) [81]
Removal of Edwards Dam	18	27	55	0.37 (0.09) [82]
Shad Sport Fishery	11	67	22	0.12 (0.07) [76]

[a] Standard errors are in parentheses and item response rates (n) are in brackets.

Table 10. Adjacent Anglers', Who Have Not Fished the Lower Kennebec River Since 1984, Ratings of Proposed Fishery Management Options.

Fishery Management Options	No Effect (0)	Somewhat Likely (1)	Very Likely (2)	Mean Evaluations[a]
Run of Atlantic Salmon	17%	37%	46%	1.28 (0.10) [57]
More Access for Boat Launching	31	30	39	1.07 (0.12) [54]
Increase Brown Trout Stocking	26	41	33	1.07 (0.10) [57]
More Access for Shoreline Fishing	36	24	40	1.04 (0.12) [53]
Fish Passage at Edwards Dam	36	33	31	0.94 (0.12) [52]
Native Population of Striped Bass	43	39	18	0.76 (0.11) [49]
Removal of Edwards Dam	50	29	21	0.71 (0.12) [48]
Larger Population of Smelt	64	19	17	0.52 (0.11) [48]
Shad Sport Fishery	91	5	5	0.14 (0.07) [43]

[a] Standard errors are in parentheses and item response rates (n) are in brackets.

Note, however, the majority said dam removal (50%), smelt (64%), and shad (91%) will have no effect on whether they fish the lower Kennebec, and the largest percentage (43%) was in the no effect category for striped bass. Finally, the mean rating for fish passage is again significantly larger than the mean rating for removal of the dam.

Nonadjacent anglers, who have not fished the lower Kennebec since 1984, provided relative ratings to the attributes that are similar to those provided by anglers from the adjacent community sample who have not fished the river since 1984. The only difference being that striped bass now receives a higher mean rating than the provision of fish passage (Table 11). The absolute values of the mean rankings do change. A run of Atlantic salmon is not significantly different from somewhat likely (1) at the 10 percent level. The mean ratings for all other characteristics are significantly less than somewhat likely (1) and are significantly larger than no effect (0) at the 10 percent level. Despite this last result, the largest percentage of anglers indicate that all nine of the attributes will have "no effect" on their fishing of the lower Kennebec River, and only Atlantic salmon (42%) and brown trout (46%) have less than 50 percent of the respondents indicating such a change would not have any effect. Fish passage, once again, has a mean rating that is larger than the mean rating for removal of the dam. However, these mean ratings of 0.55 and 0.49, respectively are not significantly different at the 10 percent level.

Nonresident anglers, who have not fished the lower Kennebec River since 1984, provided a quite different ranking of the options than was provided by resident anglers. Atlantic salmon once again received the highest mean rating, and Atlantic salmon, brown trout and shoreline fishing all received mean ratings that are not significantly different from somewhat likely (1) at the 10 percent level (Table 12). All other characteristics received mean ratings significantly less than somewhat likely (1) and significantly greater than no effect (0) at the 10 percent level. As with resident anglers from the other communities subsample, most nonresidents indicated that each of the nine attributes would have no effect on their fishing the lower Kennebec River. For the bottom five attributes, boat launching, fish passage, dam removal, shad and smelt, over 50 percent of the respondents indicated that these attributes would have no effect as to whether they might fish the lower Kennebec River in the future.

Table 11. Nonadjacent Anglers', Who Have Not Fished the Lower Kennebec River Since 1984, Ratings of Proposed Fishery Management Options

Fishery Management Options	No Effect (0)	Somewhat Likely (1)	Very Likely (2)	Mean Evaluations[a]
Run of Atlantic Salmon	42%	29%	29%	0.88 (0.09) [82]
More Access for Boat Launching	50	24	26	0.76 (0.10) [78]
Increase Brown Trout Stocking	46	36	18	0.72 (0.08) [82]
More Access for Shoreline Fishing	53	27	20	0.67 (0.09) [79]
Native Striped Bass Population	57	23	20	0.63 (0.09) [79]
Fish Passage at Edwards Dam	60	25	15	0.55 (0.09) [75]
Removal of Edwards Dam	65	21	14	0.49 (0.08) [78]
Larger Population of Smelt	74	20	6	0.33 (0.07) [77]
Shad Sport Fishery	83	12	5	0.22 (0.06) [77]

[a] Standard errors are in parentheses and item response rates (n) are in brackets.

Table 12. Nonresident Anglers Who, Have Not Fished the Lower Kennebec River Since 1984, Ratings' of Proposed Fishery Management Options

Fishery Management Options	No Effect (0)	Somewhat Likely (1)	Very Likely (2)	Mean Evaluations[a]
Run of Atlantic Salmon	40%	28%	32%	0.94 (0.09) [95]
Increase Brown Trout Stocking	39	31	30	0.90 (0.09) [91]
More Access for Shoreline Fishing	43	25	32	0.89 (0.09) [91]
Native Striped Bass Population	47	32	21	0.74 (0.08) [90]
More Access for Boat Launching	53	27	20	0.68 (0.08) [93]
Fish Passage at Edwards Dam	57	33	10	0.53 (0.07) [88]
Removal of Edwards Dam	69	19	12	0.44 (0.08) [89]
Shad Sport Fishery	78	17	5	0.26 (0.06) [84]
Larger Population of Smelt	85	8	7	0.22 (0.06) [86]

[a] Standard errors are in parentheses and item response rates (n) are in brackets.

Finally, as we found for the resident sample from other communities, the mean ratings for fish passage (0.53) and dam removal (0.44) are not statistically different at the 10 percent level.

Several important implications arise from the qualitative evaluations presented in this section. First, a run of Atlantic salmon and increased brown trout stocking are the two fishery management activities that are the most important to all respondents, and are the fishery management options that are most likely to increase angler participation in the lower Kennebec River fishery. A shad sport fishery is likely to have little or no effect on anglers' decisions to fish the lower Kennebec River, and a larger population of smelt appears only to be of interest to the small number of anglers who currently fish the lower Kennebec River. Adjacent anglers who currently fish the lower Kennebec expressed the greatest interest, of each of the three samples of respondents, in fishing for a native striped bass population. The final, and perhaps most important implication, is that respondents rate fish passage as being equal or more likely to affect whether they fish the lower Kennebec River than removing Edwards Dam.

These findings begin to tell a story that perhaps removing Edwards Dam, in contrast to our previous hypothesis, may not be preferred to simply providing fish passage. It is important to understand, however, that respondents answered these preference questions before reading scenario descriptions of the effects of fish passage and dam removal.

Scenario Valuation Estimates

Mean Hicksian surplus for Scenario I -- providing fish passage at Edwards Dam -- ranges from $5.59 for nonresident anglers to $15.81 for adjacent anglers (Table 13). Referring to the hypothesis we presented earlier, all three estimates are significantly different from zero. In turn, the null hypothesis that provision of fish passage will not affect the values anglers hold for fishing the lower Kennebec River can be rejected (see 90 percent confidence intervals in Table 13). Furthermore, the adjacent and nonadjacent means are not significantly different at the 10 percent level. Nor are the nonadjacent and nonresident means significantly different at the 10 percent level. However, the adjacent mean is significantly larger than the nonresident mean at the 10 percent level. An important result is that 41 percent of adjacent community respondents, 60 percent of other community respondents and 70 percent of nonresidents answered zero to the open-ended valuation question for Scenario I, indicating that they do not place any value on the improved fisheries resulting from the provision of fish passage at Edwards Dam.

When asked whether they would fish the lower Kennebec River if sport fisheries were improved in accordance with Scenario I, nearly three quarters of the adjacent anglers (74 percent) said they would fish the lower Kennebec, compared to 38 percent of

these anglers who currently fish this section of the river (Table 13). In contrast, less than 50 percent of nonadjacent anglers and nonresidents said they would fish the lower Kennebec (37 and 40 percent respectively). Predictions of self reported participation for anglers who said they would fish if Scenario I is accomplished, ranged from 12 trips per year for adjacent anglers to 2 trips per year for nonresidents.

Moving to Scenario II, the open-ended means range from $10.45 for nonresidents to $15.97 for respondents from adjacent communities. Estimated mean Hicksian surplus is not significantly different across the three samples for Scenario II. In addition, 45 percent of the adjacent sample, 62 percent of the nonadjacent sample and 67 percent of the nonresident sample said they would not pay anything for improved sport fisheries proposed under Scenario II.

As with Scenario I, approximately three quarters of the adjacent sample (76 percent) indicated they would fish the lower Kennebec if fisheries were improved as proposed in Scenario II. Less than 50 percent of respondents from the nonadjacent and nonresident samples indicated they would fish the lower Kennebec under these conditions. Self-reported participation, for those indicating they would fish the lower Kennebec River if Scenario II were implemented, range from 12.6 trips per year for anglers from the adjacent sample to 2.2 trips per year for nonresidents.

The most important implication of these findings is a comparison of the results for Scenario I with the results for Scenario II. That is, the difference in the Hicksian surplus estimates between Scenarios I and II provides estimates of the additional sport fishing benefits accruing to individuals from each sample from the additional increment in fishing quality provided by the removal of Edwards Dam. Pair-wise comparisons of the means for each of the three samples indicates the Hicksian surplus estimates for Scenario I are not significantly different from the Hicksian surplus estimates for Scenario II at the 10 percent level. Thus, the null form of our second hypothesis can not be rejected. In addition, self-reported participation rates are not significantly different between Scenario I and Scenario II. These findings lead us to conclude that providing fish passage and removing Edwards Dam each provide exactly the same sport fishing benefits to licensed Maine anglers. Furthermore, we interpret this finding to imply that the marginal value of the additional increase in sport fishing quality provided by removal of the dam is $0, i.e. the marginal value accruing to the differences in sport fishing quality as described in Scenario II versus Scenario I. We thought that one reason for this finding might be that the average age of respondents was 43 years of age.

Table 13. Respondents' Evaluation of Fish Passage and Dam Removal Scenarios

Valuation Scenarios	Maine Residents		Nonresidents
	Adjacent Anglers	Nonadjacent Anglers	
Fish Passage (Scenario I)			
Open-Ended Valuation Question			
-Mean	$15.81	$10.27	$5.59
	(2.78)[a]	(3.08)	(1.33)
-N	75	55	70
-Percent $0	41%	60%	70%
-90% Confidence Interval	($11.22,$20.40)	($5.17,$15.37)	($3.40,$7.78)
Fish Lower Kennebec River	74%	37%	40%
Average Trips Per Year			
-Mean	12.0	4.9	2.0
	(1.2)	(0.7)	(0.2)
-N	103	47	52
Removal of Edwards Dam (Scenario II)			
Open-Ended Valuation Question			
-Mean	$15.97	$12.09	$10.45
	(2.90)	(3.63)	(2.60)
-N	73	55	69
-Percent $0	45%	62%	67%
-90% Confidence Interval	($11.19,$20.75)	($6.10,$18.08)	($6.20,$14.78)
Fish Lower Kennebec River	76%	39%	47%
Average Trips Per Year			
-Mean	12.6	7.1	2.2
	(1.6)	(1.0)	(0.2)
-N	103	49	59

[a] Standard errors are presented in parentheses

Improved sport fisheries would be realized between 1999 and 2020. Over this period of time, the average age of respondents would progress to 73 years of age in 2020, and it is likely that the average respondent may no longer fish in Maine. In turn, we stratified our sample by age. One group contained anglers less than 40 years of age and the other group contained anglers 40 years of age and older. For both of these subsamples, we found

that the Hicksian surplus estimates for Scenario I were not statistically different from the Hicksian surplus estimates for Scenario II at the 10 percent level.

Using the estimated means from Scenario I and assigning a value of $0 to individuals who did not respond to the survey, we propose that the aggregate annual benefit of improving sport fisheries in the lower Kennebec River via increased management and provision of fish passage is $1.49 million per year ($0.12 million for adjacent anglers, $1.06 million for nonadjacent anglers and $0.31 million for nonresidents) regardless of whether fish passage is provided or Edwards Dam is removed.[9] A 90 percent confidence interval on this aggregate figure provides a low estimate of $0.81 million and a high estimate of $2.18 million.

This aggregate benefit estimate can be used in cost-benefit calculations to determine whether the sport fishing benefits exceed the costs of providing fish passage at Edwards Dam and the fishery management costs associated with the accomplishment of the sport fishing objectives in Scenario I. Likewise, $1.49 million is the benefit estimate to be included in a cost-benefit analysis of removing the dam. Ultimately, from an economic perspective, the choice between providing fish passage or removing the dam should be based on whether either or both alternatives have positive net present values; benefits in excess of costs. If both alternatives generate positive net present values, the alternative with the largest net present value should be selected.

The estimate of $1.49 million, however, is not the only benefit figure to be considered in such an analyses. Benefits accruing to anglers who do not hold a Maine fishing license are not counted. As noted earlier, the largest group here is resident anglers who currently fish tidal waters under the jurisdiction of the Department of Marine Resources and who do not purchase a Maine fishing license. Using Atlantic salmon fishing on the Penobscot River as an example, only about 300 nonresidents currently fish this river for Atlantic salmon each year. As a result, participation by nonresidents who do not currently fish in Maine is not expected to be substantial. In addition, our sample does include one component of anglers, from adjacent communities, who currently fish the lower Kennebec River, and these anglers assign the same values to providing fish passage and removing the dam. In turn, we propose that omitting marine sport anglers, who do not hold a Maine fishing license, is not likely to change the valuation relationship between the provision of fish passage and removing the dam. These anglers, however, are likely to value improved sport fisheries on the lower

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[9] Aggregate figures derived by multiplying number of licensed anglers by the survey response rate and multiplying the response rate by the mean Hicksian surplus for the group

Kennebec River and $1.49 million should be interpreted as a minimum estimate of the benefits of improving sport fishing on the lower Kennebec River.

Angler Ratings of the Importance of Species Described in Scenarios

After answering the questions for each of the scenarios, all respondents were asked to rate the importance of each of the five species described in the scenarios in terms of their importance in anglers' decisions to fish the lower Kennebec River between Milstar Dam in Waterville and Chops Point at the head of Merrymeeting Bay. Response ratings ranged from "not important" (0) to "somewhat important" (1) to "very important" (2).

Overall, Atlantic salmon and brown trout received the highest ratings, and the mean ratings for salmon and trout are not statistically different within each of the three samples (Table 14). With only one exception, the mean ratings were significantly less than very important (2) and significantly greater than somewhat important (1) at the 10 percent level. The exception is the mean rating for brown trout in the other communities sample which is not significantly different from somewhat important (1). Striped bass is third with mean ratings that are not significantly different from somewhat important for each of the three samples of respondents.

Rainbow smelt and shad received the lowest mean ratings, all of which are significantly less than somewhat important (1) and significantly greater than not important (0). Furthermore, the largest percentage of respondents indicated that smelt are "not important" and the majority of all respondents indicated that shad are not important.

These findings shed some light on why anglers do not place a value on the removal of Edwards Dam. The two most important species from an anglers' perspective would be essentially unaffected by a change from fish passage to removal of Edwards Dam. An Atlantic salmon fishery starts in the year 2020 in both scenarios. Stocking of brown trout is the key impediment to the expansion of this fishery, with removal of the dam having only a marginal impact on the quality of fish caught. It is logical that anglers focusing on these two species would place the same value on improved fisheries resulting from the removal of Edwards Dam.

Striped bass would be substantially affected by the removal of Edwards Dam. However, even for those respondents indicating striped bass is very important, a statistically significant difference does not exist between the Hicksian surplus estimates for Scenarios I and II within any of the three groups of respondents. The reason for this may be the large minimum length on striped bass that can be legally taken. Perhaps anglers felt the fishery management proposal would not affect this regulation nor be sufficient to have the average striper meet this regulation.

Table 14. Respondents Ratings of the Importance of Species, Described in the Scenarios, in their Decisions to Fish the Lower Kennebec River

Species	Maine Residents		Nonresidents
	Adjacent Anglers	Nonadjacent Anglers	
Atlantic Salmon			
-Not Important (0)	7%	28%	25%
-Somewhat Important (1)	19	19	18
-Very Important (2)	74	53	57
-Mean	1.7 (0.1)[a]	1.2 (0.1)	1.3 (0.1)
-N	147	116	127
Brown Trout			
-Not Important (0)	10%	31%	24%
-Somewhat Important (1)	31	25	26
-Very Important (2)	59	44	50
-Mean	1.5 (0.1)	1.1 (0.1)	1.3 (0.1)
-N	147	120	126
Striped Bass			
-Not Important (0)	19%	39%	29%
-Somewhat Important (1)	29	24	29
-Very Important (2)	52	37	42
-Mean	1.3 (0.7)	1.0 (0.1)	1.1 (0.1)
-N	144	114	123
Rainbow Smelt			
-Not Important (0)	28%	48%	56%
-Somewhat Important (1)	37	31	18
-Very Important (2)	35	21	26
-Mean	1.1 (0.1)	0.7 (0.1)	0.7 (0.1)
-N	140	112	117
American Shad			
-Not Important (0)	53%	60%	58%
-Somewhat Important (1)	33	31	23
-Very Important (2)	14	9	19
-Mean	0.6 (0.1)	0.5 (0.1)	0.6 (0.1)
-N	131	110	118

[a] Standard errors are presented in parentheses

Rainbow smelt and American shad both would be substantially affected by the removal of Edwards Dam. Low angler interest in these species, and the existence of a ongoing sport fishery for smelt in the lower Kennebec, may further explain why anglers do not value improved fisheries resulting from the removal of Edwards Dam.

Conclusions

In the study, a sample of anglers holding a Maine inland fishing license, evaluated two separate scenarios for improving sport fisheries on the lower Kennebec River: 1) provision of fish passage; and 2) removal of Edwards Dam. These scenarios were described in terms of effects each option would have on five species of fish; Atlantic salmon, striped bass, rainbow smelt, American shad and brown trout. The estimated benefits of improved sport fishing on the lower Kennebec River are $1.49 million per year for all anglers holding a Maine fishing license. A 90 percent confidence interval around this estimate yields a high estimate of $2.18 million and a low estimate of $0.81 million. The benefit estimate is the same whether fish passage is provided at Edwards Dam or whether Edwards Dam itself is removed. Removing Edwards Dam would provide an increase in the quality of sport fishing over the increment of quality from simply providing fish passage. However, anglers holding a Maine fishing license place a marginal value of $0 on the increased quality provided by removal of the dam.

Anglers responding to the survey are primarily interested in Atlantic salmon and brown trout, both of which use fishways. In turn, angling benefits for Atlantic salmon and brown trout could be realized whether fish passage is provided or the dam is removed. Rainbow smelt and striped bass do not use fishways. However, our results indicate only moderate angler interest in rainbow smelt, and angler interest in this species may be satisfied by the current rainbow smelt fishery in the lower Kennebec River. Angler interest in striped bass is somewhat stronger than it is for rainbow smelt, but lower than angler interest in Atlantic salmon and brown trout. We suspect that anglers did not respond to the increase in striped bass fishing quality due to removal of the dam because of the large minimum length on striped bass. Currently, the minimum length for keeping striped bass is 36 inches and it is unlikely that this regulation will change even if a native population of striped bass is established in the lower Kennebec River. Finally, American shad use fishways, but anglers expressed very little interest in an shad fishery. We conclude, therefore, that most of the $1.49 million benefit estimate accrues to improved Atlantic salmon and brown trout fishing, and this component of the benefit estimate is realized regardless of whether fish passage is provided or the dam is removed.

The finding that anglers are indifferent between providing fish passage at Edwards Dam and removing the dam is fairly robust. That is, we considered angler preferences in three different dimensions. First, anglers were asked qualitative questions regarding each option. Second, anglers responded to a contingent-valuation question for each option. Finally, anglers reported their predicted participation in the lower Kennebec River sport fishery under each option. This convergent validity, three different types of evaluations providing similar statistical results, strongly indicates anglers are indifferent between the provision of fish passage at Edwards Dam or removing the dam itself. The only exception is the sample of anglers from adjacent communities. These anglers, in responding to the qualitative evaluation questions, expressed a preference for fish passage over dam removal.

The benefit estimate of $1.49 million must be interpreted as being conservative because we did not survey anglers who marine sport fish and who do not hold a Maine inland fishing license. That is, anglers are not required to hold an inland fishing license when fishing below the head of tide on Maine's coastal brooks, streams and rivers. In turn, anglers fishing the lower Kennebec below Edwards Dam are not required to purchase a fishing license. Unfortunately, there is no uniform list from which to draw a sample of anglers who currently fish the lower Kennebec River and who do not hold a Maine fishing license. In an attempt to address this issue, we over sampled resident anglers from communities adjacent to the lower Kennebec River. This strategy provided a subsample of anglers who currently fish the lower Kennebec River. We found that these anglers who do fish the lower Kennebec River are also indifferent between the provision of fish passage or the removal of Edwards Dam. We suspect this finding is likely to be true of all anglers who marine sport fish in Maine; some will value improved sport fishing on the lower Kennebec, but as a group they will be indifferent between fish passage or dam removal.

An additional aspect of our sampling scheme is that we sampled resident and nonresident anglers who currently fish in Maine and who do not fish the lower Kennebec. We propose that anglers currently fishing in Maine are the individuals most likely to take advantage of improved sport fishing on the lower Kennebec River. These anglers demonstrate a moderate interest is fishing the lower Kennebec River, but are indifferent between the provision of fish passage and the removal of Edwards Dam.

Our basic interpretation is that improved sport fishing on the lower Kennebec River can provide a specialized fishery for a select group of anglers. In fact, if improved sport fisheries were put forward as a referendum vote of all Maine anglers, and approving the referendum implied that all anglers would share in the cost of improving these fisheries, our results indicate that the referendum would be soundly defeated. This is true, however, of most sport fisheries in that only a small proportion of all anglers fish any given fishery. In the current example, one must

ask whether the benefits of improved sport fishing are worth the costs to the citizens of Maine from the provision of this fishery. Given that anglers appear to be indifferent between the provision of fish passage and the removal of Edwards Dam, the option with the largest positive, net present value should be selected. Net benefits -- benefits minus costs -- will be different between these alternatives due to different streams of costs through time. Provision of fish passage includes the costs of constructing and maintaining a fishway. Whereas, removal of the dam requires a one time cost of removing Edwards Dam and includes the opportunity cost of replacing the electricity that would have been generated at the dam's power station. Fishery management costs will also be different according to whether fish passage is provided or the dam is removed. We should also note that any fish passage option that accomplishes the fishery management objectives in our first scenario would be consistent with the annual benefit estimate of $1.49 million. A fish passage system, that meets these objectives, should be selected to minimize costs and to meet the biological needs of the species using the fishway.

One final issue is worth noting, we did not consider the economic impact of improved sport fishing on the lower Kennebec River. This was done because we are considering the benefits of improved fisheries from a state-wide perspective. We expect that resident angler participation in an improved sport fishery in the lower Kennebec River will result in anglers switching from fishing other locations in Maine to fishing the lower Kennebec. For example, an Atlantic salmon angler may fish the lower Kennebec rather than the lower reaches of the Penobscot River. Thus, money spent by resident anglers in communities along the lower Kennebec River is likely to result in reduced angler expenditures in other communities in Maine. The Maine economy, as a whole, has not gained, rather angler expenditures are redistributed within the state. This treatment of angler expenditures (direct economic impact) is consistent with the federal guidelines for evaluating water resource projects (Water Resources Council, 1983). Finally, nonresident expenditures, although representing new money in Maine's economy, are likely to be relatively small. In the 10 to 30 years it will take to establish improved sport fisheries on the lower Kennebec River, we do not see nonresident angler participation exceeding the roughly 300 nonresident anglers who currently fish the Penobscot River for Atlantic salmon each year. In fact, some nonresident anglers may actually switch from the Penobscot River to the lower Kennebec River. If this type of substitution occurs, the resulting nonresident expenditures along the lower Kennebec River can not be considered new money in Maine's economy.

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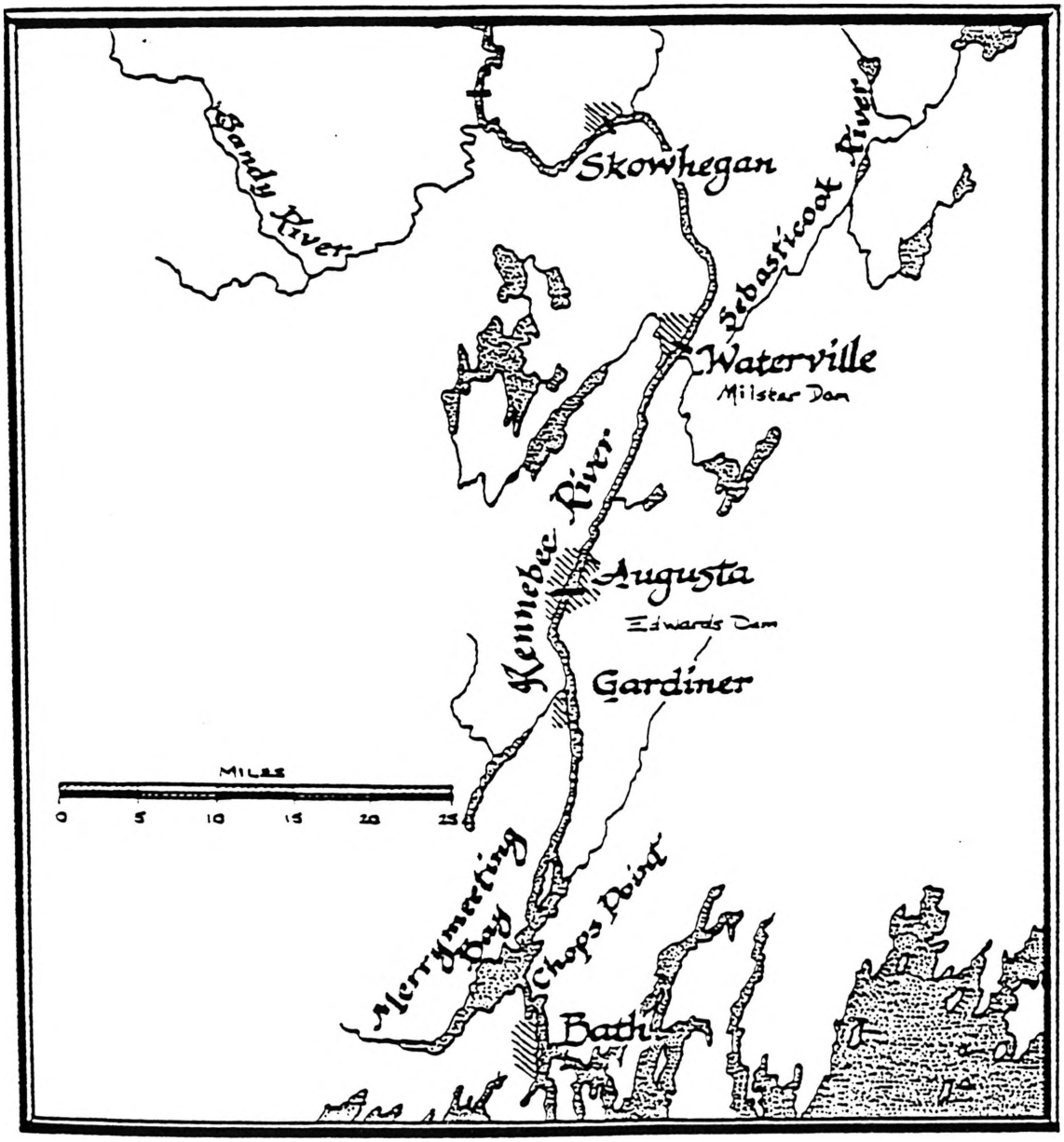
APPENDIX A

MAIL SURVEY SUMMARY STATISTICS

Kennebec River Survey



SECTION A. In this section we are interested in learning some general information about your fishing activities in Maine.

1. Which category best describes the first time you went freshwater or saltwater fishing **in Maine**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Before 1940	8.2%	10.1%	4.0%
1940 to 1949	14.5	12.9	4.0
1950 to 1959	22.6	19.4	15.3
1960 to 1969	25.8	17.3	14.0
1970 to 1974	8.8	10.1	10.7
1975 to 1979	9.4	12.2	8.0
1980 to 1984	2.5	5.0	10.0
Since 1984	8.2	12.9	34.0

2. About how often do you go freshwater or saltwater fishing **in Maine**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Every year	80.4%	77.7%	46.1%
Almost every year	9.5	11.5	24.3
About half of the years	3.2	5.8	6.6
Less than half of the years	7.0	3.6	11.2
Only fished in Maine once	0.0	1.4	11.8

3. Which type of water body do you fish most often **in Maine**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Lakes and ponds	73.5%	63.1%	77.6%
Rivers	7.1	10.8	9.5%
Streams and brooks	11.0	19.2	8.8%
Coastal bays and (Marine fishing)	8.4	6.9	4.1%

4. Which of the following species of fish have you tried to catch while fishing **in Maine** since **1984**? (CIRCLE ALL NUMBERS THAT APPLY)

	ADJACENT	NONADJACENT	NONRESIDENT
I do not try to catch specific species	13.7%	13.1%	8.6%
Alewives	4.3	0.0	0.0
Atlantic Salmon	27.5	21.8	12.3
Brook Trout	84.1	92.4	61.6
Brown Trout	65.2	49.6	39.9
Bluefish	48.6	34.5	5.8
Eel	4.3	3.4	2.2
Groundfish (Cod, Pollock and Flounder)	17.4	21.0	5.8
Lake Trout (Togue)	68.8	63.0	45.7
Landlocked Salmon	71.7	64.7	57.2
Largemouth Bass	53.6	44.5	44.9
Mackerel	36.2	42.0	5.8
Pickerel	37.7	45.4	34.1
Shad	2.9	0.8	1.4
Smallmouth Bass	48.6	50.4	58.0
Smelt	44.9	31.9	7.2
Striped Bass	41.3	26.1	11.6
Sturgeon	1.4	0.0	0.0
White Perch	57.2	47.1	35.5
Yellow Perch	11.6	21.0	20.3
Other	12.3	5.9	5.8

SECTION B. In this section we would like to learn about your fishing effort on different parts of the lower Kennebec River, from **Milstar Dam in Waterville to Chops Point on Merrymeeting Bay.** (SEE THE MAP ON THE COVER OF THE SURVEY)

1. Have you fished the lower Kennebec River **from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?** (Please refer to the map on the cover of the survey) (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	53.1%	12.2%	3.9%
NO ---> SKIP to Section C.	46.9	87.8	96.1
	(n=162)	(n=139)	(n=154)

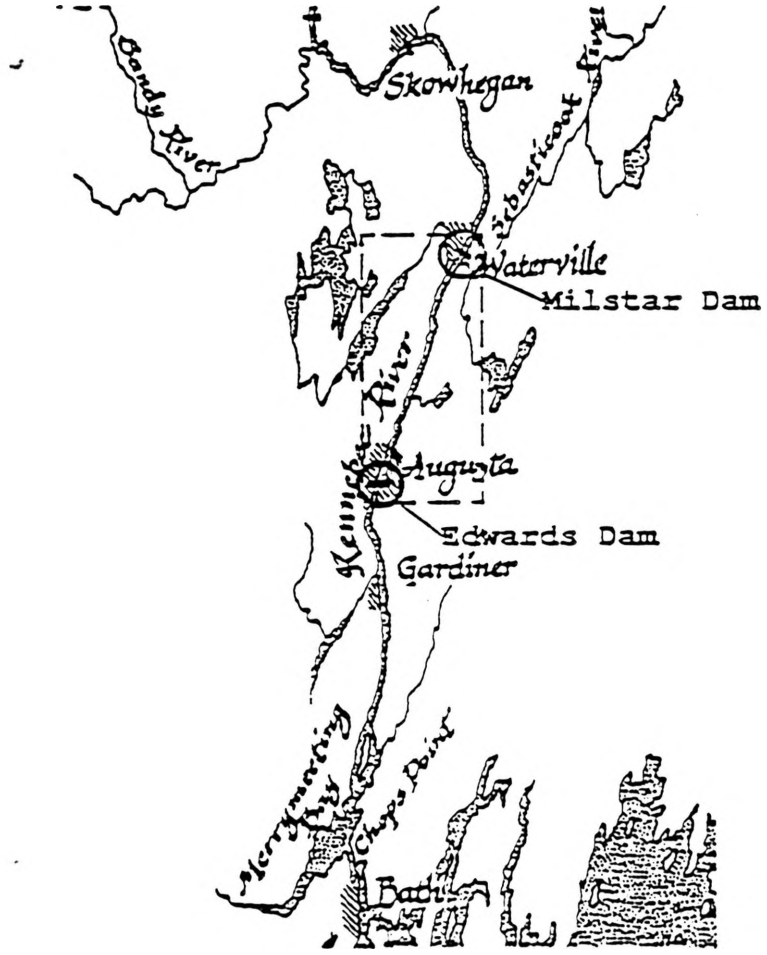
2. Which category best describes the first time you went fishing on the lower Kennebec River **from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?** (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Before 1940	3.5%	13.0%	0.0%
1940 to 1949	4.7	0.0	0.0
1950 to 1959	7.1	0.0	16.7
1960 to 1969	20.0	0.0	0.0
1970 to 1974	11.8	13.3	16.7
1975 to 1979	3.5	13.3	0.0
1980 to 1984	23.5	6.7	16.7
Since 1984	25.9	53.3	50.0

3. About how often do you go fishing on the lower Kennebec River **from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?** (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Every year	57.6%	40.0%	50.0%
Almost every year	14.1	13.3	0.0
About half of the years	9.4	13.3	33.3
Less than half of the years	11.8	26.7	0.0
Only fished the lower Kennebec River once	7.1	6.7	16.7

QUESTIONS 4 THROUGH 6 CONCERN THE SECTION OF THE LOWER KENNEBEC RIVER FROM MILSTAR DAM IN WATERVILLE TO EDWARDS DAM IN AUGUSTA (SEE THE MAP BELOW)



4. Have you fished the section of the lower Kennebec River **below** Milstar **Dam in Waterville and above Edwards Dam in Augusta** since **1984**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	43.0%	47.1%	66.7%
NO --> SKIP to Question 10.	57.0 (n=86)	52.9 (n=17)	33.3 (n=6)

5. There are many reasons why you might choose to fish the lower Kennebec River **between Milstar Dam in Waterville and Edwards Dam in Augusta.** What is the most important reason why you fished this section of the river since **1984**? (FILL IN THE BLANK)

ADJACENT

Convenient/Close to home	35.3 %
Brown Trout	29.4
Improved Water Quality	11.6
Striped Bass	5.9
Good Fishing	5.9

NONADJACENT

Brown Trout	37.5%
Striped Bass	25.0
Good Fishing	25.0
Trout and Bass	12.5

NONRESIDENT

Easy Access	25.0 %
Close to Relatives	25.0
Good Fishing	25.0
Convenient	25.0

6. For the section of the lower Kennebec River **between Milstar Dam in Waterville and Edwards Dam in Augusta**, which of the following species have you tried to catch since **1984**? (CIRCLE ALL NUMBERS THAT APPLY)

	ADJACENT	NONADJACENT	NONRESIDENT
I do not try to catch specific species	27.0%	25.0%	0.0%
Brook Trout	37.0	50.0	25.0
Brown Trout	81.5	66.7	50.0
Eel	3.7	0.0	0.0
Landlocked Salmon	18.5	33.3	0.0
Largemouth Bass	51.9	16.7	25.0
Pickerel	22.2	16.7	50.0
Smallmouth Bass	51.9	50.0	50.0
White Perch	18.5	0.0	25.0
Yellow Perch	0.0	0.0	25.0
Other	3.7	0.0	0.0

7. Since **1984**, about how many trips per year did you take to fish the lower Kennebec River **between Milstar Dam in Waterville and Edwards** Dam **in Augusta** during an average year? (Even if you walked to the river from your home, please consider this to be a trip.)
(FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENTS
Trips per year since 1984	9.4 (se=2.08) (n=35)	6.0 (se=1.35) (n=8)	5.8 (se=4.8) (n=4)

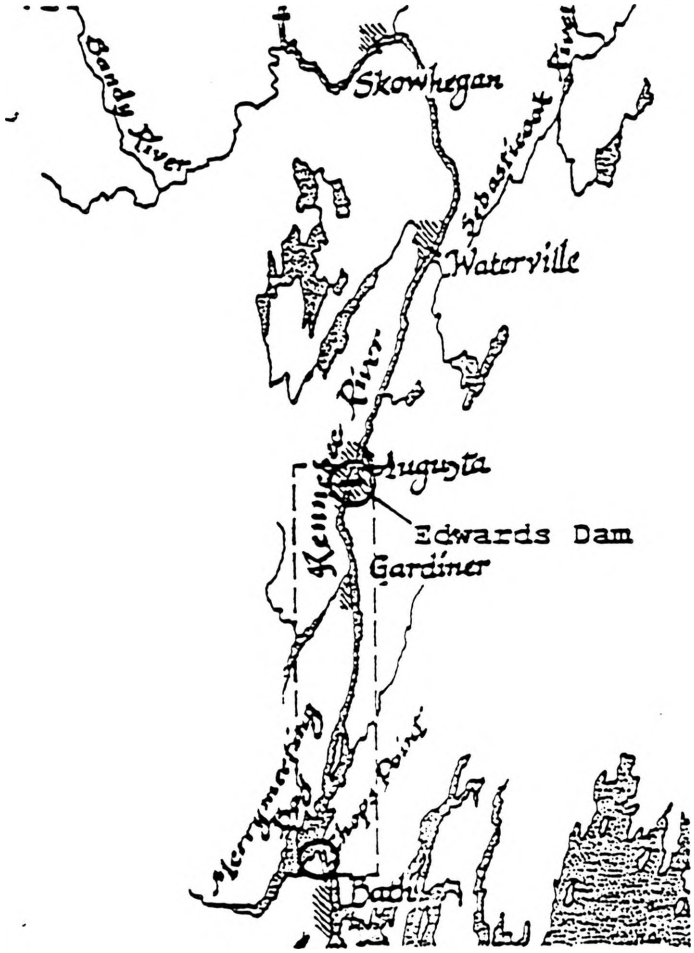
8. Fishing trips may involve a number of different expenses, since 1984, about how much did an average trip to the lower Kennebec River **between Milstar Dam in Waterville and Edwards Dam in Augusta** cost you? (Only report expenses for an average trip where your primary objective was to fish the lower Kennebec River **between Milstar Dam in Waterville and Edwards Dam in Augusta.** If you shared expenses with others, only report your share of the expenses. If you did not purchase an item, please enter zero.) (FILL IN ALL THE BLANKS)

	ADJACENT	NONADJACENT	NONRESIDENT
Transportation (gas, oil, tolls, etc.)	$4.94	$13.38	$ 42.25
Public Transportation (Airline, etc.)	0.00	0.00	0.00
Food and Beverages (groceries, restaurants, etc.	3.25	21.88	80.00
Lodging	0.00	0.00	32.50
Guide Fees	0.00	0.00	37.50
Bait	1.69	4.50	9.25
Other Fishing Expenses (Do Not include Fishing Licenses or Equipment Purchases)	0.00	0.00	0.00
TOTAL EXPENDITURES FOR AN AVERAGE FISHING TRIP TO THE LOWER KENNEBEC RIVER **BETWEEN MILSTAR DAM IN WATERVILLE ANDEDWARDS DAM IN AUGUSTA** SINCE **1984**	$9.88 (n=36)	$39.76 (n=8)	$201.50 (n=4)

9. Your personal costs for a fishing trip may rise or fall over time. For example, gas prices rose dramatically in the 1970s, fell somewhat in the early 1980s and have recently risen again. In the question above you reported your expenses for an <u>average</u> fishing trip to the lower Kennebec River **between Milstar Dam in Waterville and Edwards Dam in Augusta** since **1984**. <u>What</u> <u>is</u> <u>the</u> <u>most</u> that a fishing trip could have cost before you would have decided <u>not</u> <u>to</u> take **any** fishing trips to this section of the lower Kennebec River?
(FILL IN THE BLANK)

	<u>ADJACENT</u>	<u>NONADJACENT</u>	<u>NONRESIDENT</u>
The **most** that I would pay <u>per</u> <u>trip</u>	$25.56 (se=5.79) (n=32)	$177.86 (se=137.53) (n=7)	$243.33 (se=110.50) (n=3)

QUESTIONS 10 THROUGH 15 CONCERN THE SECTION OF THE LOWER KENNEBEC RIVER FROM EDWARDS DAM IN AUGUSTA TO CHOPS POINT ON MERRYMEETING BAY (SEE THE MAP BELOW)



10. Have you fished the section of the lower Kennebec River **below** Edwards **Dam in Augusta and above Chops Point on Merrymeeting Bay** since **1984**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	81.4%	100.0%	50.0%
NO ---> SKIP to Question 16.	18.6 (n=86)	0.0 (n=17)	50.0 (n=6)

11. There are many reasons why you might choose to fish the lower Kennebec River **between Edwards Dam in Augusta and Chops Point on Merrymeeting Bay.** What is the most important reason why you fished this section of the river since **1984**? (FILL IN THE BLANK)

ADJACENT	
Convenience/Close to home	35.8%
Striped Bass	13.4
Bluefish	11.9
Easy Access	7.5
Atlantic Salmon	6.0
NONADJACENT	
Brown Trout	11.8%
Blue Fish	11.8
Stripers	11.8
Easy Access	11.8
Good Fishing	11.8
NONRESIDENT	
Convenient Camping	50.0%
Stripers	50.0

12. For the section of the lower Kennebec River **between Edwards Dam in Augusta and Chops Point on Merrymeeting Bay**, which of the following species have you tried to catch since **1984**? (CIRCLE ALL NUMBERS THAT APPLY)

	ADJACENT	NONADJACENT	NONRESIDENT
I do not try to catch specific species	7.1%	17.6%	33.3%
Alewives	6.2	7.1	0.0
Atlantic Salmon	36.9	14.3	50.0
Bluefish	40.0	57.1	0.0
Brown Trout	30.8	42.9	0.0
Largemouth Bass	20.0	7.1	0.0
Shad	6.2	7.1	0.0
Smallmouth Bass	12.3	14.3	50.0
Smelt	49.2	28.6	0.0
Striped Bass	76.9	64.3	50.0
Sturgeon	6.2	0.0	0.0
White Perch	9.2	0.0	0.0
Yellow Perch	6.2	0.0	0.0
Other	9.1	7.1	0.0

13. Since **1984**, about how many trips per year did you take to fish the lower Kennebec River **between Edwards Dam in Augusta and Chops Point** on **Merrymeeting Bay** during an average year? (Even if you walked to the river from your home, please consider this to be a trip.) (Do not include trips to primarily fish **below Chops Point on Merrymeeting** Bay) (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
Trips per year since **1984**	7.5 (se=1.17) (n=66)	3.7 (se=0.68) (n=14)	4.5 (se=3.5) (n=2)

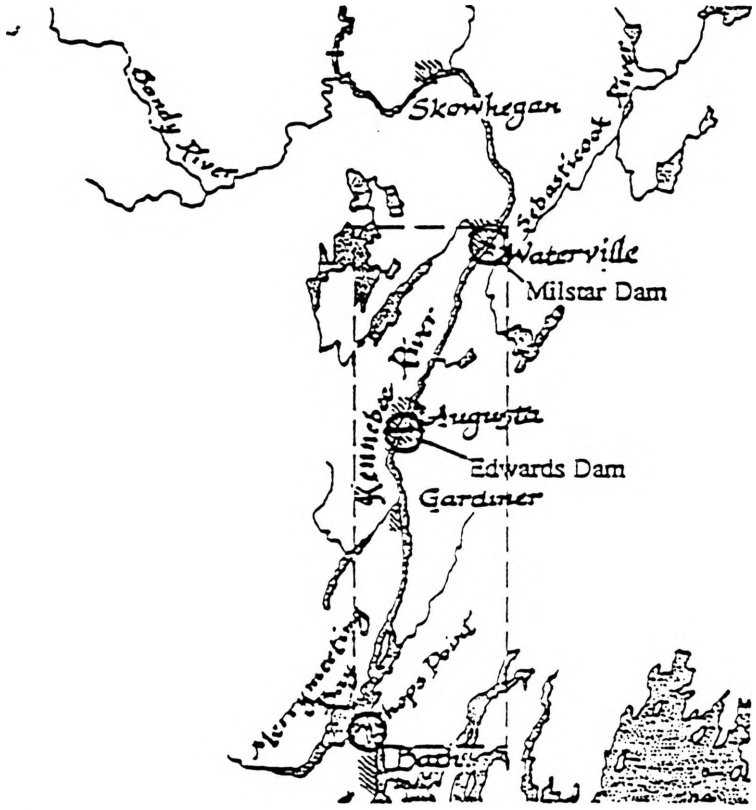
14. Fishing trips may involve a number of different expenses, Since **1984**, about how much did an <u>average</u> trip to fish the lower Kennebec River **between Edwards Dam in Augusta and Chops Point on Merrymeeting Bay** cost you? (Only report expenses for an average trip where your <u>primary objective</u> was to fish the lower Kennebec River **between Edwards Dam in Augusta and Chops Point on Merrymeeting Bay.** If you shared expenses with others, only report your share of expenses. If you <u>did not</u> purchase an item, please enter <u>zero</u>.) (FILL IN <u>ALL</u> THE BLANKS)

	<u>ADJACENT</u>	<u>NONADJACENT</u>	<u>NONRESIDENT</u>
Transportation (gas, oil, tolls, etc.)	$9.61	$16.88	$ 26.50
Public Transportation (Airline, etc.)	0.00	0.00	0.00
Food and Beverages (groceries, restaurants, etc.)	6.00	16.38	100.00
Lodging	0.09	1.25	137.50
Guide Fees	0.00	0.00	0.00
Bait	2.77	3.62	4.00
Other Fishing Expenses (<u>Do Not</u> include Fishing Licenses or Equipment Purchases)	1.34	2.19	0.00
TOTAL EXPENDITURES FOR AN AVERAGE FISHING TRIP TO THE LOWER KENNEBEC RIVER **BETWEEN EDWARDS DAM IN AUGUSTA AND CHOPS POINT ON MERRYMEETING BAY** SINCE **1984**	$19.81 (se=3.08) (n=70)	$40.32 (se=7.24) (n=16)	$268.00 (se=257) (n=2)

15. Your personal costs for a fishing trip may rise or fall over time. For example, gas prices rose dramatically in the 1970s, fell somewhat in the early 1980s and have recently risen again. In the question above you reported your expenses for an <u>average</u> fishing trip to the lower Kennebec River **between Edwards Dam in Augusta and Chops Point on Merrymeeting Bay** since 1984. <u>What is the most</u> that an average fishing trip could have cost before you would have decided <u>not to</u> take any fishing trips to this section of the lower Kennebec River?
(FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
The **most** I would pay <u>per trip</u>	$111.95 (se=79.32) (n=63)	$113.67 (se=63.92) (n=15)	$365.00 (se=335.00) (n=2)

QUESTIONS 16 THROUGH 18 CONCERN THE ENTIRE KENNEBEC RIVER FROM MILSTAR DAM IN WATERVILLE TO CHOPS POINT ON MERRYMEETING BAY (SEE THE MAP BELOW)



16. Some factors may keep you from fishing the lower Kennebec River below **Milstar Dam in Waterville and above Chops Point on Merrymeeting Bay.** Do any of the following factors reduce your fishing effort on the lower Kennebec River? (CIRCLE ONE NUMBER FOR EACH FACTOR)

	ADJACENT	NONADJACENT	NONRESIDENT
Crowding by other anglers			
No Effect on Effort	77.9%	66.7%	66.7%
Reduce Effort Somewhat	14.3	8.3	16.7
Reduce Effort Very Much	7.8	25.0	16.7
Too far from my home or camp			
No Effect on Effort	89.5%	69.2%	50.0%
Reduce Effort Somewhat	7.9	15.4	50.0
Reduce Effort Very Much	2.6	15.4	0.0
Poor water quality			
No Effect on Effort	27.5%	62.5%	83.3%
Reduce Effort Somewhat	41.2	25.0	0.0
Reduce Effort Very Much	31.3	12.5	16.7
Poor boat access			
No Effect on Effort	66.7%	75.0%	66.7%
Reduce Effort Somewhat	25.6	16.7	33.3
Reduce Effort Very Much	7.7	8.3	0.0
Not likely to catch a fish			
No Effect on Effort	56.3%	33.3%	50.0%
Reduce Effort Somewhat	30.0	33.3	16.7
Reduce Effort Very Much	13.7	33.3	33.3
Poor access for shoreline fishing			
No Effect on Effort	56.4%	53.8%	16.7
Reduce Effort Somewhat	25.6	15.4	83.3
Reduce Effort Very Much	17.9	30.8	0.0
Undesireable fish species			
No Effect on Effort	66.2%	53.8%	66.7%
Reduce Effort Somewhat	27.3	23.1	16.7
Reduce Effort Very Much	6.5	23.1	16.7
No convenient stores or lodging			
No Effect on Effort	96.1%	75.0%	50.0%
Reduce Effort Somewhat	2.6	25.0	50.0
Reduce Effort Very Much	1.3	0.0	0.0
Fishing buddies do not fish there			
No Effect on Effort	75.3%	66.7%	83.3%
Reduce Effort Somewhat	11.7	16.7	16.7
Reduce Effort Very Much	13.0	16.7	0.0
Not a scenic area			
No Effect on Effort	91.9%	90.9%	66.7%
Reduce Effort Somewhat	5.4	9.1	16.7
Reduce Effort Very Much	2.7	0.0	16.7
Other			
No Effect on Effort	0.0%	0.0%	0.0%
Reduce Effort Somewhat	0.0	0.0	0.0
Reduce Effort Very Much	7.2	6.7	0.0

17. There may be many reasons why you might choose to fish the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay.** What is the most important factor that would have to change to make you increase your fishing effort on the lower Kennebec River? (FILL IN THE BLANK)

Adjacent	
Improved Water Quality	41.5%
More Desirable Fish	27.7
Removal of Edwards Dam	10.8
Lessen Restrictions	7.7
Increased Boat Access	4.6
Nonadjacent	
More Desirable Fish	50.0%
Improved Water Quality	33.3
Removal of Edwards Dam	8.3
More Stores	8.3
Nonresidents	
Improved Water Quality	40.0%
Removal of Edwards Dam	20.0
More Desirable Fish	20.0
Boat Charters	20.0

18. A number of attributes of the lower Kennebec River **below Milstar Dam in Waterville and above Chops Point on Merrymeeting Bay** are changing as a number of new fishery management programs are being proposed. How would the changes listed below affect your decision to fish the lower Kennebec River in the future? (CIRCLE ONE NUMBER FOR EACH FACTOR)

	ADJACENT	NONADJACENT	NONRESIDENT
A run of Atlantic Salmon			
Fish Less Each Year	2.4%	7.1%	16.7%
No Effect	17.1	21.4	33.3
Fish More Each Year	80.5	71.4	50.0
Native striped bass population			
Fish Less Each Year	6.1%	7.7%	16.7%
No Effect	19.5	30.8	33.3
Fish More Each Year	74.4	61.5	50.0
Increased stocking of brown trout			
Fish Less Each Year	1.2%	18.8%	0.0%
No Effect	19.0	18.8	0.0
Fish More Each Year	79.8	62.5	100.0
A larger population of smelt			
Fish Less Each Year	5.1%	13.3%	33.3%
No Effect	46.8	26.7	50.0
Fish More Each Year	48.1	60.0	16.7
A shad sport fishery			
Fish Less Each Year	10.5%	30.8%	16.7%
No Effect	67.1	46.2	50.0
Fish More Each Year	22.4	23.1	33.3
Fish passage provided at Edwards Dam			
Fish Less Each Year	2.5%	14.3%	16.7%
No Effect	27.2	35.7	33.3
Fish More Each Year	70.4	50.0	50.0
Removal of Edwards Dam			
Fish Less Each Year	18.3%	13.3%	33.3%
No Effect	26.8	33.3	33.3
Fish More Each Year	54.9	53.3	33.3
More access for shoreline fishing			
Fish Less Each Year	2.6%	21.4%	16.7%
No Effect	47.4	21.4	0.0
Fish More Each Year	50.0	57.1	83.3
More access for boat launching			
Fish Less Each Year	4.9%	21.4%	33.3%
No Effect	53.1	28.6	33.3
Fish More Each Year	42.0	50.0	33.3

SECTION C. In this section we would like to find out why you do not fish the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay.**

1. Have you fished the lower Kennebec River **below Milstar Dam in Waterville and above Chops Point on Merrymeeting** Bay since **1984**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES --> Skip to Section D.	53.1%	12.2%	3.9%
NO	46.9 (n=162)	87.8 (n=139)	96.1 (n=154)

2. Have you ever fished the lower Kennebec River **below Milstar Dam in Waterville and above Chops Point on Merrymeeting Bay?** (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES --> Skip to Question 4.	19.0%	0.0%	4.5%
NO	81.0 (n=63)	100.0 (n=98)	95.5 (n=112)

3. What is the primary reason that you have never fished the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay?**
(FILL IN THE BLANK)

Adjacent

Poor Water Quality	27.3%
Prefer Lake Fishing	27.2
Not Convenient/Too Far	22.7
Not Enough Fish	9.1
Poor Access	4.5
Buddies Don't Fish There	4.5
No Knowledge of River	4.5

Nonadjacent

Not Convenient/Too Far	50.9%
Poor Water Quality	14.0
No Knowledge of River	10.5
Prefer Lake Fishing	7.1
Prefer Remore Areas	7.0

Nonresidents

Not Convenient/Too Far	35.9%
No Knowledge of River	26.4
Prefer Lake Fishing	18.9
Prefer Remote Areas	5.7
Poor Water Quality	3.8

4. A number of attributes of the lower Kennebec River **below Milstar Dam in Waterville and above Chops Point on Merrymeeting Bay** are changing as a number of new fishery management programs are being proposed. How would the changes listed below affect your decision to fish the lower Kennebec River in the future? (CIRCLE ONE NUMBER FOR EACH FACTOR)

	ADJACENT	NONADJACENT	NONRESIDENT
A run of Atlantic Salmon			
No effect	17.5%	41.0%	38.5%
Somewhat Likely to Fish	36.8	28.9	28.1
Very Likely to Fish	45.6	30.1	33.3
Native striped bass population			
No effect	42.9%	56.3%	46.2%
Somewhat Likely to Fish	38.8	22.5	31.9
Very Likely to Fish	18.4	21.2	22.0
Increased stocking of brown trout			
No effect	26.3%	45.8%	39.1%
Somewhat Likely to Fish	40.4	36.1	31.5
Very Likely to Fish	33.3	18.1	29.3
A larger population of smelt			
No effect	64.6%	74.4%	85.1%
Somewhat Likely to Fish	18.8	19.2	8.0
Very Likely to Fish	16.7	6.4	6.9
A shad sport fishery			
No effect	90.7%	83.3%	78.8%
Somewhat Likely to Fish	4.7	11.5	16.5
Very Likely to Fish	4.7	5.1	4.7
Fish passage provided at Edwards Dam			
No effect	36.5%	60.5%	56.2%
Somewhat Likely to Fish	32.7	25.0	32.6
Very Likely to Fish	30.8	14.5	11.2
Removal of Edwards Dam			
No effect	50.0%	64.6%	67.8%
Somewhat Likely to Fish	29.2	21.5	18.9
Very Likely to Fish	20.8	13.9	13.3
More access for shoreline fishing			
No effect	35.8%	52.5%	42.4%
Somewhat Likely to Fish	24.5	26.2	26.1
Very Likely to Fish	39.6	21.2	31.5
More access for boat launching			
No effect	31.5%	49.4%	52.1%
Somewhat Likely to Fish	29.6	25.3	26.6
Very Likely to Fish	38.9	25.3	21.3

5. Would you ever fish on the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay** in the future? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	72.2%	52.2%	61.2%

What is the most important factor that would have to change for you to fish the lower Kennebec River in the future? (FILL IN THE BLANK)

Adjacent

Cleaner Water	42.9%
Increased Access	20.0
Better Fishing	11.4
Removal of Edwards Dam	11.4
Atlantic Salmon	5.7
More Information	5.7

Nonadjacent

Cleaner Water	35.1%
Atlantic Salmon	13.5
Better Fishing	13.5
Increased Access	8.1
More Information	8.1

Nonresidents

Better Fishing	27.7%
Increased Access	17.1
Atlantic Salmon	14.9
More Information	8.5
Removal of Edwards Dam	8.5
Cleaner Water	6.4
More Trout & Salmon	6.4

	ADJACENT	NONADJACENT	NONRESIDENT
NO	27.8%	47.8%	38.8%

What is the most important reason why you would never fish the lower Kennebec River in the future? (FILL IN THE BLANK)

Adjacent	
Too Far	33.3%
Prefer Ponds	33.3
Not Scenic	16.7
Don't Fish Much	16.7
Nonadjacent	
Too Far	77.8%
Prefer Ponds	5.6
Don't Fish Much	5.6
Prefer Marine	2.8
Toxins in Fish	2.8
Not Scenic	2.8
Poor Access	2.8
Nonresidents	
Too Far	70.8%
Prefer Ponds	12.5
Prefer Streams	8.4
Poor Habitat	4.2
Not Familiar with Area	4.2

SECTION D. In this section we would like to learn about the value you place on improved sport fisheries on the lower Kennebec River between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay.
Please read the following information carefully before answering the questions in this section.

Historically, the Kennebec River supported abundant populations of Atlantic salmon, striped bass, American shad, rainbow smelt and alewives. The populations of these species, and other native species of the Kennebec River, declined as dams were built, blocking upstream and downstream passage to spawning and feeding grounds, and as the water quality of the Kennebec River declined due to industrial and municipal discharges. However, over the past 20 years the water quality of the Kennebec River has improved to a level where it is again able to support many species of fish. In fact, the Maine Departments of Marine Resources and Inland Fisheries and Wildlife have implemented programs to increase fishery resources in the Kennebec River.

In 1987, the owners of several major dams on the Kennebec River agreed to provide permanent upstream and downstream fish passage on the Kennebec River and its tributaries. However, Edwards Dam in Augusta, which is the first dam on the Kennebec River, was not part of the agreement, and no fish passage exists at Edwards Dam. The first dam subject to the agreement is Milstar Dam in Waterville. Unless fish passage is provided at Edwards Dam, the agreement among dam owners to provide permanent fish passage further upriver is irrelevant.

Two options are available that would provide access to upstream spawning and feeding habitat on the Kennebec River. One option is to build fish passage facilities at Edwards Dam in Augusta. According to fishery biologists, fish passage facilities would provide access to upstream habitat for some fish species, but not for others. Another option would be to remove Edwards Dam entirely from the lower Kennebec River. This would provide access up to Milstar Dam in Waterville for all apecies. Either of these actions could help to improve sport fishing in the lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay. However, the effects of each of these actions may be quite different.

SCENARIO I

FISH PASSAGE AT EDWARDS DAM AND ENHANCED MANAGEMENT EFFORTS BY THE DEPARTMENTS OF MARINE RESOURCES AND INLAND FISHERIES AND WILDLIFE, AND THE ATLANTIC SALMON COMMISSION, WOULD HAVE THE FOLLOWING EFFECTS ON THE FOLLOWING SPECIES IN THE LOWER KENNEBEC RIVER.

Atlantic Salmon- Fish passage at Edwards Dam and at the other dams on the Kennebec River up to Abenaki Dam in Madison would allow Atlantic Salmon to enter the lower reaches of the Sebasticook and Sandy Rivers. Substantial Atlantic salmon spawning habitat would be open in the lower Kennebec River watershed by the year 2002. Providing fish passage and stocking Atlantic salmon would allow for an Atlantic salmon stock that could begin to support a sport fishery by the year 2020.

Striped Bass - Striped bass generally do not use fishways so providing fish passage at Edwards Dam would not have a significant effect on the population of striped bass in the lower Kennebec River. Consequently, the sport fishery for striped bass would be unchanged in the lower Kennebec River.

Rainbow Smelt - Rainbow smelt generally do not use fishways so providing fish passage at Edwards Dam would not have a significant effect on the population of smelt in the lower Kennebec River. Consequently, the sport fishery for smelt would be unchanged in the lower Kennebec River.

American Shad - Currently American shad are stocked in the lower Kennebec River by the Department of Marine Resources near Waterville, and in the Sebasticook River, with plans to increase stocking through 1999. Fish passage at Edwards Dam would make additional habitat available to American shad and could substantially increase the lower Kennebec Rivers population of American shad. A sport fishery for American shad would be ongoing by 1999 in the lower Kennebec River.

Brown Trout - Fish passage at Edwards Dam would not produce a significant increase in the number of wild brown trout in the fishery. However, fish passage at Edwards Dam would permit stocked brown trout to freely access the productive waters of the lower Kennebec River estuary. This would allow for brown trout to grow faster and larger. Fish passage would also allow the brown trout to migrate to inland waters where they would be available to anglers.

Suppose that a nonprofit corporation was formed that operates similar to the Nature Conservancy. This nonprofit corporation would raise funds and work to improve sport fishing on the lower Kennebec River. These efforts would be undertaken in cooperation with the Departments of Marine Resources and Inland Fisheries and Wildlife, and the Atlantic Salmon Commission. However, due to limited agency funds, the objectives of Scenario I on the previous page would not be accomplished without the actions of the nonprofit corporation. The primary task of the nonprofit corporation would be to accomplish the objectives of Scenario I (provide fish passage at Edwards Dam and accomplish the sport fishery goals set out on the previous page for Atlantic salmon,shad and brown trout). All funds for this nonprofit corporation would be raised by selling supporting memberships to private citizens like yourself.

1. If this nonprofit corporation contacted you and asked you to purchase a supporting membership, with all funds being used to accomplish the objectives of Scenario I, what is the **most** you would pay for an annual supporting membership? (If you would not pay anything please enter zero) (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
The **most** that I would pay for a supporting membership	$15.81 (se=2.78) (n=75)	$10.27 (se=3.08) (n=55)	$ 5.59 (se=1.33) (n=70)

2. If sport fisheries on the lower Kennebec River were improved as described in Scenario I, by providing fish passage and increasing stocking efforts, would you fish the lower Kennebec River **from Milstar Dam in Waterfville to Chops Point on Merrymeeting Bay**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	74.0%	37.0%	40.3%
NO --> SKIP to Scenario II.	26.0	63.0	59.7

3. On average, how many trips do you think you would take per year to the lower Kennebec River between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay if the fisheries improved as described in Scenario I? (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
Trips per year	12.0 (se=1.22) (n=103)	4.9 (se=0.70) (n=47)	2.0 (se=0.16) (n=52)

SCENARIO II

REMOVING EDWARDS DAM AND ENHANCED MANAGEMENT EFFORTS BY THE DEPARTMENT OF MARINE RESOURCES AND INLAND FISHERIES AND WILDLIFE, AND THE ATLANTIC SALMON COMMISSION, WOULD HAVE THE FOLLOWING EFFECTS ON THE FOLLOWING SPECIES IN THE LOWER KENNEBEC RIVER.

Atlantic Salmon - Removal of Edwards Dam would reduce mortality rates for Atlantic salmon migrating upstream and downstream and would open up substantial salmon spawning habitat in the lower Kennebec River. However, an Atlantic salmon stock that could begin to support a sport fishery would still start in 2020. Removal of Edwards Dam could also increase, riffle habitat on the river, creating more fishing sites for Atlantic salmon fishing.

Striped Bass - The removal of Edwards Dam will increase the amount of striped bass spawning habitat in the lower Kennebec River from 20 to 38 miles. The removal of the Edwards Dam, combined with the ongoing striped bass restoration program will result in a substantial population of native striped bass. The lower Kennebec River could become a premier striped bass fishing river in New England by 2004.

Rainbow Smelt - The removal of the Edwards Dam would significantly increase the amount of rainbow smelt spawning habitat in the lower Kennebec River. This should result in better fishing opportunities in the winter smelt fisheries below Edwards Dam. The increased number of smelt will also provide a significant food base for game species such as striped bass and brown trout.

American Shad - Removal of Edwards Dam would reduce mortality rates for shad migrating downstream and adults moving upstream. This should significantly increase the number of adult shad returning to the river. However, the sport fishery for shad will probably still start around 1999.

Brown Trout - Removal of Edwards Dm would reduce mortality of juvenille brown trout moving downstream and would provide greater access to the estuary where growth is faster. With increased management the quality of the brown trout fishery on the lower Kennebec River would be enhanced. The primary limiting factor for this fishery would be the lack of suitable spawning habitat below Waterville. For this reason natural reproduction would not be significant and the fishery would require stocking each year where hatchery fish aretocked, allowed to grow,and then caught.

Suppose that a nonprofit corporation was formed that operates similar to the Nature Conservancy. This nonprofit corporation would raise funds and work to improve sport fishing on the lower Kennebec River. These efforts would be undertaken in cooperation with the Departments of Marine Resources and Inland Fisheries and Wildlife, and the Atlantic Salmon Commission. However, due to limited agency funds, the objectives of Scenario II on the previous page would not be accomplished without the actions of the nonprofit corporation. The primary task of the nonprofit corporation would be to accomplish the objectives of Scenario II (remove Edwards Dam and accomplish the sport fishery goals set out on the previous page for Atlantic salmon, striped bass, smelt, shad and brown trout). All funds for this nonprofit corporation would be raised by selling supporting memberships to private citizens like yourself.

4. If this nonprofit corporation contacted you and asked you to purchase a supporting membership, with all funds being used to accomplish the objectives of Scenario II, what is the **most** you would pay for an annual supporting membership? (If you would not pay anything please enter zero) (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
The **most** that I would pay for a supporting membership	$15.97 (se=2.90) (n=73)	$12.09 (se=3.63) (n=55)	$10.45 (se=2.60) (n=69)

5. If sport fisheries on the lower Kennebec River were improved as described in Scenario II, by removing Edwards Dam and increasing stocking efforts, would you fish the lower Kennebec River **from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay**? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
YES	76.4%	38.9%	46.9%
NO --> SKIP to Question 7.	23.6	61.1	53.1

6. On average, how many trips do you think you would take per year to the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay** if the fisheries were improved as described in Scenario II? (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
Trips per year	12.6 (se=1.56) (n=103)	7.1 (se=0.99) (n=49)	2.2 (se=0.18) (n=59)

7. How important do you feel improved sport fisheries for the following species are in your decision to fish the lower Kennebec River **between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay**? (CIRCLE ONE NUMBER FOR EACH SPECIES)

	ADJACENT	NONADJACENT	NONRESIDENT
American Shad			
Not Important	52.7%	60.4%	57.5%
Somewhat Important	33.6	30.6	22.5
Very Important	13.7	9.0	20.0
Atlantic Salmon			
Not Important	7.5%	28.2%	24.8%
Somewhat Important	19.0	18.8	17.8
Very Important	73.5	53.0	57.4
Brown Trout			
Not Important	9.5%	30.6%	23.4%
Somewhat Important	31.3	24.8	25.8
Very Important	59.2	44.6	50.8
Rainbow Smelt			
Not Important	27.9%	47.8%	55.6%
Somewhat Important	37.1	31.9	17.9
Very Important	35.0	20.4	26.5
Striped Bass			
Not Important	18.8%	39.1%	28.8%
Somewhat Important	29.2	23.5	28.8
Very Important	52.1	37.4	42.4

SECTION E. In this last section we would like to ask you some questions about your background which will help us compare your answers with those of other people. We stress that all of your answers will be strictly confidential.

1. How old are you? (FILL IN THE BLANK)

	ADJACENT	NONADJACENT	NONRESIDENT
Years Old	43	42	43

2. Are you? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
MALE	78%	79%	87%
FEMALE	22	21	13

3. What is your zip code? (FILL IN THE NUMBER)

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4. What is the highest level of education you have completed? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Eight years or less	3.2%	3.0%	1.4%
Some high school	5.8	8.3	2.7
High school	34.4	29.5	21.8
Some college or technical school	29.2	28.8	25.9
Associate degree	6.5	4.5	10.9
B.A. or equivalent	8.4	15.9	20.4
M.A. or equivalent	6.5	6.8	10.9
Advanced degree (M.D., PhD., etc.)	5.8	3.0	6.1

5. With reference to your primary occupation, are you currently? (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Employed full-time	69.9%	60.6%	68.5%
Employed part-time	7.1	8.0	3.4
Full-time homemaker	2.6	4.4	4.7
Unemployed	1.3	1.5	2.7
Retired, not working	10.3	14.6	12.1
Retired, working part-time	3.2	2.9	4.7
Other	5.8	8.0	4.0

6. Please circle the response that comes closest to your total 1989 household income, before taxes. (CIRCLE ONE NUMBER)

	ADJACENT	NONADJACENT	NONRESIDENT
Less than $5,000	6.0%	8.9%	4.3%
$ 5,000 to $ 9,999	5.3	6.5	1.4
$10,000 to $14,999	9.3	5.7	2.8
$15,000 to $19,999	7.3	17.9	2.1
$20,000 to $24,999	10.0	7.3	8.5
$25,000 to $29,999	11.3	7.3	6.4
$30,000 to $34,999	8.7	9.8	9.2
$35,000 to $39,999	9.3	7.3	8.5
$40,000 to $44,999	13.3	8.1	9.2
$45,000 to $49,999	7.3	7.3	4.3
$50,000 to $59,999	4.7	4.1	10.6
$60,000 to $69,999	4.0	4.1	7.8
$70,000 to $79,999	0.7	2.4	9.2
$80,000 to $89,999	0.0	0.0	3.5
$90,000 to $99,999	0.0	0.0	2.1
$100,000 or More	2.7	3.3	9.9

APPENDIX B

BIOLOGICAL STUDIES

by

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and

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BIOLOGICAL STUDIES

Several activities were undertaken during the Summer of 1989 to assess the biological effects of the presence of Edwards Dam in Augusta, Maine on selected sport fisheries in the lower Kennebec River. This work had two purposes: (1) to provide biological input for the development of scenarios in the economic survey, and (2) to provide background information for analyses of alternative sport fisheries management options. Interviews were conducted with Thomas Squiers, Maine Department of Marine Resources (DMR), whose responses were principally concerned with American shad and striped bass; Dennis McNeish, Maine Department of Inland Fisheries and Wildlife (IFW), whose responses were principally concerned with brown trout; and Edward Baum, Maine Atlantic Sea-Run Salmon Commission (ASRSC), whose responses were principally concerned with Atlantic salmon. The respondents were asked to describe the current status of sport fishing for the selected species, to describe the constraints preventing or restricting development of a sport fishery for each species, and to indicate their expectations for each species with respect to four scenarios regarding efforts to enhance sport fishing in the lower Kennebec River. A summary of their responses follows.

CURRENT STATUS

> "What is the current status of the recreational fishery for the selected species (Atlantic salmon, brown trout, American shad, striped bass, and rainbow smelt) in the lower Kennebec River?"

Atlantic Salmon - For all practical purposes there is no sport fishery for Atlantic salmon in the Kennebec River above Augusta. Anglers occasionally take a stray from the Penobscot in the Kennebec River below Edwards Dam and a few salmon are taken by IFW in Bond Brook each year. There is at best a small remnant population of Kennebec salmon, and quite likely the entire population of Kennebec salmon is extinct.

Brown Trout - There is a very successful sport fishery for brown trout between Waterville and Augusta. This is strictly a "put, grow, and take" fishery and extends from Skowhegan to Augusta. There is also a limited sport fishery from Edwards Dam to the mouth of Cobbossee Stream.

American Shad - At this time there is no recreational fishery for shad in the lower Kennebec. There is a remnant population below Edwards Dam that appears to be on the increase. This population only supports an incidental sport fishery. There is an ongoing restoration effort above Edwards Dam, funded by the Kennebec Hydro Developers Group, (KHDG) but no recreational fishery exists at the present time.

Striped Bass - There is a popular recreational fishery from Augusta to the mouth of the estuary. However, no creel survey

information exist to estimate angler pressure, success rates, etc. Striped bass are not known to occur above Edwards Dam.

Rainbow Smelt - Smelt are virtually non-existent above Edwards Dam. Below Augusta, there is a major recreational fishery (primarily in the winter) that is basically unmanaged. Results of creel surveys by DMR indicate that the rainbow smelt population is substantial and the fishery is extensive.

CONSTRAINTS

"What do you believe are the constraints that are preventing or limiting the development of a sport fishery for the target species in the lower Kennebec River?"

Atlantic Salmon - The primary constraint is the lack of fish passage at Edwards Dam prevents access by returning salmon. In addition, the federal hatchery system cannot supply enough juvenile salmon to support a restoration effort on the Kennebec without curtailing one of the existing projects (such as the Penobscot or St. Croix). The U.S. Fish and Wildlife Service will probably not provide hatchery fish unless there is a reasonable likelihood of restoring a self-sustaining population. The lack of fish passage at Augusta and at the upper dams would preclude use of fish from the federal hatcheries. There could be intense competition between brown trout and Atlantic salmon. Such competition has been described in the fisheries literature, but the two species coexist throughout most of the European range of the Atlantic salmon. It should be noted that the relicensing of Edwards Dam will almost assuredly include fish passage facilities, thus negating the ASRSC's primary concern; leaving the availability of hatchery fish for stocking as the primary constraint.

Brown Trout - Between Waterville and Augusta the fishery is still somewhat underutilized. In this section, management objectives for catch rate and growth rates are close to being met. The primary constraint on a recreational fishery below Augusta appears to be a bureaucratic problem of jurisdiction. IFW stocks fish that are paid for with money from fishing license purchases, but a license is not required to fish in the Kennebec River below Edwards Dam. In addition, IFW is not allowed (under the current situation) to set management restrictions, although DMR has recently enacted regulations that mirror the IFW inland regulations. Although IFW would like to expand its brown trout program into the lower Kennebec, they are reluctant to do so because of the perceived problem of spending license dollars on a fishery where a license is not required. The hatchery system is near its production capacity for brown trout and more brown trout could only be made available by curtailing some other program

such as the landlocked salmon or brook trout programs or by expanding the existing capacity of the state hatchery system. Any brown trout fishery in the Kennebec River below Waterville will require continual stocking as spawning habitat is limited.

American Shad - The only real constraints are that the current population appears to be small and Edwards Dam prevents access to the river above Augusta.

Striped Bass - A substantial sport fishery currently exists in the estuary, although the population is rather small. The dam in Augusta is a major restriction to development of a sport fishery, as it denies access to historical spawning grounds.

Rainbow Smelt - There is a major sport fishery below Edwards Dam. The dam prevents access by rainbow smelt and, thus, is a major constraint. Because smelt do not use fishways, removal of the dam would be necessary. This would provide additional spawning habitat but it is uncertain if this would result in a substantial benefit to the smelt fishery.

It should be noted that public access to the river between Waterville and Augusta is a significant constraint on the development of a recreational fishery. Between Waterville and Edwards Dam there is only one site for launching trailerable boats, and very few sites for launching hand carried craft.

FISH PASSAGE AT EDWARDS DAM

"Expectations for the target species if fish passage is provided at Edwards Dam."

Atlantic Salmon - Provision of fish passage alone will do little or nothing to improve the status of Atlantic salmon in the lower Kennebec River.

Brown Trout - Installation of fish passage facilities would probably have little effect on the brown trout population. It might allow some fish to move into the estuary where they would presumably grow more rapidly, and potentially result in a larger sport fishery in the lower river.

American Shad - Fish passage would open up about 17 miles of historical spawning habitat between Waterville and Augusta. This action would probably result in substantial benefit to the shad population.

Striped Bass - Striped bass generally do not use fishways so this action would be unlikely to have any significant benefit to the striped bass population.

Rainbow Smelt - Rainbow smelt generally do not use fishways so this action would be unlikely to have any significant benefit to the smelt population.

FISH PASSAGE AND INCREASED FISHERIES MANAGEMENT

"Expectation for the target species if fish passage is provided and some additional management is enacted."

Atlantic Salmon - With fish passage and an active restoration program, sea-run Atlantic salmon could presumably be reestablished in the Kennebec River. However, most of the species' historical spawning grounds are above Waterville, so adequate passage would be required at the upper dams as well, particularly if fish from the federal hatcheries are to be used.

Brown Trout - A fishway coupled with increased stocking below Edwards Dam has excellent prospects of providing an expanded sport fishery. This would require resolution of the jurisdictional problems between DMR and IFW. Because spawning grounds are limited, the fishway in itself provides only limited additional benefits to the population. Any increase in the population would have to be supported by increased hatchery production. That would require expanding the brown trout production capacity of the hatchery system either by the construction of new facilities or by diverting resources from an existing stocking program.

American Shad - The additional habitat made available by the fishway could provide for a substantial increase in the shad population. Additional management would include agreements with the dam owners at Waterville and upstream to provide passage facilities. Adult shad and alewives will be trucked into the Waterville, Madison, and Sebasticook areas through 1999 under an agreement with the KHDG.

Striped Bass - Striped bass generally do not use fishways so this action would be unlikely to have any significant benefit to the striped bass population.

Rainbow Smelt - Rainbow smelt generally do not use fishways so this action would be unlikely to have any significant benefit to the smelt population.

BREACH OR REMOVE EDWARDS DAM

"Expectations for each of the target species if Edwards Dam is breached or removed."

Atlantic Salmon - Removal of the dam alone will do little or nothing to improve the status of Atlantic salmon in the lower Kennebec River.

Brown Trout - This action would provide significantly more riverine habitat (J. Lund, Maine Natural Resources Council, personal communication). However, it is doubtful that it would provide additional spawning habitat. By itself, this action would probably not benefit the population. The additional riverine habitat would be welcomed by IFW as that type of habitat is in short supply in central Maine and it is believed that the area would receive heavy fishing pressure.

American Shad - This would open up about 17 miles of historical spawning habitat between Waterville and Augusta. This action would probably result in substantial benefit to the shad population.

Striped Bass - Removal or breaching would provide access to historical spawning habitat and would be a significant benefit to the striped bass population.

Rainbow Smelt - A significant population increase could be expected if the dam were totally removed, not merely breached. This action would provide a significant increase in available spawning habitat.

BREACH OR REMOVE DAM AND INCREASED FISHERIES MANAGEMENT

"Expectations for each of the target species if Edwards Dam is removed or breached and additional management is enacted."

Atlantic Salmon - Removal of the dam coupled with an active restoration program has a reasonable chance of success. As noted earlier, most of the historical spawning grounds for salmon are above the Waterville dams, so additional fish passage facilities would be needed if the federal hatcheries are to provide fish.

Brown Trout - With additional stocking and free movement between the estuary and the river, the Kennebec could support an excellent sport fishery for brown trout. As mentioned earlier, this would require resolution of the jurisdictional problems between DMR and IFW.

Amerian Shad - The agreements between DMR and the KHDG to truck fish and provide passage at the upper dams would probably result in a substantial increase in the shad population.

Striped Bass - DMR plans to stock striped bass in 1989 and 1990. If the dam were removed, the agency might stock the section from Waterville to Augusta to augment any natural reproduction.

Rainbow Smelt - DMR would possibly try egg transfers into the section between Waterville and Augusta if the fish had open access to and from the sea. As many of the tributary streams between Waterville and Augusta are today heavily silted, it is unknown how much additional smelt habitat might become available.

CURRENT STATUS TO PASSAGE WITH MANAGEMENT

"Expectations for each of the target species going from the current situation to a fishway and an active management program."

Atlantic Salmon - With fish passage and an active restoration program, sea-run Atlantic salmon could presumably be reestablished in the Kennebec River. However, most of the historical spawning grounds are above Waterville, so adequate passage would be required at the upper dams as well, particularly if fish from the federal hatcheries are to be used. Under the current situation, hatchery production could not support a restoration effort in the Kennebec River without diverting fish

from one of the ongoing restoration efforts in the Penobscot, St. Croix, and other rivers.

Brown Trout - A fishway coupled with increased stocking below Edwards Dam has excellent prospects of providing an expanded sport fishery. This would require resolution of the jurisdictional problems between DMR and IFW. Because spawning grounds are limited, the fishway in itself provides only limited additional benefits to the population. Any increase in the population would have to be supported by increased hatchery production. That would require expanding the brown trout production capacity of the hatchery system either by construction of new facilities or by diverting resources from the existing stocking programs.

American Shad - The additional habitat made available by installation of a fishway could provide for a substantial increase in the shad population. Additional management would include agreements with the dam owners at Waterville and upstream to provide fish passage facilities. Adult shad and alewives will be trucked into the Waterville, Madison, and Sebasticook areas through 1999 under an agreement with the KHDG.

Striped Bass - Striped bass generally do not use fishways so this action would be unlikely to have any significant benefit to the striped bass population.

Rainbow Smelt - Rainbow smelt generally do not use fishways so this action would be unlikely to have any significant benefit to the smelt population.

PASSAGE WITH MANAGEMENT TO BREACHING OR REMOVING DAM WITH MANAGEMENT

"Expectations for each of the target species going from a fishway at Edwards Dam and active management to removal of Edwards Dam with active Management."

Atlantic Salmon - Removal of the dam coupled with an active restoration program has a reasonable chance of success. The increased survival of smolts and the increased efficiency of upstream passage for returning adults that would likely result from removal of the dam would probably improve the chances for a successful restoration as compared to the situation of a fishway. As noted earlier, most of the historical spawning grounds for salmon are above the Waterville dams, so additional fish passage facilities would be needed if the federal hatcheries are to provide fish and current hatchery production could not support a restoration effort in the Kennebec without diverting resources from one of the other restoration programs.

Brown Trout - With additional stocking and free movement between the estuary and the river, the Kennebec could support an excellent sport fishery for brown trout. As mentioned earlier, this would require resolution of the jurisdictional problems between DMR and IFW. Removal of Edwards Dam would probably

reduce mortality associated with downstream movement by brown trout, and provide improved access to the estuary, where growth would likely be faster. The lack of suitable spawning habitat below Waterville would be a limiting factor in how much the population could increase naturally.

American Shad - Removal of Edwards Dam would probably increase survival of emigrating juvenile American shad, which in theory should provide for increased numbers of returning adults.

Striped Bass - Because striped bass generally do not use fishways, the removal of Edwards Dam provides a significantly better alternative than construction of a fishway. The Maine DMR suggests that removal of Edwards Dam would result in a rapid increase in striped bass.

Rainbow Smelt - Because rainbow smelt generally do not use fishways, the removal of Edwards Dam provides a significantly better alternative than construction of a fishway. DMR would possibly try egg transfers in the section between Waterville and Augusta if the fish had open access to and from the sea. As many of the tributary streams between Waterville and Augusta are today heavily silted, it is unknown how much additional smelt habitat might become available, but DMR believes a sport fishery could develop that is similar to the one that currently exists below Edwards Dam.

FINAL THOUGHTS

We have made several attempts at determining what type of habitat would result if Edwards Dam is removed. We have been unsuccessful at finding any historical evidence in this matter and few of the people we contacted (C. Ritzi, Ritzi and Associates, D. Murch, Maine Department of Environmental Protection, E. Baum, T. Squiers, D. McNeish) feel qualified to speak with authority about the suitability of the habitat for salmonids. John Lund of the Natural Resources Council of Maine canoed the river when Edwards Dam was breached in the early 1970's and in his opinion, the river offered excellent salmonid habitat. It is our belief that this is a critical question regarding the benefits of removing Edwards Dam and will likely require the services of hydrological experts.

In early August, we conducted field surveys to determine the suitability of tributaries between Waterville and Augusta as spawning and nursery streams for salmonids. The results of our surveys coincide with those of the IFW and ASRSC in that we found very little suitable spawning habitat in the tributary streams between Waterville and Augusta. Most of the streams were quite warm, had heavy silt loads, and showed evidence of nutrient enrichment. Lack of fish passage facilites at dams on Messalonskee Stream and the Sebasticook River (the two largest tributaries to the Kennebec River between Waterville and Augusta) prevents use of these watersheds by spawning salmonids.

A supplemental literature search on species interactions between striped bass and brown trout has revealed that striped bass do not appear to feed heavily on brown trout in an Oklahoma reservoir (Deppert and Mense 1979). As previously mentioned, there is the possibility that interspecific competition could develop between brown trout and Atlantic salmon. A rather extensive literature has developed concerning this topic, but we feel it sufficient to point out that the two species historically coexisted (and continue to do so) throughout most of the European range of the Atlantic salmon. In light of this fact, we feel it is unwarranted to regard competition as the major concern with respect to developing a sport fishery in the lower Kennebec River.

REFERENCES

Deppert, D.L. and J.B. Mense. 1979. Effect of striped bass predation on and Oklahoma trout fishery. In: R.W. Dimmick, ed. Proceedings of 33rd Annual Conference of Southeastern Fish and Wildlife Agencies.

APPENDIX C

TELEPHONE SURVEY SUMMARY STATISTICS

Telephone # _____
Respondent Name _____
Respondent Identification # _____

Date _____ Time _____ Status _____

Hello, My name is _____ and I am calling from the Depeartment of Agricultural & Resource Economics at the University of Maine. May I please speak to (Respondent's Name)?

Yes --> Continue with phone survey, repeating the introduction if necessary.

No --> When would be the best time to reach him/her?

Other _____

Recently we sent you a questionnaire asking your opinions about improved sport fishing on the lower Kennebec River in Maine. As of today we haven't received your questionnaire. Have you sent it back to us?

	ADJACENT	NONADJACENT	NONRESIDENT
Yes --> Thank you for participating in the survey ---> **STOP**	28%	32%	40%
No -->	72	68	60

May I ask why you haven't returned the survey?

Adjacent

No Time	33.3%
Never Fished the Kennebec	25.5
Didn't Bother	16.6
Forgot	16.6
In Hospital	8.3

Nonadjacent

Never Fished the Kennebec	35.0%
No Time	20.0
Forgot	15.0
Don't Fish Often	10.0
Lost it	5.0
Gave it Away	5.0
Didn't Understand	5.0
Never Received Survey	5.0

Nonresident	
Never Fished the Kennebec	45.5%
No Time	18.2
Didn't Bother	18.2
Lost it	9.1
Gave it Away	9.1

Your response to the survey is very important. Since we have not received a completed survey from you, may I ask a few questions about your fishing efforts in Maine?

	ADJACENT	NONADJACENT	NONRESIDENT
Yes --> Continue with the survey	57%	66%	57%
No --> Thank you for your time. --> **STOP**	43	34	43

For each of the following questions I will list catagories of answers. Please stop me when I reach the catagory that best describes you. (Interviewer circle the correct response)

Section A.

In the first group of questions we are interested in learning some general information about your fishing activities in Maine.

1. The first question is, which category best describes the first time you went freshwater or saltwater fishing in Maine?

	ADJACENT	NONADJACENT	NONRESIDENT
Before 1940	0.0%	4.7%	0.0%
1940 to 1949	18.8	9.5	0.0
1950 to 1959	6.2	9.5	0.0
1960 to 1969	31.2	28.6	9.1
1970 to 1974	12.5	23.8	0.0
1975 to 1979	12.5	9.5	9.1
1980 to 1984	12.5	0.0	9.1
Since 1984	0.0	4.7	63.6
Never fished --->Skip out of survey	6.2	9.5	9.1

2. Since the first time you fished in Maine, about how often do you go freshwater or saltwater fishing in Maine?

	ADJACENT	NONADJACENT	NONRESIDENT
Every year	53.3%	57.9%	30.0%
Almost every year	6.6	15.8	10.0
About half of the years	13.3	5.3	0.0
Less than half of the years	20.0	21.1	20.0
Only fished in Maine once	6.6	0.0	40.0

3. Which type of the following bodies of water do you fish most often in Maine?

	ADJACENT	NONADJACENT	NONRESIDENT
Lakes and ponds	66.6%	42.1%	90.0%
Rivers	13.3	5.3	0.0
Streams and brooks	20.0	21.1	10.0
Coastal bays and Ocean Waters	0.0	31.6	0.0

SECTION B. In this next group of questions we would like to learn about your fishing effort on the lower Kennebec River in Maine. When I say lower Kennebec River, I mean the section of the Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay.

1. Have you ever fished the lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?

	ADJACENT	NONADJACENT	NONRESIDENT
YES ---> Continue	20.0%	0.0%	0.0%
NO ---> SKIP to Question 5.	80.0	100.0	100.0
DON'T KNOW ---> SKIP to Question 6.	46.9	0.0	0.0

2. Which category best describes the first time you went fishing on the lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?

	ADJACENT	NONADJACENT	NONRESIDENT
Before 1940	0.0%	0.0%	0.0%
1940 to 1949	33.3	0.0	0.0
1950 to 1959	0.0	0.0	0.0
1960 to 1969	0.0	0.0	0.0
1970 to 1974	0.0	0.0	0.0
1975 to 1979	66.6	0.0	0.0
1980 to 1984	0.0	0.0	0.0
Since 1984	0.0	0.0	0.0

3. Since the first time you fished the lower Kennebec River, about how often do you go fishing on the lower Kennebec River from Milstar Dam in Waterville to Chops Point on Merrymeeting Bay?

	ADJACENT	NONADJACENT	NONRESIDENT
Every year	66.6%	0.0%	0.0%
Almost every year	33.3	0.0	0.0
About half of the years	0.0	0.0	0.0
Less than half of the years	0.0	0.0	0.0
Only fished the lower Kennebec River once	0.0	0.0	0.0

4. Since 1984, about how many trips per year did you take to fish the lower Kennebec River between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay during an average year? (Even if you walked to the river from your home please considfer this to be a trip)

	ADJACENT	NONADJACENT	NONRESIDENT
Trips per year	3.2%	0.0%	0.0%

5. What is the primary reason that you have not fished the lower Kennebec River between Milstar Dam in Waterville and Chops Point on Merrymeeting Bay?

Adjacent

Poor Water Quality	36.4%
No Interest	27.3
Prefer Lake Fishing	9.1
Not Convenient/Too Far	9.1
No Boat	9.1

Nonadjacent

Not Convenient/Too Far	35.3%
Not Familiar with Area	35.3
Buddies Don't Fish There	5.9
Prefer Lake Fishing	5.9
Prefer Marine Fishing	5.9
Prefer Ice Fishing	5.9
Poor Water Quality	5.9

Nonresident

Not Convenient/Too Far	62.5%
No Knowledge of River	25.0
Prefer Marine Fishing	12.5

6. Would you fish the lower Kennebec River (more --> if answered yes to #1b) if sport fishing for American shad, Atlantic salmon, brown trout, rainbow smelt and striped bess were improved?

	ADJACENT	NONADJACENT	NONRESIDENT
YES	80.0%	27.8%	44.4%

What is the most important factor that would have to change to make you fish (more --> if answered yes to #1b) in the future?

Adjacent

Improved Water Quality	41.7%
Better Fishing	41.7
Increased Access	16.6

Nonadjacent

Better Fishing	50.0%
Improved Water Quality	50.0

Nonresident

Improved Water Quality	100.0%

	ADJACENT	NONADJACENT	NONRESIDENT
NO	20.0%	72.2%	55.6%

What is the most important reason why you would not fish the lower Kennebec River(more --> if answered yes to #1b) in the future?

Adjacent

Improved Water Quality	66.6%
No Interest	33.3

Nonadjacent

Not Convenient/Too Far	50.0%
Buddies Don't Fish There	10.0
Prefer Marine Fishing	10.0
Prefer Fly Fishing	10.0
Don't Fish Often	10.0
Too Old	10.0

Nonresident

Not convenient/Too Far	50.0%
Too Expensive	25.0
Prefer Lakes	25.0

SECTION C. In this last group of questions we would like to ask you some questions about your background which will help us compare your answers with those of other people. We stress that all of your answers will be strictly confidential.

1. What is your age?

	ADJACENT	NONADJACENT	NONRESIDENT
Years Old	40	41	39

2. What is your zip code?

— — — — —

3. What is your sex?

	ADJACENT	NONADJACENT	NONRESIDENT
MALE	93%	79%	88%
FEMALE	7	21	12

4. Please stop me when I reach the response that comes closest to your level of education.

	ADJACENT	NONADJACENT	NONRESIDENT
Eight years or less	0.0%	5.3%	0.0%
Some high school	13.3	10.5	0.0
High school	40.0	26.3	44.4
Some college or technical school	13.3	42.1	22.2
Associate degree	20.0	5.3	11.1
B.A. or equivalent	13.3	5.3	0.0
M.A. or equivalent	0.0	5.3	11.1
Advanced degree (M.D., PhD., etc.)	0.0	0.0	11.1

5. Please stop me when I reach the response that comes closest to your total 1989 household income, before taxes.

	ADJACENT	NONADJACENT	NONRESIDENT
Less than $5,000	7.1%	5.3%	0.0%
$ 5,000 to $ 9,999	7.1	5.3	0.0
$10,000 to $14,999	0.0	5.3	0.0
$15,000 to $19,999	28.5	5.3	0.0
$20,000 to $24,999	14.3	5.3	0.0
$25,000 to $29,999	21.4	5.3	16.6
$30,000 to $34,999	7.1	26.3	16.6
$35,000 to $39,999	7.1	0.0	16.6
$40,000 to $44,999	0.0	10.5	0.0
$45,000 to $49,999	7.1	10.5	0.0
$50,000 to $59,999	0.0	5.3	16.6
$60,000 to $69,999	0.0	0.0	16.6
$70,000 to $79,999	0.0	0.0	0.0
$80,000 to $89,999	0.0	5.3	0.0
$90,000 to $99,999	0.0	0.0	16.6
$100,000 or More	0.0	10.5	0.0

Thank you for your time