

2004

Pinnipeds, salmon, and fisheries : real managment or political economy? / Tracy L. Rouleau

Tracy L. Rouleau
San Jose State University

Follow this and additional works at: https://scholarworks.sjsu.edu/etd_theses

Recommended Citation

Rouleau, Tracy L., "Pinnipeds, salmon, and fisheries : real managment or political economy? / Tracy L. Rouleau" (2004). *Master's Theses*. 2680.

DOI: <https://doi.org/10.31979/etd.r4u4-hk29>

https://scholarworks.sjsu.edu/etd_theses/2680

This Thesis is brought to you for free and open access by the Master's Theses and Graduate Research at SJSU ScholarWorks. It has been accepted for inclusion in Master's Theses by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

PINNIPEDS, SALMON, AND FISHERIES: REAL MANAGEMENT OR
POLITICAL ECONOMY?

A Thesis

Presented to

The Faculty of the Department of Environmental Studies
San José State University

In Partial Fulfillment

Of the Requirements for the Degree
Master of Science

By

Tracy L. Rouleau

December 2004

UMI Number: 1425482

Copyright 2004 by
Rouleau, Tracy L.

All rights reserved.

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI[®]

UMI Microform 1425482

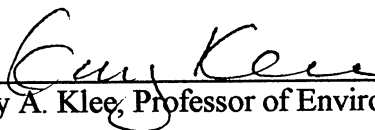
Copyright 2005 by ProQuest Information and Learning Company.

All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

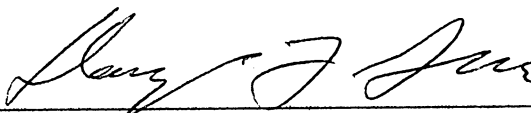
ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

© 2004
Tracy L. Rouleau
ALL RIGHTS RESERVED

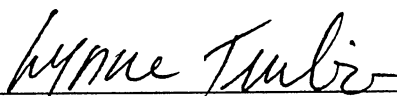
APPROVED FOR THE DEPARTMENT
OF ENVIRONMENTAL STUDIES



Dr. Gary A. Klee, Professor of Environmental Studies



Dr. Douglas Greer, Professor of Economics



Dr. Lynne Trulio, Associate Professor of Environmental
Studies

APPROVED FOR THE UNIVERSITY



ABSTRACT

PINNIPEDS, SALMON, AND FISHERIES: REAL MANAGEMENT OR POLITICAL ECONOMY?

by Tracy L. Rouleau

Growing human coastal populations, increases in pinniped populations, and declines in salmonid populations have resulted in resource conflicts on the Central California Coast. In 1999, the National Marine Fisheries Service (NMFS) issued a report to Congress recommending that lethal means of control be used to remove certain pinnipeds and to minimize these conflicts. This study used Contingent Valuation method (CV) to determine an economic value for the sea lions that might be legally killed as an outcome of operational conflicts with commercial fishermen. It also examined the uses of the economic value in the policy-making forum, particularly those policies that are related to this conflict. This economic value of the sea lions, determined to be between \$21 million and \$65 million, suggests that lethal control measures may not be the best option, and that the sea lions have a real value that must be considered before any decisions are made.

DEDICATION

This is dedicated to Ron, who has been my rock, and has supported me endlessly and selflessly throughout the years. I couldn't have done it without you. Thank you.

TABLE OF CONTENTS

<u>Section Headings</u>	<u>Page</u>
LIST OF ILLUSTRATIONS	ix
LIST OF TABLES	x
CHAPTER	
1 PROBLEM STATEMENT	1
Introduction	1
Importance	2
Thesis Statement	6
Objectives	7
Implications	8
2 LITERATURE REVIEW: PINNIPEDS, SALMONIDS, AND COMMERCIAL FISHERIES	10
Introduction	10
Regulation, Management, and Ecology of Salmon	10
Pinniped-Salmonid Predation Studies	14
Sea Lion Interaction with the U.S. Commercial Fishing Industry	21

3	LITERATURE REVIEW: ECONOMIC THEORY AND CONTROVERSIES ASSOCIATED WITH CONTINGENT VALUATION	25
	The Origins of Economic Valuation of Natural Resources in the United States	25
	General Regulatory Guidelines for Economic Valuation of Natural Resources	32
	Contingent Valuation Method Studies, Guidelines, and Controversies	40
4	METHODS	58
	Introduction	58
	Study Area	59
	Sampling Strategy	59
	Procedures	62
	Survey Structure	64
	Limitations	67
5	RESULTS	70
	Results	70
	Aggregation	83

6 DISCUSSION AND SUGGESTIONS FOR FURTHER RESEARCH	86
Discussion	86
Uses for Economic Values in Environmental Policy	95
Further Research	98
Conclusion	100
REFERENCES	
APPENDICES	
A Human Subjects-Institutional Review Board Approval	113
B Sampling Strategy for Non-User Values	115
C Sample Surveys and Supporting Documents	118

ILLUSTRATIONS

Figure	Page
1. Individual Demand Curve.....	35
2. Aggregate Demand Curve.....	35
3. Aggregate Supply Curve.....	37
4. Market Price, Consumer and Producer Surplus.....	37
5. Northern California Counties with Grid.....	60
6. Harbor Seal.....	64
7. California Sea Lions on Pier.....	65
8. Research Design of the Contingent Valuation Study.....	70
9. Percentage of Respondents Willing to Pay to Compensate Fishermen for Damage Done by Sea Lions (Use and Non-Use Combined).....	73
10. Willingness to Pay to Compensate Fishermen for Damage Done by Sea Lions (Non-Use Values Only).....	75
11. Willingness to Pay to Compensate Fishermen for Damage Done by Sea Lions (Use Values Only)	76
12. Understanding of Calculation of Total Economic Value.....	90
13. Consideration of Family Budget Question.....	90
14. Understanding of Conflict Question.....	91
15. Understanding of Survey Question.....	91

TABLES

Table	Page	
1.	Major Developments in the Use of CBA to Value Environmental Resources.....	31
2.	Mean and Median WTP Values.....	72
3.	Crosstabulation: Survey Type x Total WTP.....	74
4.	Comparison of Incomes of Respondents with that of the California Population.....	77
5.	Behavioral and Attitudinal Characteristics of Respondents.....	78
6.	Crosstabulation: Gender x Total WTP.....	80
7.	Crosstabulation: Age x Total WTP.....	81
8.	Crosstabulation: Income x Total WTP.....	82
9.	Use and Non-Use Median and Mean WTP Aggregation.....	84
10.	Total (Combined) Mean and Median WTP Aggregation.....	85
11.	Crosstabulation: Support for Environmental Organizations x Total WTP.....	94
12.	Crosstabulation: Agree with Lethal Controls x Total WTP	96

CHAPTER 1

PROBLEM STATEMENT

Introduction

Conflicts between humans and marine mammals take a variety of forms. Human activities such as recreation and development often result in the harassment, injury, or death of marine mammals or destruction of the habitat upon which their lives depend. Conflict can also arise when marine mammals are locally abundant and compete with humans for food or livelihood. The resolution of such conflicts usually falls under the jurisdiction of one or several government agencies. These agencies are required to research the problem and to provide a resolution supported by applicable laws and/or agency guidelines. An example of this type of conflict is the conflict between fishermen, pinnipeds, and salmon on the Central California Coast.

Pinnipeds have been a part of many coastal human cultures for centuries. Historically, they were harvested for their pelts and meat, and were relied upon, especially by coastal communities, as an integral part of their commerce. However, during the late 1800's to mid 1900's, pinnipeds were considered competitors with fisherman and were killed indiscriminately. Stewart (1997) found the population of California sea lions in US waters was just over 5,000 animals in 1950. The Marine Mammal Protection Act (MMPA) of 1972 ensured the recovery of many pinniped stocks, resulting in an increase in pinniped populations in California waters. Increases have been recorded for Guadeloupe fur seals, northern fur seals, California sea lions, harbor seals,

and northern elephant seals. Current California sea lion populations estimated to be between 138,000 and 243,000 (Carretta et al. 2003).

Human populations near the coastlines of the United States have increased with similar vigor. Over half the population of the United States lives in the 10% of land area defined as coastal, and that proportion is steadily increasing (NOAA 1996). Increases in coastal development and economic activity have accompanied this expansion of the coastal population. Habitat alterations associated with such accelerated development often affect various species adversely, resulting in a change from prime habitat to marginal habitat. This habitat degradation can result in a decline of many commercially valuable species due to an increase in competition for limited marine resources. Conflicts erupt between competing species for these limited resources, resulting in the need for well-researched management policies to address all of the related impacts. This course of events is well illustrated in the conflict between salmon, pinnipeds and fisherfolk on the Central California Coast.

Importance

Precipitous declines in salmonid species have caused concern in recent years among federal and state agencies, private and public interests. Five populations of pacific salmonids are now listed under the Endangered Species Act (ESA), and 21 populations were proposed for listing as of February 2004 (NOAA 2004). Population declines have been caused by a number of factors including habitat loss and degradation, inadequate riverine passage and flows due to hydropower, agriculture, logging and other

developments, overfishing, negative interactions with other species and hatchery fish, and environmental fluctuations and declines in fresh water and marine productivity caused by El Niño and stochastic events such as drought and flooding (NOAA 1997). Numerous studies have indicated that land use activities associated with logging, road construction, urban development, mining, agriculture, and recreation have significantly altered the quality and quantity of salmon habitat. These activities result in impacts such as alteration of streambank and channel morphology, alteration of ambient water temperatures, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of spawning gravels and large woody debris, removal of riparian vegetation resulting in increased stream bank erosion, and degradation of water quality (NMFS 1998).

The decline in salmonid stocks combined with commercial and recreational fishing pressure, and increasing pinniped populations has created conflicts in Washington, Oregon and California. California sea lions are very visible predators of salmonid stocks and often compete with commercial and recreational fishermen for their catches. Sea lions have been observed feeding on salmon smolts at rivermouths, and cause depredation to commercial salmon trollers and commercial passenger fishing vessels (CPFV's) in the form of lost fish and damage to gear (Hanan and Fluharty 1997; Harvey and Weise 1997).

In an attempt to rectify the problem of declining salmonid stocks, the National Marine Fisheries Service (NMFS) issued a report to Congress recommending that pinniped populations be controlled by lethal means to reduce predation on salmonids and

reduce economic losses to salmon fishermen (NOAA 1997). This report was based on a review of previous literature and noted that most of the information collected was incidental to other research projects and not collected specifically to address the current problem.

Ironically, the report issued by the NMFS found insufficient data to connect pinniped predation to declining salmon stocks. "The Working Group could not determine if either pinniped species (California sea lions and Pacific harbor seals) is having a significant negative impact on any wild salmonid population"(NOAA 1997, 28), with the single exception of Ballard Locks, a river system where salmonid passage is restricted by a human-made structure. Furthermore, Butterworth (1992) found that there is no scientific evidence that reducing the populations of pinnipeds will increase the number of fish. The reduction of pinniped populations can increase the population of other predators that consume proportionately larger amounts of salmonids (Butterworth 1992; Trites 1997). Hanson (1997) found that the foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal and that predation on salmonid appeared to be coincidental with the fish migrations rather than dependent upon them. Many investigators agree that although pinnipeds can have a significant effect on salmonid populations in certain circumstances, overall, marine predation is a minor factor in salmon declines (Steele 1998; Trites 1997; Hanson 1997; NMFS 1998). Pinnipeds as predators play an important role in the coastal ecosystem, culling out unfit individuals and strengthening the species (NMFS 1998). Finally, the author could find no evidence in a preliminary literature review of any scientific literature indicating that predation by

pinnipeds negatively affects salmonid populations, with the exception of the Ballard Locks situation mentioned above.

The primary political impetus behind the recommendations to enact lethal means of control on certain pinniped populations is the economic damage to fishing gear, equipment and fisherman profits. One major factor that is often overlooked when dealing with wildlife/human conflicts is the non-marketable economic values of wildlife populations. Sea lions are a valuable economic resource for many reasons. They are an integral part of a large coastal tourism economy and they are viewed and photographed by tourists and wildlife photographers. Added to those values is a value placed on pinnipeds by society, known in economic terms as their intrinsic value or their existence value (Hanley and Spash 1995). Therefore, it would be logical to make a comparison of the regional economic value of the sea lion populations to the losses caused by their depredations before management policies are finalized and lethal means of population control implemented.

Traditional economic analysis is a currently accepted means of providing a comparison of the costs and benefits of a proposed environmental project. Unfortunately, when measuring the value of a good that does not have an established market, traditional analyses often fail. Contingent Valuation is a survey-based technique used to elicit preferences for non-marketed goods such as wildlife populations. It is the most commonly used tool to place a market value on non-marketed environmental resources (Mitchell and Carson 1989). The success of this method relies on two primary factors, the flexibility in constructing hypothetical markets for non-marketed goods, and the "fact

that the elicitation of stated preferences is the only approach to valuing non-marketed goods which is not limited to inferring values from past actions"(Carson 1998). This statement by Carson refers to the non-use values of environmental resources. In general, the total economic value of an environmental good is referred to as the preservation value (Mendelsohn 1985), or total value (Goodman et al. 1997; White et al. 1997), which is a combination of *user* and *non-user* values. User values can generally be easily measured using standard economic techniques that are based on recorded "market" information (past actions). Examples of user values include hunting and fishing license purchases, and fees collected at a national park. Non-user values consist of *option* and *existence values*. Option and existence values are economic terms used to describe respectively, the value that society places on having the resource available even if it is not utilized by the respondent (the "option" to use is available), and the value that the respondent places on the actual existence of the resource in question.

Thesis Statement

The purpose of this study is to determine an economic value for proposed changes in the populations of California sea lions in Northern California using the Contingent Valuation method (CV). It will also examine policies and laws related to the conflict for the possible and required uses of this information. The study region will encompass all of Northern California as defined in the "Population and Sampling Strategy" subdivision of the Methods section. The CV method is the best possible method of determining a physical quantification of the value of the sea lions to tourists and the local economy,

because it is the only accepted method that accounts for all of the relevant values (Hanley and Spash 1995, Bishop et al. 1997, Goodman et al. 1997). Placing the economic value for these sea lion populations in the proper context with existing policy and management requirements, will help to determine if the lethal means of control of pinniped populations suggested by the report is an appropriate solution or an unwarranted option to resolve the existing conflict.

Objectives

The overall objective of this study is to develop a quantitative economic value for proposed changes to sea lion populations by surveying respondents in the study area. The study area covers all of “Northern California” defined here as all of the State of California north of latitude 36°30', which is the latitude of the southern border of Monterey County and coincides with the southern boundaries of the conflicts. This research sought to answer the following questions:

1. How do survey respondents in Northern California value California sea lion populations in the context of the proposed recommendations for lethal control?

Methods used to address this question include:

- a) Use CV method to determine *non-user* values for sea lion populations in the context of the proposed recommendations for lethal control.
- b) Use CV method to determine *user* values for sea lion populations in the context of the proposed recommendations for lethal control.

- c) Aggregate user and non-user values over appropriate populations to determine total value of sea lions in light of proposed recommendations for lethal control.
2. What recommendations come from this research that can assist policy-makers with their decisions to resolve the existing conflict between salmon, pinnipeds and fisherfolk?

Methods used to address this question include:

- a) Examine all related laws and policies for required uses of economic valuation in determination of policy decisions.
- b) Conduct a literature review to determine how economic valuation could be applied.

Ultimately, this research may help the participants in this conflict look to other, non-lethal means of resolving this contentious issue.

Implications

The NMFS has stated that mitigation methods should be used to ameliorate the economic losses caused by pinniped depredation and protect the declining salmonid resources (NOAA 1997). Currently the method suggested by the NMFS is lethal control of the offending pinnipeds. However, this approach may actually be destroying a valuable resource, and such decisions should be based on an evaluation of all costs and benefits.

In "Using Public Surveys to Estimate the Total Economic Value of Natural Resources," Goodman et al. (1997) explain that Cost-Benefit Analysis (CBA) is mandated for evaluating most national regulatory policies in the US. The authors note

that Executive Order 12866, issued by President Clinton, states that the regulatory process shall be conducted in such a way that it assesses

all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. (U.S. President 1993, 12866)

This statement clearly mandates the consideration of all costs and benefits of multiple alternatives in policy decisions.

This work evaluates an important component of the pinniped-salmon-fishing industry debate – the value of pinnipeds. The economic value determined by this study includes the economic value of the sea lion populations to the tourism/recreation of these areas, plus the value of sea lions as perceived by society. The results of this study can be used by local, regional and federal governments, such as the NMFS, USFWS, Pacific Fisheries Council, and locally affected municipal governments, in preparing long-term salmonid and pinniped management policies. Federal policy requires decisions to take economic impacts into account before recommending a particular management strategy, and societal values should be taken into account to prevent political backlash once a particular strategy is implemented. Thus, although economic losses to commercial fisheries from pinnipeds have been calculated, the complementary value of the loss of the pinnipeds has not been calculated. Finally, these values may be able to be applied in similar situations to assist in the development of regional interstate management strategies.

CHAPTER 2

LITERATURE REVIEW: PINNIPEDS, SALMONIDS, AND COMMERCIAL FISHERIES

Introduction

While firm economic and ecological data are needed to evaluate the interactions between pinnipeds, salmonids and the commercial fishing industry, there is little concrete evidence documenting the relationship and interactions between pinnipeds, salmonid species, and commercial fishermen. This literature review will cover the basic ecology and management issues surrounding California salmonid populations, will review some of the research that has been done directly on pinniped-salmonid predation interactions, and will address sea lion interactions with the commercial fishing industry.

Regulation, Management, and Ecology of Salmon

Salmon populations are protected and regulated by a number of agencies. The National Marine Fisheries Service (NMFS), part of the National Oceanic and Atmospheric Administration (NOAA), which operates under the U.S. Department of Commerce is the primary federal agency with jurisdiction over salmon. The NMFS works in conjunction with state, regional and local agencies, most notably, the Pacific Fishery Management Council and the states' Departments of Fish and Game (or Fish and Wildlife). In central California, the NMFS works primarily with the Monterey Bay National Marine Sanctuary (MBNMS), California Department of Fish and Game, county governments, and the California Coastal Commission (CCC).

Pacific salmonids are protected under the Magnuson-Stevens Fishery Conservation and Management Act, which is amended by the Sustainable Fisheries Act. The

Magnuson-Stevens Fishery Conservation and Management Act recognizes that:

Fish of the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the Continental Shelf appertaining to the United States, and the anadromous species which spawn in United States rivers or estuaries, constitute valuable and renewable natural resources. These fishery resources contribute to the food supply, economy, and health of the Nation to provide recreational opportunities. (Magnuson-Stevens Fishery Conservation and Management Act §2 1996)

The Magnuson-Stevens Act established eight regional fishery management councils to manage fisheries 3-200 miles offshore. The Pacific Fishery Management Council is responsible for the fisheries off the coasts of California, Oregon and Washington.

The Sustainable Fisheries Act adds to the Magnuson-Stevens Act, requiring among other things, protection of habitat for fisheries covered under the Magnuson-Stevens Act.

A national program for the conservation and management of the fishery resources of the United States is necessary to prevent overfishing, to rebuild overfished stocks, to insure conservation, to facilitate long-term protection of essential fish habitats, and to realize the full potential of the Nation's fishery resources. (Magnuson-Stevens Fishery Conservation and Management Act §2 1996).

The other major legal statute with jurisdiction over salmon is the federal Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over endangered or threatened species or populations listed under the ESA, and is required to designate "Critical Habitat" for listed species (ESA §1533.3 1973). The ESA allows for the listing of a species under either of two categories, endangered or threatened.

"Endangered" is defined as "any species which is in danger of extinction throughout all or a portion of its range" (ESA §1532 1973). "Threatened" indicates "any species which

is likely to become an endangered species”(ESA §1532 1973). The status of many salmonid species has become precarious in recent years. Five populations of Pacific salmonids are listed as endangered under the ESA, two in California. As of August 2002, twenty-one populations were listed as threatened and four more are proposed for listing.

The NMFS provides a summary of reasons for the severe reductions in each of the salmonid populations listed. The primary reason listed in the listing of California populations of steelhead, coho and chinook salmon is related to the destruction of habitat (NMFS 1999a; 1998; 1997a; 1996). The NMFS notes that the factors that endanger salmonids are “numerous and varied.” However, according to the final rules published by NMFS, the “present depressed condition” is *in every case* attributed to “several long-standing, human-induced factors (e.g., habitat degradation, water diversions, harvest, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and poor ocean conditions” (NMFS 1999a; 1998; 1997a; 1996)

Many researchers (Steele 1998, Kier (William M.) Associates 1995, Kondolf 2000) also state that habitat loss and degradation due to human activities are the major causes of salmon declines. Salmon have a number of habitat needs throughout their lifecycle. First and foremost, they require sufficient amounts of good quality water for survival, growth, reproduction and migration. Important water quality factors include temperature, oxygen content, low turbidity, and a steady sufficient flow. For instance, Coho salmon need clear water with high oxygen content that is present year round. High turbidity and low oxygen content limit primary production, and abundance and diversity of invertebrates

(NMFS 1998). Stochastic impacts combined with habitat degradation and loss are the major reasons for the decline in coho populations (NMFS 1998, Smith 1998a, 1998b, Kier (William M.) Associates 1995).

Other essential elements of salmon habitat include appropriately sized spawning gravel, woody debris, riparian vegetation, and bottom roughness. These elements influence the degree and quality of habitat available (Steele 1998, Kondolf 2000). The importance of habitat qualities depends on the species. For instance, canopy that shades and overhangs the channel is especially important to coho salmon as it provides shade, food, cover and darkens that water to provide a competitive advantage (Steele 1998). This canopy will later recruit to the stream in the form of woody debris. Whereas chinook habitat is “limited by deep water and low water velocities” (Hanrahan, Dauble and Geist 2004), and requires large woody debris for juvenile chinook habitat (Mossop and Bradford 2004).

Stream hydrology is essential to supporting healthy salmon populations (Kondolf 2000) as it is the force that structures the stream environment. Other variables can affect salmonid populations. However, as long as structural features of streams (pools, overhangs etc.) are maintained, populations can rebound (Steele 1998). Nooks and pockets can increase escape opportunities, and many locations throughout the stream may accommodate more individuals.

Critical habitat as defined by the NMFS (NMFS 1999b; 1997b) considers all of the following species requirements:

- Space for individual and population growth, and for normal behavior,
- Food, water, air, light, minerals, or other nutritional or physiological requirements,

- Cover or shelter,
- Sites for breeding, reproduction, or rearing of offspring,
- Habitats that are protected from disturbance or a representative of the historic geographical and ecological distribution of this species

The designation of critical habitat does not necessarily curtail all human activities within an area. Actually, a critical habitat designation contributes to species conservation by identifying important areas and by describing features necessary to the survival of the species (NMFS 1999b; 1997b). The NMFS recognizes that there are three separate habitats required by salmon for growth, reproduction and survival: freshwater streams, estuarine areas and marine habitats. The NMFS has stated that the current freshwater range of the species encompasses all of the habitat elements necessary for survival, and will not designate areas outside of the current range as critical habitat (NMFS 1997b). Included in the designation are upland areas and inaccessible headwaters or intermittent streams that provide key habitat elements for salmon in downstream waters, also included are estuarine areas that are important for rearing and migrating salmon. Marine habitats, although recognized as vital to the survival of salmon, are not included in the critical habitat designation at this time. However, the NMFS may revise this designation if information becomes available that warrants the inclusion of such habitats (NMFS 1997b).

Pinniped-Salmonid Predation Studies

In the evaluation that occurs for listing salmonid species occurring in California, the NMFS must list the causes for population decline. Currently 26 species or populations of

west coast salmonids are listed, but in no case does the NMFS cite marine predation as a cause of salmonid declines. In fact, they state that marine mammal predation is a minor factor in the decline of salmonid populations, pointing out that “predators play an important role in the ecosystem, culling out unfit individuals, thereby strengthening the species as a whole” (NMFS 1996, 56141; 1997a, 24588). The NMFS also reported research indicating that “the foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal” (Hanson 1997). Furthermore, they listed six studies that contend salmonids are a minor component of pinniped diets (NMFS 1996). However, it is probable that pinniped predation may impede the recovery of certain locally depressed salmonid stocks (NMFS 1996, 1997a; NOAA 1997; 1999). With respect to research on pinniped-fisheries conflicts, three studies stand out: California sea lion predation on salmonids at Chittenden Locks in Seattle, Washington (Gearin, Pfeiffer and Jeffries 1986; Gearin et al. 1988), Cape fur seals and fisheries of the South African coast (Butterworth et al. 1988; Butterworth 1992; Punt and Butterworth 1995), and pinniped-salmonid studies in Monterey Bay, California (Hanan, Jones and Read 1989; Hanan and Fluharty 1997).

The Hiram M. Chittenden locks in Seattle, Washington, is the site of the most famous (or infamous) instance of sea lion predation on salmonid stocks. The locks (also known as Ballard Locks) connect Lake Washington to Puget Sound, and restrict passage for the steelhead. The fish are forced either to travel through the locks or use the fish ladder built by the Army Corps of Engineers to reach their natal streams. In the early 1980’s, a male sea lion took up residence and began feeding on steelhead that were returning to

Lake Washington to spawn. Soon, other males arrived, and by the mid-1980s sea lions feeding on the steelhead had become a serious problem.

The Northwest and Alaska Fisheries Center (NAFCA), part of the NMFS, began studies focused on predation control with an additional purpose of observing sea lion abundance and distribution (Gearin Pfeiffer and Jeffries 1986; Gearin et al. 1988). The reports found that sea lions were consuming up to 65% of the steelhead migrating through the locks (Gearin et al. 1988; Jeffries and Scordino 1997; NMFS 1997a; NOAA 1997). This caused the spawning escapement (the number of fish that “escaped” to spawn) to drop below 250 four years in a row (1993-1996), reaching an all time low of 70 spawners in 1994 (Jeffries and Scordino 1997). Non-lethal deterrents, including acoustic harassment devices, barrier nets, taste aversion conditioning, and even a fake killer whale (locally known as “Fake Willy”) were all unsuccessful. In 1994, the MMPA was amended to allow for lethal “takes” of predatory sea lions at the locks. Specifically, §1389 authorizes the “intentional lethal taking of individually identifiable pinnipeds which are having a significant negative impact on the decline or recovery of salmonid stocks that ...migrate through Ballard Locks” (MMPA 1972). Since, observers had noticed that the majority of the predation was done by a few male sea lions, an application was filed by the Washington Department of Fish and Wildlife (WDFW) to lethally remove the offending pinnipeds. However, once the plans were made public, Sea World, in Orlando, FL offered to take the five of the offending sea lions and keep them captive permanently. Working together, the NMFS and WDFW captured three of the five sea lions that had been qualified for lethal removal and shipped them to Florida. The

other two sea lions (marked 41 and 87) did not participate in any further predation of spawning steelhead. Sea lion 41 was not seen again and sea lion 87 was assumed to have been killed incidental to the local tribal coho fishery (Jeffries and Scordino 1997). When considering the situation at Ballard Locks, it is important to note that only 3% of 248 tagged pinnipeds were observed preying on steelhead at Ballard Locks in 1995 (NOAA 1997).

The situation at Ballard locks illustrates how pinnipeds can have a severe effect on locally depressed salmonid populations in the presence of human-made structures that impede the migrating ability of salmonids. Environmental stochasticity can also have similar effects. Low water flow conditions in the streams of smaller watersheds can also impede the migration of salmonids resulting in increased predation by pinnipeds, avian and piscivorous predators (NMFS 1996; NMFS 1997a). Low or late rainfall can prevent the stream from flowing with sufficient volume to break open the river mouth to the sea. The salmonids congregating in the shallow waters offshore, waiting to migrate upstream, are extremely susceptible to increased predation. Similarly, young smolts trying to migrate to sea are also trapped in the lagoons waiting for the water to break through the beach crest, providing easy prey for shorebirds (Smith 1998a).

The South African fur seal (*Arctocephalus pusillus pusillus*) and the commercial fisheries in the Benguela Current are another source of extensive research regarding pinniped-fishery conflicts. The vigorous recovery of South African fur seal populations from overexploitation in the 17th and 18th centuries caused concerns that fish catches would decline. In response to these concerns, the South African government began

research on seal-fishery interactions in the Benguela Current off the western coast of South Africa in the mid-1980's (Best, Crawford and Van Der Elst 1997; Butterworth 1992; Punt and Butterworth 1995; Wickens et al. 1992). The research generally addressed two types of seal-fishery interactions, operational and biological. Operational interactions are defined as when seals directly interfere with commercial fishing operations in the form of lost catch, damage to gear or disturbance to the fish populations (Wickens et al.1992). These interactions parallel some of the concerns regarding sea lions and salmonids on California's coast. The resulting economic quantification of the seal-fishery operational interactions in South Africa showed minimal losses (3% of the wholesale value) to the fishery (Wickens et al. 1992). Economists at the NMFS are presently conducting a similar quantification of the sea lion-salmon fishery operational costs in the U.S. (Thompson 1998).

In addition to the operational interactions, extensive research has been conducted on the biological aspects of South African seal-fishery interactions using sophisticated modelling techniques. Simplistic models of the man-seal-fishery system indicated that reductions of seal populations could increase the fishery yields, but these results were not supported when there were even minor increases in the complexity of the modelling system (Butterworth et al. 1988; Butterworth 1992). The "Benguela Ecology Programme Workshop on Seal-Fishery Biological Interactions," convened to address seal-fishery interactions, recommended a more complex age-structured multi-species simulation tool. The "Minimal Realistic Model" approach is an "extension to the multiple-species case of

the methods commonly applied to conduct risk assessments for fish populations” (Punt and Butterworth 1995, 256). This framework involves three steps:

- i. A number of operating models of the biological system are constructed, each reflecting an alternative view of the system. The models vary the biological parameters such as levels of hake consumption by seals, levels of hake predation/cannibalism, and population dynamic parameters.
- ii. Simulations are carried out. Each simulation involves projecting the various data sets out a specified number of years while incorporating man-induced removals determined by applying management procedures to the simulated fishery populations.
- iii. The results of the simulations are summarized using performance indices, chosen to allow decision-makers to assess how changes in seal populations will affect the hake fisheries.

(Punt and Butterworth 1995, 260)

There are two species of Cape hake; both are predatory and cannibalistic, feeding on each other and on the commercially important anchovy. The modelling exercise showed that fishery yield increases, resulting from seal population decreases, “are likely to be small, and could even be detrimental for reasons related to predation on the deep-water hake (*M. paradoxus*) by the shallow-water hake (*M. capensis*)” (Punt and Butterworth 1995, 283). Seals prey on *M. capensis*, which, in turn preys on *M. paradoxus*. “Fewer seals will lead to more of *M. capensis*, and hence through predation to fewer *M. paradoxus* with a net result of less hake overall” (Punt and Butterworth 1995, 283). In a comparison of consumption of commercial fisheries by different predators, Wickens et al. 1992 (785) found that the two species of hake are “by far the largest consumers” of commercial fish, contributing to 56% of the total consumption. They were followed by “all other groundfish”- 18%, and by “commercial fisheries”- 7%. Seals contributed to only 6% of the total fishery consumption.

Locally, Weise and Harvey researched the "Food Habits of California Sea Lions and Their Impact on Salmonid Fisheries in Monterey Bay, California" (Weise and Harvey 1999a). Their research sought to "identify and determine the relative importance of prey items seasonally consumed by California sea lions in Monterey Bay, California" and "determine the proportion of salmonids in the California sea lion diet on a seasonal basis in the Monterey Bay region" (Weise and Harvey 1999a, 13). Using prey hardparts (otoliths, beaks, bones, eye lenses, teeth and cartilaginous parts) found in fecal samples, the seasonal food habits of California sea lions were recorded from the summer of 1997 through the fall of 1998. Most of the prey were identified down to the species level, with 59.1% of the prey species being cephalopods (primarily market squid) and 40.9% being fishes (primarily Pacific sardine, northern anchovy, rockfish, and Pacific hake) (Weise and Harvey 1999a). The research indicated that there was little difference in seasonal food habits with market squid and northern anchovy being the dominant prey species.

Identification of salmonids in the prey samples was subject to limitations well documented in the literature (Weise and Harvey 1999a; 1999b). Large fishes are typically underestimated because they are less likely to be consumed whole and their otoliths may not appear in the samples. Also, fishes with smaller otoliths can be underestimated in the count due to the higher probability of complete digestion of the otoliths. Salmon, particularly, are affected by these limitations due to their large size and small otoliths.

The research on the food habits of California sea lions done by Weise and Harvey (1999a) echoes that published in Impacts of California Sea Lions and Pacific Harbor

Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon and

California by NOAA (1997) as well as other sources (NMFS 1999a; 1996). It indicates that although salmonids are certainly a component of the California sea lion's diet, they are a minor component. Moreover, sea lions are by nature opportunistic predators that feed on a variety of prey items that are seasonally and locally abundant. Finally, it underscores the difficulty in determining the impacts of pinniped foraging on depressed salmonid stocks due to the limitations in the methodology.

Sea Lion Interaction with the U.S. Commercial Fishing Industry

Depredation by California sea lions of sport fish caught by anglers has been an issue of contention for over 20 years. The California Department of Fish and Game began studying fisheries/sea lion interactions in 1978 (Hanan, Jones and Read 1989). For this review, two separate studies on sea lion interactions with Commercial Passenger Fishing Vessels (CPFV) were examined. The first study reviewed is a study by Hanan, Jones and Read (1989) under the auspices of the California Fish and Game Department that examined sea lion interaction and depredation rates with the CPFV in San Diego County from 1984-1988. More recently, Dr. James Harvey conducted another study with Michael J. Weise concerned with the impacts of California sea lions and Pacific harbor seals on salmonids in Monterey Bay, California (Harvey and Weise 1997). These two studies are compared and contrasted below:

Both studies utilized similar methods; using observers onboard CPFVs and in the Harvey and Weise study, dockside, to record depredation incidents by California sea

lions and Pacific harbor seals. In both cases, depredation, or takes, by Pacific harbor seals were insignificant and the focus was on depredation by sea lions. The methods were essentially the same, with observers onboard the boats recording incidents of depredation in which a hooked fish was actually taken off the line, and interactions with the pinnipeds in which no depredation was actually witnessed, but the proximity of the pinniped indicated a possible depredation. Hanan, Jones and Read (1989) conducted their survey over a period of 4 years, and used polynomial and exponential regression to indicate the average number of depredation incidents per CPFV trip, and the average number of interactions (no actual take witnessed) per CPFV trip. Harvey and Weise (1997) presented their results in a percentage loss over a four-month period, May through July 1997.

Both studies also revealed seasonal trends in depredation and interaction rates that coincided with migration patterns of the California sea lion, with the depredation rates decreasing in spring and early summer coincidental with the height of the pupping and breeding season. Hanan, Jones and Read (1989) concluded that depredation rates are a function of fish availability, and the desirability of the fish targeted by the CPFV industry. They also postulated that a few rogue sea lions have learned that it is easier to follow fishing boats and take a few "desirable" fish than to catch a large number of their normal prey. Harvey and Weise (1997) reported that the greatest number of takes coincided with the southward migration of the sea lions to their breeding grounds, and the average probable loss reported in dockside surveys was much higher than the actual average probable loss observed on onboard surveys.

Harvey and Weise (1997) also indicated the importance of determining the difference between a probable take and an actual take. This illustrates one of the criticisms of Hanan, Jones and Read (1989) where a sea lion swimming within 100 yards of the boat was recorded as an interaction. In addition, Hanan, Jones and Read (1989) counted multiple depredations by a single sea lion as multiple incidents, thereby counting depredations by a single "rogue" sea lion as multiple incidents. This affects the credibility of the data presented in the form of average number of sea lions interacting with CPFVs, for instance one sea lion interacting with the boat 3 times would be recorded as 3 separate incidents, effectively tripling the number of sea lions. Although Harvey and Weise (1997) conducted a much shorter survey than Hanan, Jones and Read (1989) (four months vs. four years), their methods were much more reliable, and data much more credible. The method of using onboard surveys in conjunction with dockside surveys allowed a much higher sample percentage than Hanan, Jones and Read (1989). Also, the sighting of a pinniped, even with a fish, was "noted but not logged" because the fish may have been taken from another boat or actually caught by the pinniped.

It is important as well as difficult to differentiate between the socioeconomic conflicts that arise between pinnipeds and humans related to the pinnipeds interference with human activities and competition for marine resources, and the impacts of pinniped predation on salmonids. It is clear from the literature that although pinnipeds may have an impact on the recovery of locally depressed salmonid populations, they are not considered to be a major factor in the decline of such populations (NOAA 1997; 1999; NMFS 1997a; 1996; Weise and Harvey 1999a). In fact, some scientists postulate that

decreased numbers of pinnipeds could actually result in decreases in salmonid populations as the pinnipeds feed on other piscivorous fish that consume a proportionately higher amount of salmonids (Punt and Butterworth 1995; Wickens et al. 1992). Clearly, more research into the population dynamics of these ecosystems is necessary. However, the purpose of this paper is to address the socioeconomic aspects of the conflicts that arise between pinnipeds and humans in direct competition for these diminishing salmonid resources and to address the inconsistencies between the statutes (ESA, MMPA, and the Magnuson-Stevens Fishery Conservation and Management Act) enacted to protect them.

CHAPTER 3

LITERATURE REVIEW: UNDERLYING ECONOMIC THEORY AND CONTROVERSIES ASSOCIATED WITH CONTINGENT VALUATION

The Origins of Economic Valuation of Natural Resources in the United States

In the United States, economic valuation of natural resources, and the use of cost-benefit analysis, traces its roots to the Progressive Era (1900 –1920) and the rise of conservation politics. During the early part of the twentieth century, the social problems and excessive consumption that were the hallmarks of the Industrial Revolution of the late 19th century promoted unrestrained economic growth and resulting environmental degradation (Gottlieb 1993; Kline 1997). Although the use of cost-benefit analysis for water improvement programs had been suggested as early as 1808 by Albert Gallatin, President Thomas Jefferson’s secretary of the treasury (Hanley and Spash 1993), economic analysis of resource use was not required by federal regulation until the Federal Reclamation Act and the Rivers and Harbor Act (1899) were passed. Both required economic analyses including a comparison of costs and benefits by federal water agencies for federal projects (Hanley and Spash 1993; Lipton et al. 1995).

The use of cost-benefit analysis was primarily limited to federal water agencies such as the Bureau of Reclamation and the Army Corps of Engineers well into the 20th century (Hanley and Spash 1993). The Flood Control Act of 1936 required the Army Corps of Engineers to evaluate all proposed water resource projects, ensuring that the benefits exceed the costs. In 1946, the Federal Interagency River Basin Committee’s

Subcommittee on Benefits and Costs began work on the “Green Book”. Published in 1950, the Green Book (formally titled *Proposed Practices for Economic Analysis of River Basin Projects*) attempted to codify the general principles of cost-benefit analysis for use in federal projects (Hanley and Spash 1993; Lipton et al. 1995). Although the report was never fully accepted by either its’ parent committee or by relevant federal agencies it nevertheless was notable for several reasons. It was the first such report to provide general guidelines for the use of economic techniques to determine costs and benefits, and the first to use sophisticated economic techniques and bring in the language of welfare economics. In addition, it encouraged further research and debate among academics, another first for a report of this type (Hanley and Spash 1993; Lipton et al. 1995).

Cost benefit analysis (CBA) matured as a common analysis technique in the regulatory process in the 1970s and 1980s. The National Environmental Policy Act (NEPA) of 1969 broadly stated that the Federal Government shall

(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by subchapter II of this chapter, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations (NEPA §102.2 1969)

More specifically, the statute also required the use of CBA in Environmental Impact Statements (EIS).

To assess the adequacy of compliance with section 102(2)(B) of the Act the statement shall, when a cost-benefit analysis is prepared, discuss the relationship between the analysis and any analyses of unquantified environmental impacts, values and amenities. For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important

qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision (NEPA §1502.23 1978).

Notice the regulation specifies that the presence of “qualitative considerations” precludes the use of a monetary cost-benefit analysis, revealing that the act does not provide for non-use values.

Two Executive Orders, one issued by President Ronald Reagan the other by President William Clinton made specific provisions for the use of CBA in the regulatory process. It was Executive Order 12291 of 1981 that first “explicitly” required the use of CBA in the formulation of all new “major” regulations (Hanley and Spash 1993; Lipton et al 1995). This Executive Order was superceded in 1993 by Executive Order 12866, which required the selection of “those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity)” (U.S. President 1993, 12866). In addition, and perhaps more importantly for our purposes, Executive Order 12866 required consideration of non-use benefits in that the regulatory process

should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. (U.S. President 1993, 12866)

Another major environmental regulation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), also known as the “superfund” law, allowed claims for damages to natural resources that resulted from the

release of oil or other hazardous substances. CERCLA (1980) required that regulations regarding damage assessment to natural resources specify

alternative protocols for conducting assessments in individual cases to determine the type and extent of short and long-term injury, destruction, or loss. Such regulations shall identify the best available procedures to determine such damages, including both direct and indirect injury, destruction or loss and shall take into consideration factors including, but not limited to, replacement value, use value, and ability of the ecosystem or resource to recover. (CERCLA §301 1980)

President Reagan delegated the responsibility of rulemaking in response to CERCLA to the Department of the Interior (DOI). After publishing a preliminary rule and receiving “extensive comments on the proper definition of damages and on appropriate methods for determining such damages” the DOI published its 1986 final rule (Kopp and Pease 1997). Soon after its release, the rule was challenged in litigation. This was not surprising, considering that the approach recommended in the final rule differed substantially from the one recommended by the DOI’s regulatory team. In addition, it did not allow for the inclusion of option or existence values, “except when use values could not be determined” (Kopp and Pease 1997).

In *Ohio, et al. v. Department of the Interior*, industry groups, environmental interests and ten states challenged different parts of the final rule. The court struck down the DOI’s “lesser-of” rule, which provided the trustees the option to recover either the cost of restoration or the value of diminution of use values, whichever was less. The court also overruled the DOI’s exclusion of option and existence values, and hierarchy of valuation techniques relegating contingent valuation as a last resort (Cummings and Harrison 1994; Kopp and Pease 1997). The court decision acknowledged restoration costs as a general

measure of damages, promulgated the inclusion of passive use values in Natural Resource Damage Assessments (NRDA), and upheld the DOI's determination of CV as "reasonable and consistent with congressional intent." The decision resulted in a flurry of debate regarding the decision in general, the future of NRDA and the use of CV in such assessments (Cummings and Harrison 1994; McConnell 1994).

Finally, on March 24, 1989, an event occurred which thrust environmental valuation techniques used in NRDA's to the forefront of the political and public spectrum. At four minutes past midnight, the Exxon Valdez ran aground on Bligh Reef, spilling 11.2 million gallons of crude oil into Alaska's Prince William Sound. It was characterized as the "worst marine environmental disaster this nation has ever experienced" (Kopp and Pease 1997, 32). The Exxon Valdez spill became a catalyst for Congressional revision of the Clean Water Act, passage of the Oil Pollution Act of 1990 (OPA), and movement of the primary regulatory responsibility for NRDA's related to oil spills from the DOI to NOAA (Kopp and Pease 1997).

NOAA had the *Ohio* case to use as a reference, and more clearly stated standards by the OPA. Nevertheless, they followed a similar path to the DOI. They sought comments and public input before the publishing the proposed rule. Many of the comments referred to the inclusion of passive-use values and specifically mentioned the use of CV method (Kopp and Pease 1997). Consequently, NOAA commissioned a panel of experts chaired by two Nobel Laureates to create regulations and guidelines for NRDA's, and to review the role of passive-use values, and the appropriateness of CV in such determinations. Published in 1993, the *Report of the NOAA Panel on Contingent Valuation* remains a

standard reference to which CV studies are compared. The guidelines it presented are still considered as the Best Available Practice by many CV practitioners (Arrow et al. 1993; Diamond 1996; Kopp and Pease 1997; Wang 1997). A summary of the major developments regarding cost-benefit analysis since the turn of the century is presented in Table 1.

Table 1. Major Developments in the Use of CBA to Value Environmental Resources

<i>Year</i>	<i>Event</i>
1808	Albert Gallatin suggests use of cost-benefit analyses in water improvement programs
1900-1920	Progressive Era and rise of conservation movement result in popular views that natural resources should be managed using scientific and economic principles.
1902	Federal Reclamation Act of 1902 and River and Harbor Act of 1902 both require economic analyses to be performed on federal projects
1936	Flood Control Act of 1936 requires that benefits exceed costs on federal flood projects
1946	Federal Interagency River Basin appoints Subcommittee on Benefits and Costs
1950	<i>Proposed Practices for Economic Analysis of River Basin Projects</i> published by Subcommittee on Benefits and Costs
1950-1970	Further development of Cost-Benefit Analysis in the field of water resources Publications include: Eckstein's <i>Water Resource Development: The Economics of Project Evaluation</i> and Arthur Maass and Associates' <i>Design of Water-Resource Systems</i>
1969	NEPA requires the use of Cost-Benefit Analysis in EIS
1970-1980	CBA interest expanded from Water Resource Valuation to include wildlife, air quality, human health and aesthetics Development of the importance of non-use values
1980	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
1981	Executive Order 12291 – requires application of CBA to all new regulations
1986	Department of Interior releases final rule for implementation of CERCLA
1989	Exxon Valdez Oil Spill
1993	Publication of the <i>Report of the NOAA Panel on Contingent Valuation</i>
1993	Executive Order 12866 – requires application of CBA to consider use and non-use values in evaluation of all new regulations

General Regulatory Guidelines for Economic Valuation of Natural Resources

The process of environmental policy formulation involves a complex interaction between the disciplines of economics, science, politics and law. Natural resource managers and regulatory agencies are increasingly being asked to make policy decisions based upon an amalgamation of the competing interests of science, economics, commerce, and legal issues. Also, with the now generally required use of cost-benefit analysis as a test of the efficiency of a regulatory action, rule-makers and natural resource managers are often making policy decisions based on a discipline that previously was solely in the realm of economists. Consequently, various regulatory agencies and academic institutions have published general “economic guidelines” written “to eliminate this confusion for those non-economists who seek insight into economic thought and into how economic analysis can contribute to coastal zone management” (Edwards 1986).

The first concept in environmental valuation discussed by both Edwards (1986) and Lipton et al. (1995) is the concept of economic value. It is appropriate that this is the first term described, as it is the most basic tenet of environmental economic valuation and yet lies at the heart of the controversies surrounding environmental economic valuation. *The American Heritage Dictionary* defines economics as the “science that deals with the production, distribution, and consumption of goods and services.” Edwards (1986) takes this idea one step further and explains that economics is actually a “behavioral” science. Economists study how people allocate their resources among the available goods and services to receive the maximum satisfaction, or put in economic terms the maximum “utility.” Lipton et al. provides a definition for “economic value” that is most likely

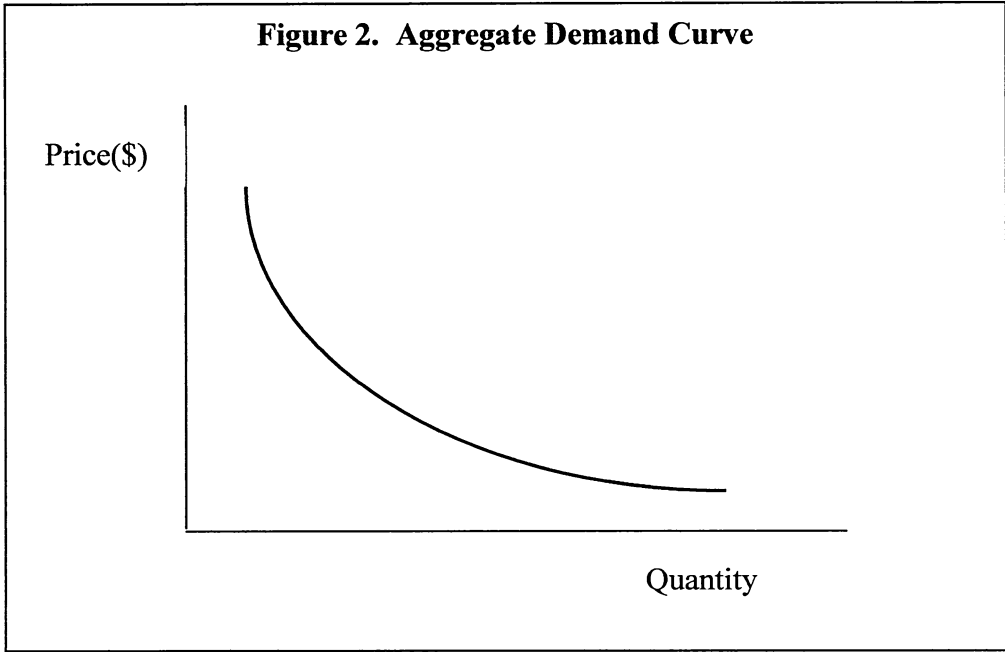
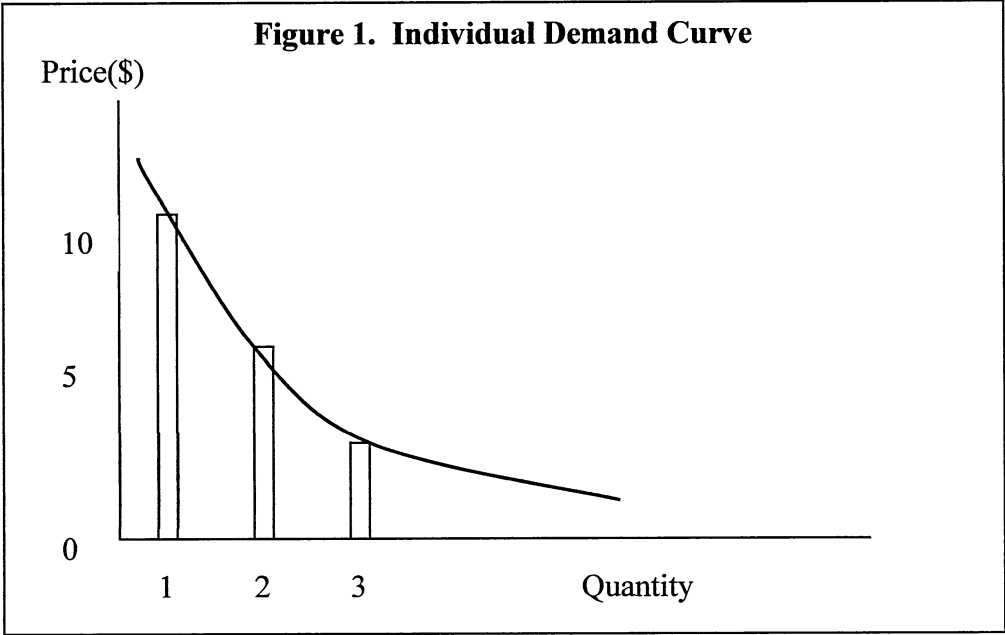
familiar to economists. “Economic value is a measure of what the maximum amount an individual is willing to forego in other goods and services in order to obtain some good, service, or state of the world” (Lipton et al. 1995). They also list some of the characteristics of economic value as follows:

- Products or services have value only if human beings value them, directly or indirectly,
- Value is measured in terms of trade-offs, and is therefore relative,
- Typically, money is used as a unit of account, and
- To determine values for society as a whole, values are aggregated from individual values. (Lipton et al. 1995, 5)

To relate this “economic value” to environmental resources, Colgan (1995) explains that the primary role of environmental economists is to measure the economic value of environmental resources and how these values change due to fluctuations in the level of environmental goods and services. Finally, Freeman (1995) does a good job of describing and categorizing environmental values. He perceives environmental values in the form of “service flows to people.” He then lists these service flows as follows: first, a source of “material inputs to the economy such as fossil fuels, wood products, minerals, water and fish”; second, a source of “life support services in the form of a breathable atmosphere” and habitable climate; third, a source of “amenity services” providing opportunities for “recreation, wildlife observation, the pleasures of scenic views” and other indirectly related services; and finally, dispersal and disposal of waste products “generated by economic activity and disposed of in the environment” (Freeman 1995, 90).

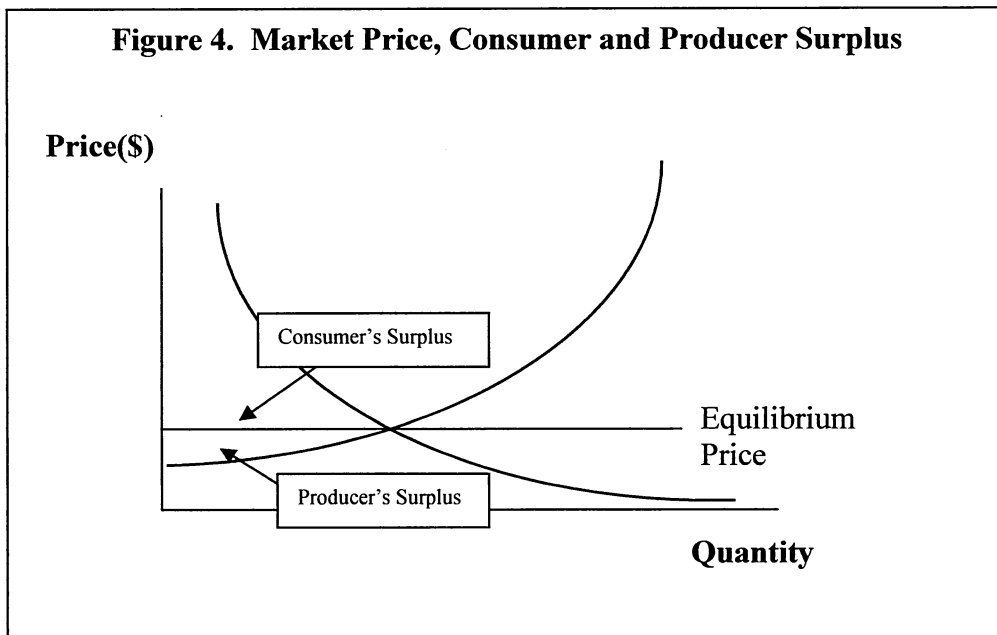
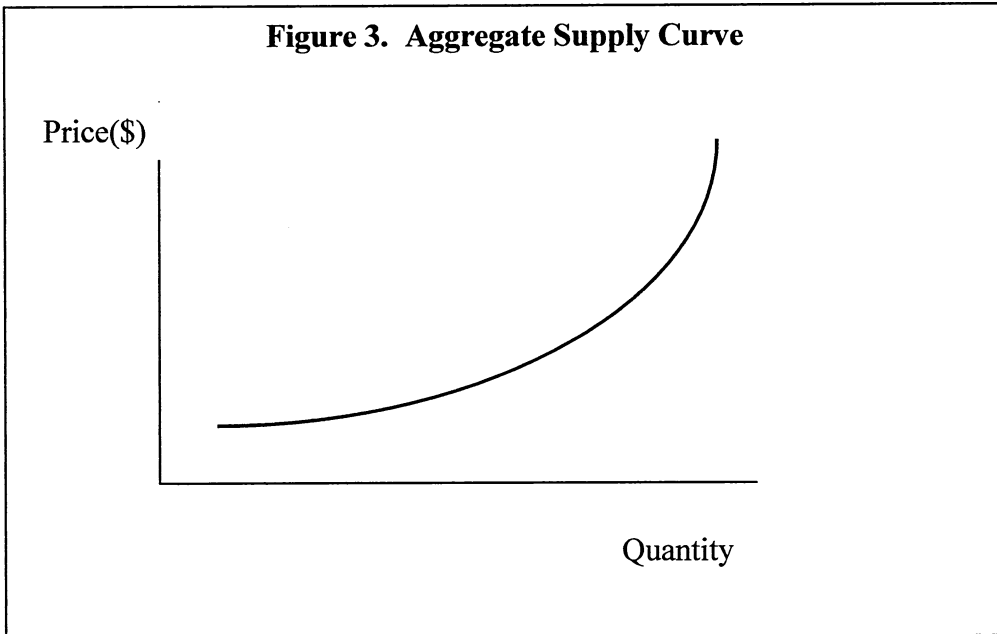
The next three terms that we will discuss are basic economic concepts that provide groundwork for a discussion of market and non-market valuations. These are the concepts of consumer's surplus, producer's surplus and willingness-to-pay (WTP). Edwards (1986) explains that the amount of money a person is willing to pay for a specific commodity depends on the amount of utility that consumer expects to receive from the commodity in question. As more than one of a commodity is purchased, the utility generally decreases (Edwards 1986; Lipton et al. 1995). Let us use pizza as an example. A consumer may value one pizza at \$10, however, a second pizza would likely be valued less (as the consumer has satisfied her urge for pizza with the first pizza and may only be able to consume half of the second pizza) perhaps \$5. Finally, a third pizza would be valued lower still, perhaps at \$2.50. The amounts of \$10, \$5, and \$2.50 represent the consumer's WTP for pizza. Put into a graphical form they represent the individual's demand curve (Fig. 1). Economists aggregate individual demand curves to create the aggregate or consumer's demand curve (Edwards 1986; Lipton et al. 1995) this is illustrated in Fig. 2.

The other side of this equation involves pricing and the producer or supply of the commodity. In a conversely similar function to the creation of a demand curve, a supply curve can be created by aggregating individual producers' pricing and supply functions. The supply curve is represented by the aggregate of the individual producer's relationship between the quantities of a good or service produced and the price received for that



product (Lipton et al. 1995) and is represented in Fig. 3. Since producers will produce more of a particular good for a higher price, the supply curve is upward sloping.

The intersection of the aggregate supply and demand curves for a particular commodity determines the market price or equilibrium price (Fig. 4). The area above the supply curve and below the price represents the producer's surplus. Conversely, the area below the demand curve but above the price represents the consumer's surplus. The consumer's surplus plus the producer's surplus equals the total economic value of the commodity in question (Fig 4). The final conceptual area covered by both publications that we will review involves those concepts that are specific to the field of environmental valuation, alternative values such as non-market values, option, and existence values. So far, we have discussed the concepts of economic value, supply and demand as they are used in a market-based economy. Edwards (1986) points out that although economic supply and demand are necessary for the existence of markets, markets are not necessarily required for the existence of supply and demand. However, how do we value the environment without using a well-developed market? Lipton et al. (1995) explain that environmental valuation "applies the welfare economics concepts of producer and consumer surplus to issues involving natural resources and the state of the environment." Keep in mind that there are many facets of environmental value that *are* measured by the standard market-based mechanism, direct observation of consumer preferences in the form of market prices and quantity data. For example, the demand for hunting and fishing can be determined by the amount spent on licenses and gear and other expenditures related to these activities. Fees collected at a national park are another



example. What is most important for our purposes is that the standard market-based mechanism *cannot* measure certain other aspects of environmental value. These are

appropriately termed “non-market values.” With non-market values, typically there is no producer or the consumer is both the producer and the consumer (Lipton et al. 1995).

In general, the total economic value of an environmental good is referred to as the preservation value (Mendelsohn 1985), or total value (Goodman et al. 1997; White et al. 1997), which is a combination of *use* and *non-use* values. Use values are the economic value of a resource, whether market-based or not, that is received by those consumers who actually “use” the resource. Many use values can be easily measured using standard economic techniques that are based on recorded market information; however, there are use values that cannot be determined using market based techniques. Examples include activities such as bird watching, sunbathing, swimming, boating, viewing of wildlife, and photography. These values are sometimes called “non-consumptive use” values and need to be measured indirectly (Edwards 1986). Non-use values are another type of non-market values and consist of *option* and *existence* values. Option and existence values are economic terms used to describe respectively, the value that society places on having the resource available even if it is not utilized by the respondent (the “option” to use is available), and the value that the respondent places on the actual existence of the resource in question.

Non-use values are discussed in several of the papers presented in *Sustaining Coastal Resources* (Colgan 1995), especially those related to coastal resources. Recall Freeman’s (1995) categorization of the resource-environment complex as “service flows to people.” He explains that the “amenity services” provided by the environment are sometimes called non-use or existence values. Also, in their discussion of the value of

wetland services, Mullarkey and Bishop (1995) explain that in addition to the conventional uses of wetlands, people may “derive pleasure solely from the knowledge that the wetland continues to exist,” providing reasons of “altruism, bequest value, and feelings of environmental responsibility.” They also suggest that simply reflecting on “one’s own personal desire to provide future generations with a bequest including a healthy environment should be convincing enough to justify the theoretical possibility of existence values” (Mullarkey and Bishop 1995, 83). Finally, Townsend (1995) contributes to the issue of non-use values by explaining that even if an individual doesn’t use a resource they may get value from the feeling that the resource will be available for their descendants, or get a feeling of pride in their community and its clean environment. These feelings of bequest and pride, although they are not traded in a market, contribute to the welfare of society and by increasing a consumer’s satisfaction (or utility) are in principal, economic benefits (Townsend 1995).

Now that we have discussed the values of coastal environmental amenities that cannot be measured by the standard market mechanism of direct observation, the question remains how do we measure these values? Both Lipton et al. (1995) and Edwards (1986) review the major methods in non-market valuation. These methods are generally put into one of two categories, direct or indirect. Indirect methods include the hedonic pricing method (HPM), the travel cost method (TCM), and random utility modeling (RUM). These indirect techniques rely on observable behavior generally use physical linkages to produce value estimates that are abstractly related to market value estimates. Contingent valuation method (CV) is currently the only direct technique used

to measure non-market values. It creates a hypothetical market for a particular environmental amenity and then uses a survey format to elicit values from respondents, the values being “contingent” upon the nature of the good or service and the scenario described in the questionnaire.

In contrast to the hedonic pricing method, the travel cost method and random utility modeling, the contingent valuation method measures non-market values *directly*. It also stands out from the other methods in that it is the only technique that can measure *non-use* values (option and existence values) (Edwards 1986; Hanley and Spash 1993; Lipton et al. 1995; Mullarkey and Bishop 1995). Therefore, it is the only method that can address the issue of *total valuation* of environmental amenities. Since CV is the methodology used in this study, a detailed review is warranted. In the next section we will review the guidelines for using CV, examine the inherent problems in CV and the surrounding controversies, and finally, justify the use of CV as the primary methodology in this study.

Contingent Valuation Method Studies, Guidelines, and Controversies

Contingent Valuation method (CV) is a widely accepted economic method for determining the value of natural resources (Bateman 1997; Bishop et al 1997; Carson 1998; Hanley and Spash 1995; Li and Mattsson 1995; Mitchell and Carson 1989). Carson (1998) explains “that the elicitation of stated preferences is the only approach to valuing non-marketed goods which is not limited to inferring values from past actions” (Carson 1998, 17). In fact, many researchers consider it the only acceptable tool for measuring

non-use or passive-use values (Bishop et al. 1997; Carson 1998; Loomis and Ekstrand 1997; Mitchell and Carson 1989). Mitchell and Carson (1989, 21) state:

In an economic context, nothing has value in and of itself; value is possible only in relation to the overall economic system. Even then, value is defined only as the most someone is willing to pay for a good, or the least the owner of the good is willing to take in exchange for it.

Contingent Valuation is a survey-based technique used to elicit preferences for non-marketed goods including many environmental amenities. In general, survey questions are used to determine what respondents are “Willing-to-Pay” (WTP) for improvements in environmental amenities or what compensation they are “Willing-to-Accept” (WTA) for degradation of the environment. First, the respondent is given a detailed description of the good to be valued and the hypothetical “market” or situation that has been created to provide a context for the valuation. Next, the surveyer poses questions designed to elicit the respondents' WTP for the amenity in question. Finally, the respondent is asked for demographic information and their preferences regarding the good or situation in general. Statistical analysis of this information allows the researcher to arrive at an average WTP for all respondents which can then be extrapolated over the population surveyed to determine the total WTP for the good or service being valued.

Many CV studies have been conducted that determine values for some type of natural resource or environmental amenity. These studies range greatly in the type of natural resource they attempt to measure. CV studies can measure the value of many broad abstract environmental amenity concepts such as altered visibility in the Grand Canyon, preservation of different numbers of acres of agricultural land in Canada, improved environmental quality in Galveston Bay, or preserving different percentages of Kentucky

horse farms (Carson 1997; Levy et al. 1995). They have also measured the value of wildlife habitats including Rocky Mountain wilderness areas, the English coast, Australia's Kakadu Conservation zone and Kentucky wetlands (Carson 1997; Goodman et al. 1997). Finally, they have also been used more directly to value a particular wildlife population or populations. Examples of this include the river otter and water vole in Great Britain (White et al. 1997), marine mammal populations in California (Hageman 1985), the Mexican spotted owl (Loomis and Ekstrand 1997), Northern spotted owl, and North Carolina sea turtles (Carson 1997).

Mitchell and Carson's Using Surveys to Value Public Goods: The Contingent Valuation Method (1989) is widely cited in many CV studies and papers regarding the CV method. In fact, five out of six of the CV papers referenced in this study cited Mitchell and Carson (1989). In addition to a review of the method and procedures used in contingent valuation, Mitchell and Carson (1989) address the importance of relevance and quality in contingent valuation studies. Relevance refers to a "careful mapping of the changes the study valued against the changes implied by the policy." Of particular importance are the "correspondence between the provision of the amenity described in the scenario and the amenity changes implied by the (proposed) policy changes," and the context in which the amenity is valued. Quality ensures that even the findings of a flawed CV study may provide insights into the values of a policy, but only if "shortcomings of the study are recognized and taken into account." On the other hand, a good-quality study may "dramatically narrow the range of uncertainty." In CV methodology, "quality" is best measured using a "Best Practice Standard," Mitchell and

Carson attempt to contribute to what constitutes the “Best Practice Standard” in CV surveys. They explain that in order to obtain an “accurate” estimate of the value of a good, “the survey must simultaneously meet the methodological imperatives of survey research and the requirements of economic theory” (Mitchell and Carson 1989, 17).

The major methodological imperatives that must be considered include survey structure, data comparability, and sources of error. Mitchell and Carson (1989) review the merits and obstacles encountered with each survey instrument. In-person surveys or face-to face surveys allow the use of visual aids and allow the interviewer to convey complex issues or scenarios. This method often results in more complex and valuable data. However, it also raises the issues of interviewer bias and cost prohibitiveness. Telephone or mail surveys are far less expensive. Mail surveys can include visual aids and telephone surveys allow for probing questions to unclear responses, but they generally have a low response rate; telephone surveys do not allow for the conveyance of complex material or scenarios. Mitchell and Carson (1989) suggest the in-person survey is the optimum choice, though they do not preclude the use of telephone or mail surveys, providing the telephone surveys are not too complex, and the mail surveys eliminate the low-response bias.

Data comparability refers to “how well one person’s answers can be compared with those given by another” (Mitchell and Carson 1989, 112). Survey practitioners use “pre-testing” to determine the data comparability. Pre-testing consists of a period of practice surveys conducted in the same manner as the final survey. These practice surveys determine how the respondent interprets the wording of questions and whether the survey

questions elicit the information required for the valuation. It also allows the interviewer to practice “adapting the standardized questionnaire to the unstandardized respondents” (Riesman 1958). The importance of pre-testing cannot be over-emphasized (Johnson 1998).

The sources of error that must be considered to meet Mitchell and Carson’s “Best Practice Standard” include the closely interrelated attributes of reliability, validity and bias. As the major sources of error in CV studies, these attributes have been the subject of many debates. Reliability refers to the “extent to which the variance of a response or estimate is the result of random sources or ‘noise’”(Mitchell and Carson 1989, 122). In other words, are the results of a CV study actually derived from the survey responses or would answering the survey questions randomly produce the same results? Validity describes the extent to which a survey measures that which it is intended to measure. Bias is especially prevalent in CV studies. Many different aspects of a CV scenario can influence respondents WTP. Mitchell and Carson (1989, 124) accept the premise, proposed by several other researchers, that respondents value the entire package in a CV scenario including the “conditions under which the amenity will be provided.” Respondents do not provide a WTP for the amenity “in the abstract,” but rather consider the entire scenario as a “policy” and provide their WTP as such. Therefore, each aspect of a CV scenario provides a potential source for bias which must be addressed as completely as possible.

In contributing to what is considered by many to be the “Best Practice Standard,” Mitchell and Carson (1989) provide a good review of the “methodological imperatives” to be used in CV survey research. They also pose a challenge to the CV researcher, to make the scenario sufficiently understandable, plausible, and meaningful to respondents so that they can and will give valid and reliable values despite their lack of experience with one or more of the scenario’s dimensions. (Mitchell and Carson 1989, 120)

Only rigorous consideration of these principles will produce a CV study that meets the standard by providing a valid and reliable measurement of the respondents’ WTP.

Mitchell and Carson (1989) also insist that a good CV study meet the “requirements of economic theory.” Considering the guidelines presented in the *Report of the NOAA Panel on Contingent Valuation* are published and approved by NOAA, they are an appropriate standard to be used in this research. In section IV of the panel’s report, they list a set of “stringent guidelines” for conducting CV surveys. Some of the general guidelines presented by the NOAA panel are listed below:

- CV studies should make clear “the definition of the population sampled, the sampling frame used, the sample size, the overall sample non-response rate, and item non-response rate on important questions,
- Careful pre-testing of a pilot survey should be conducted, plus evidence should be included from the final survey that respondents understood and accepted the main description and questioning reasonably well,
- Conservative Design: when applicable choose an analysis of the responses that tends to underestimate the WTP, this can increase the reliability of the survey,
- The WTP format is preferred over the WTA (Willingness-to-Accept) because it is generally more conservative,
- Respondents should be reminded of substitute commodities such as other comparable natural resources so that they have the alternatives clearly in mind, (the NOAA panel lists this guideline as one that is often not addressed by even the best CV studies)

- A “No Answer” option should be included in the main referendum question, with a reasoning behind the no answer listed as well,
- Yes/No questions should immediately be followed up with a “Why” question,
- Cross Tabulations should be performed by key demographic and pre-familiarity categories. (Arrow et al 1993, 4608)

In concordance with the recommendations of NOAA, Carson (2000), indicates the importance of the population being sampled being the relevant one for "evaluating the benefits and/or costs of the proposed project," pointing out that the size of the population over which benefits can accrue is one of the major factors in determining the economic value of a particular good or service.

There are three crucial elements required for a CV study to be of value (Carson 2000; 1998; Fischhoff and Furby 1988; Hoehn and Randall 1987), and a well-structured CV survey contains and appropriately expresses each of these elements. First, a realistic and believable hypothetical market must be well-defined (i.e. the "good" or resource to be valued described in detail). A description of the terms under which the good or service is to be offered is presented to each respondent in an attempt to elicit a Willingness-to-Pay. This description must "simulate a market for the good in question with sufficient plausibility that the respondent's answers may be taken as an accurate representation of how they would behave if confronted with an actual market for the good" (Mitchell and Carson 1989). Second, the context of valuation must be plausible. Generally, in the case of a public good, this refers to defining some change in policy, often a policy constructed solely for the purposes of the CV exercise. Mullarkey and Bishop (1995) suggest that this description should define 1) who the other participants are, 2) whether the measure of value will be WTP or WTA, and 3) the value elicitation device. Consequently, the third

element, the payment vehicle, must also be well-defined and plausible. Hoehn and Loomis (1993, 71) explain that a "valid valuation framework imposes important constraints on the valuation of policy changes" and without these constraints, systematic bias will result. In the case of public goods, the survey should also include an inference that all households in a particular population will be required to pay for the proposed program should it be implemented. "In order to elicit meaningful responses from individuals, respondents must ... realize that their choice may have later implications in the government's decision to provide and collect payment for the good" (Carson 1998, 21).

According to Hoehn and Randall (1987) the valuation question should be in one of two formats; "tell me the highest amount you are willing to pay", or "if a program to provide the policy change cost you \$x, would you approve or disapprove of the program?" to achieve a "solid core" of results. Keeping with these recommendations, the payment vehicle is often in the form of a single addition to the respondent's taxes. Du Vair and Loomis (1993) explain that while a payment of taxes is not an "emotionally neutral method," it is a "logical or credible payment vehicle." To be sure these crucial elements are met, careful pre-testing of a pilot survey should be conducted, plus evidence should be included from the final survey that respondents understood and accepted the main description and questioning reasonably well.

Regarding survey format, Hanemann (1995) explains that the double-bounded format generates lower WTP values than a single bounded version due to an increased tendency for the respondent to say "no" to the second bid rather than "yes". Lower WTP values

being more conservative and meeting the NOAA panel requirements for conservative design. He further states,

In statistical terms, the double-bounded format provides more information for a given sample size and greatly shrinks the confidence interval; in using it, one is trading off a large reduction in variance for some downward bias (Hanemann 1995, 92).

Alberini (1995) explains that the double-bounded design creates a "tighter interval" around the true WTP and more efficient estimates of WTP.

In addition to requirements for the survey structure, the NOAA Panel also requires that certain conditions be met in the analysis of results.

- CV studies should make clear “the definition of the population sampled, the sampling frame used, the sample size, the overall sample non-response rate, and item non-response rate on important questions,
- Conservative Design: when applicable choose an analysis of the responses that tends to underestimate the WTP, this can increase the reliability of the survey,
- Cross Tabulations should be performed by key demographic and pre-familiarity categories.

(Arrow et al. 1993)

Also central to the analysis, Carson (2000) points out that "mean WTP is the traditional measure used in benefit cost analysis, while median WTP, which corresponds to the flat amount that would receive majority approval, is a standard public choice criterion.”

Mitchell and Carson (1989) indicate that the use of the median is appropriate in the case of a policy-based issue.

The current debate over CV covers a wide range of problems from survey design to the theoretical basis of CV in welfare economics. In this context, we cannot examine each problem in detail as that would expand the scope of this work to unwieldy

proportions. Therefore, we will concentrate on those perceived shortcomings regarding CV that specifically apply to this study. After a brief review regarding the debate over the inclusion of non-use values in economic valuation, we will discuss the issues of biased information and the debate raging over the problem of embedding.

Non-use values or passive-use values consist of *option* and *existence values*. Option and existence values are economic terms used to describe respectively, the value that society places on having the resource available even if it is not utilized by the respondent (the "option" to use is available), and the value that the respondent places on the actual existence of the resource in question. Bishop et al. (1997), citing seven separate studies, states that "non-use values are now well entrenched in the theory of the consumer." Economists generally trace the origins of the non-use value components to Krutilla (1967) who put forth the following; "there are many persons who obtain satisfaction from mere knowledge that part of wilderness North America remains even though they would be appalled by the prospect of being exposed to it."

There are scholars and economists who believe that the use of non-use values in economic valuation is a mistake; and that using quantitative methods to resolve conflicts over social ideologies (such as desirable amounts of wilderness) is misguided (Portney and Robyn 1992). One criticism is that the scope of existence values can become unmanageable in the context of cost-benefit analysis unless CV practitioners establish some practical way of limiting the scope of existence values. Another criticism is that existence values are hard to measure due to the fact that consumers cannot reveal their preferences with any quantifiable behavior (Portney and Robyn 1992). Finally, Portney

and Robyn (1992) also make a valid point that the medium through which information about the resource under scrutiny is conveyed can make a vast difference regarding people's preferences and behavior.

In an article directly rebutting Portney and Robyn (1992), Kopp (1992) asserts that Portney and Robyn follow a “scattershot school of argumentation” that “admits irrelevant and often contradictory propositions.” He also suggests that Portney and Robyn do not seek to deny the existence of non-use values, rather they are merely pointing out the difficulties inherent in measuring them (Kopp 1992). However, economists do not often deny that non-use values are difficult to measure, merely that great care and consideration be used in the elicitation of such measurements. In fact, Kopp points out that in their assertion that existence value should not be used in cost-benefit analysis, Portney and Robyn (1992) point to some of the criticisms of CV that are discussed in the following paragraphs.

It is clear that the debate regarding the inclusion of non-use values in economic valuation will continue. However, it is also clear that the government accepts the quantification and use of non-use values in such determinations. In the Ohio vs. DOI decision, the U.S. Court of Appeals determined that existence value was a valid part of the natural resources damage assessment process (Kopp and Pease 1997; Portney and Robyn 1992). The NOAA panel concurred, stating the premise that passive-use loss – interim or permanent – is a meaningful component of the total damage...” (Arrow et al. 1993). Mitchell and Carson (1989, 63) also point out that the public readily expresses its'

acceptance of non-use values, in the form of fees and contributions to environmental groups, and the often strong support for national environmental legislation.

Another issue often raised as a criticism of CV is the problem of respondent bias and interpretation. Many papers address the uncertainty and bias inherent in the use of CV in detail. “What is the Value of Rangitoto Island” (Vadnjaj and O’Connor 1994) deals specifically with the issue of how respondents actually interpret questions in a CV survey in relation to the dollar values that they offer or bid. This study addresses the high percentage of “protest, zero, or high dollar responses to questions of paying (or compensation) for environmental amenities.” In this study, a CV survey was conducted and then a second survey was given to the respondents to see if they had actually bid what they were willing to pay. This study strongly suggested that the actual dollar values bid are not consistent with the traditional reasoning that underlies Contingent Valuation. Similarly, in “Valuing Public Goods: The Purchase of Moral Satisfaction,” Kahneman and Knetsch (1992) further address the issues of uncertainty and bias. As Vadnjaj and O’Connor (1994) found, values elicited from survey respondents may not always be consistent with what the respondent is actually willing to pay. Kahneman and Knetsch (1992) suggest WTP survey responses are more closely related to a sense of “Moral Satisfaction” rather than an actual Willingness-to-Pay, and “the amount that individuals are willing to pay to acquire moral satisfaction should not be mistaken for a measure of the economic value of the public goods.”

Carson (1998) found results contrary to Vadnjaj and O’Connor (1994) and Kahneman and Knetsch (1992) in his exploration of the role of passive use motives (the issue of

“moral satisfaction”) and the role of information in the use of contingent valuation to make decisions concerning global resources. He contends that without CV, a “comprehensive cost-benefit analysis involving non-marketed goods with substantial non-use values is impossible” (Carson 1998, 26). He further asserts that “nothing in neo-classical economic theory requires consumers to be perfectly informed, only that they make rational decisions based on the information set that they possess.” In their guidelines, Arrow et al. (1993) also recognize this problem, and suggest a survey with a conservative design (one that underestimates WTP) can correct for or even eliminate this bias.

In addition to addressing the concept of “Moral Satisfaction,” Kahneman and Knetsch’s (1992) paper “Valuing Public Goods: The Purchase of Moral Satisfaction” deals with a criticism of CV that is especially relevant to the intent of this thesis, the “embedding” or “part-whole” effect. Kahneman and Knetsch explain that in CV an embedding effect can be demonstrated. This phenomenon arises when the WTP for a particular good varies depending on whether it is evaluated alone or as part of a larger context (Kahneman and Knetsch 1992). A study designed to estimate the value of decreased visibility in the Grand Canyon also found evidence of embedding. In this study, Levy et al. (1995) found empirical evidence that suggested that the sum of the valuations of the parts can exceed the valuation of the whole. Diamond et al. (1992) and Desvouges et al. (1992) also recorded similar results, although the validity of these two studies was disputed by subsequent studies by several authors (Hanley and Spash 1993). This thesis attempts to value a group of sea lions that comprise a small part of the sea lion

population (those who may be “lethally removed” due to the economic damage that they cause). Therefore, a review of the controversy surrounding the “embedding effect” is particularly appropriate.

Kahneman and Knetsch (1992) classify the embedding effect as “perhaps the most serious shortcoming of CV.” They also assert that the related literature does not provide adequate guidelines to define the proper level of aggregation for the evaluation of a specific good (Kahneman and Knetsch 1992). In their 1992 study, they interviewed three samples of adults regarding their WTP for different categories of “Environmental Services.” The first group was asked for their WTP for Environmental Services in general. Next, they were asked to allocate part of their WTP for a more specific classification within the general category of Environmental Services, in this case it was “Improving Disaster Preparedness.” Finally the third question restricted the category further to include only the “availability of equipment and trained personnel for rescue operations” (Kahneman and Knetsch 1992). They asked the second group the second and third questions only. The third group was only asked the final specific question relating to “equipment and trained personnel.” Kahneman and Knetsch found similar WTP for each of the three groups although the level of services varied greatly over the samples. In fact, Sample Group 2 indicated a higher WTP for “Improved Disaster Preparedness” than Sample Group 1 did for the more inclusive category of “Environmental Services” in general.

These results lead Kahneman and Knetsch to state a conservative conclusion; “the contingent valuation of any public good should routinely be supported by adequate

evidence that the estimate is robust to manipulations of embedding” (Kahneman and Knetsch 1992). In a bolder statement, they also concluded the presence of embedding will cause the estimates of value obtained from CV surveys to be “largely arbitrary” and “the purchase of moral satisfaction is especially plausible as an interpretation of WTP for” public goods (Kahneman and Knetsch 1992).

Kahneman and Knetsch’s study in the *Journal of Environmental Economics and Management* is rebutted by V. Kerry Smith. Smith (1992) argues that *none* of Kahneman and Knetsch’s arguments are correct. His assertions:

- their survey framing and questions were flawed,
- the survey techniques did not adhere to “generally accepted practices for designing and analyzing CV survey results,”
- the “properties they attribute to standard value theory” in their assessment of CV are themselves incorrect,
- the interpretation of their results does not appear to be consistent with their findings. (Smith 1992, 74)

Smith also applied the study questions to a criteria developed by Fischhoff and Furby (1988), concluding that the questions “about progressive degrees of “inclusiveness”...do not adequately define the change or its extent and timing” (Smith 1992, 81). Smith also comments that Mitchell and Carson (1989, 302) recommend “completely informing respondents of what is to come before they are asked to value the first improvement.”

Smith even referred to previous work by Kahneman:

The framing of a transaction can alter its attractiveness by controlling the costs and benefits that are assigned to its account...Framing effects in consumer behavior may be particularly pronounced in situations that have a single dimension of cost (usually money) and several dimensions of benefit. (Kahneman and Tversky 1982, 204).

Smith (1992) admits that his study is a “strongly stated” rebuttal to their conclusions. He concludes Kahneman and Knetsch’s implementation does not conform to the conventional practice for CV studies proposed by Mitchell and Carson (1989), and the framing violates the basic tenets set forth by Fischhoff and Furby (1988) for “understandable valuation tasks.”

Other authors have also found results contrary to those found by Kahneman and Knetsch (1992). Loomis et al. (1996) detail specific deficiencies in the CV study performed by Kahneman and Knetsch. Criticisms include the inadequate definition of the goods or services in question, the “lack of information on pretesting to uncover deficiencies in the survey interpretation, survey response rate, failure to utilize multivariate analysis,” reliance on an open-ended rather than dichotomous choice questionnaire format and the handling of protest bids (Loomis et al. 1996; Smith 1992). Regarding the last criticism (protest bids), they “chose to focus on medians, without discarding any responses” (Loomis et al. 1996, 454). Loomis et al (1992) also describe the qualifications necessary for a “credible CV survey.” The “context and specific increment offered of each good at every level must be spelled out” in detail, including quantity and quality of the good. Also, legitimate “zero willingness to pay values need to be separated from protest responses” (Loomis et al. 1996). More recently, Carson and Mitchell (1995) published a study directly aimed at the embedding problem which “rejected the hypothesis that respondents are insensitive to the scope of the good being valued.” Finally, Carson (1997) presents a table list of thirty CV studies that reject the hypothesis that CV studies are insensitive to scope (the embedding problem).

In their attempt to prove that CV studies are subject to bias and the embedding effect, Kahneman and Knetsch fall victim to that which they are denouncing. They created a study specifically designed to measure the effects of embedding, rather than testing for the presence of it. They state it implicitly, “Our first study was conducted to document the embedding effect” (Kahneman and Knetsch 1992). Rather than conducting a study to test a hypothesis and make a conclusion, they make a conclusion and then design a study to prove it. This directly violates one of the foremost laws of scientific inquiry.

The question remains, is the use of CV justified in the economic valuation of natural resources? Hoehn and Randall (1987) explain that CV is a progressing research program, suggesting that CV as a method is effective and consistent, and attributing differences among results to the design and execution of the survey. Hoehn and Loomis (1993) further express the importance of a “valid valuation framework” in CV research, insinuating that without it, systematic bias will result. However, perhaps most importantly, the NOAA panel guidelines and *Ohio v. DOI* decision make the regulatory requirements clear (Kopp and Pease 1997; Smith 1992). The NOAA panel specifically stating that “CV studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment including lost passive-use values” (Arrow et al. 1993).

Although economists have expressed doubts about the ability of the method to quantify the value for environmental goods, generally speaking, CV’s fundamental utility has been upheld (Ajzen et al 1996; Mitchell and Carson 1989). Provided that a careful approach to the elicitation of WTP estimates is used, when applied properly, CV is a

“Best Available Procedure” (Ajzen et al. 1996; Mitchell and Carson 1989; Smith 1992).

“It appears as accurate as other available methods, it requires the researcher to make fewer assumptions, and it is capable of measuring types of benefits that other methods can measure only with difficulty, if at all.”(Mitchell and Carson 1989)

CHAPTER 4

METHODS

Introduction

A quantitative economic value for changes in sea lion populations due to proposed lethal controls was obtained using Contingent Valuation of a Willingness-to-Pay (WTP) survey. The total economic value determined by this study includes the use and non-use values derived in the study area. Use values are an expression of the economic value of the sea lion populations to the tourists that visit areas where sea lions are found. Non-use values add the economic value placed on sea lions by non-users, those who just want to make sure the sea lions are not killed (option and existence values). Willingness-to-Pay was solicited using a double-bounded referendum WTP survey. The effectiveness of the bid vehicle, or survey, was determined using a pre-test sample, where a smaller population indicative of the entire population to be sampled, was surveyed and analyzed. The use of these techniques has provided a general economic value for sea lions as well as revealing what demographic factors influence the degree of value placed on the resource.

- 1) Economic value for the sea lions affected by the proposed policy using CV as an analytical tool,
 - a) Create a WTP questionnaire to use in the CV which will address all relevant aspects of the sea lion/salmon controversy,
 - b) Survey users and non-users of this resource within the study area,
 - c) Aggregate results over the appropriate population to determine a "total" economic value.

- 2) Determine how this information best be used to assist policy-makers with their decisions to resolve the existing conflict between salmon, pinnipeds and fisherfolk

Study Area

The study area included two separate areas for "use" and "non-use" values. Both areas were sampled using Stratified Random sampling (SRS) and were separated to allow for the proper aggregation of the data after the survey was completed, a methodology similar to that suggested by Willis (1995). "Use" values were elicited from a study area defined to include the counties of Monterey, Santa Cruz, San Mateo, San Francisco, and Marin, and ranged from the Coast Guard Pier in Monterey north to Fort Cronkite, in Marin County. This study area was chosen because it approximates the "local" area in which the problem of sea lion interaction with commercial fisherman is relevant. "Non-Use" values were elicited from a sample covering the rest of the counties in Northern California. For the purposes of this study, the area of Northern California studied was north of the latitude 36°30', the latitude of the city of Monterey.

Sampling Strategy

To determine use values, five sample sites were chosen, one from each county, from areas where sea lion interactions with the public are common. The sites selected were the Coast Guard Pier at Breaker Cove Marina, Monterey County; the Santa Cruz Beach Boardwalk, Santa Cruz County; Pescadero Beach, San Mateo County; Pier 39 in San Francisco County; and Fort Cronkite Beach, Marin County.

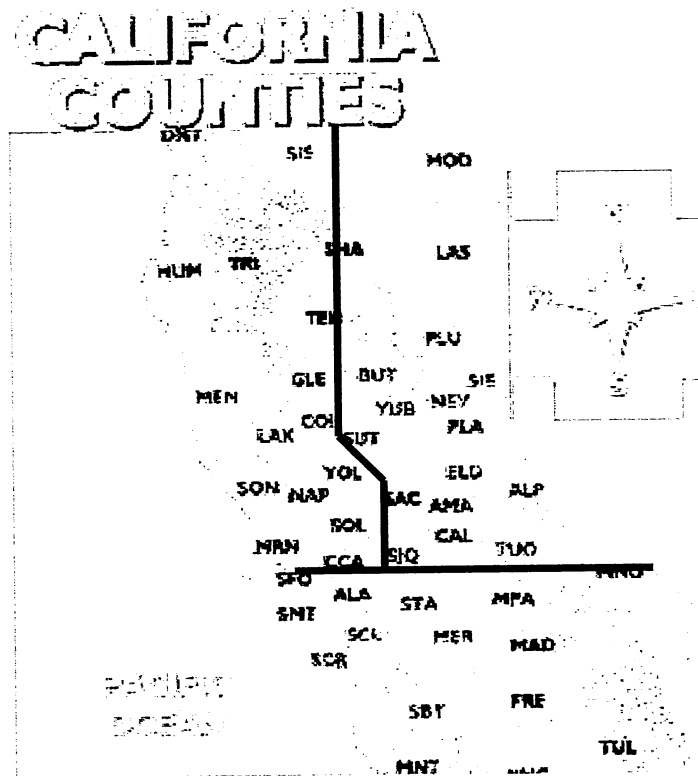


Fig. 5. Northern California Counties (with grid) (California Resources Agency 1997) (bottom boundary = latitude 36°30')

The sample for non-use values covers the entire population of Northern California as defined above, north of latitude 36°30'. The use of a stratified random sample by county size ensured that the survey measures the opinions of urban, suburban and rural Californians. Six (6) counties were sampled, two from each of three grids as follows: one grid includes all areas south of the Golden Gate Bridge, the area North of the Golden Gate bridge was then split in an East-West direction along I-5 (fig. 5).

Using a census list of all counties and populations (State of California 1999) the counties were stratified into 3 sizes: small (population <225,000), medium (population 225,000 - 750,000), and large (population >750,000). Size intervals (I) were determined

by dividing the total population of Northern California (12,174,585) by the number of counties to be surveyed (6). The county populations were added cumulatively from smallest to largest marking each interval of $I = 2,029,000$. Small counties were those included in the first interval, medium counties were those included in intervals 2 and 3, and intervals 4,5,6 made up the large counties. That way $1/6$ of the population was in the small counties, $1/3$ ($2/6$) in the medium and $1/2$ ($3/6$) in the large (See Appendix A for details on population stratification).

The next step was to eliminate the counties that could not be sampled. Counties were eliminated for one of two reasons:

- The county is not covered by PacBell's Street Address listing - these are necessary as they are the only cost-effective way of getting both phone numbers and addresses by split out by county
- The county is split by the grid lines: two counties, Shasta, and Tehama, were eliminated by this requirement

Using a random number table (Watts and Halliwell 1996, 472), six counties were chosen for sampling; three large counties, 2 medium counties and 1 small county. One large county was chosen from each grid, next, two medium counties were chosen randomly resulting in counties from grids 1 and 3. Next, the random number table was used again to choose a small county from grid 2, resulting in two counties from each grid. The selections are noted in **bold** the table in Appendix A. This sampling strategy ensured that respondents from a variety of geographical regions and a variety of community sizes were surveyed.

Procedures

First, a pre-test or pilot survey was conducted for both use and non-use values in the manner described below, 131 respondents were surveyed. Seventy (70) pre-test use values were elicited at Pier 39 in San Francisco. Sixty-one (61) non-use values were elicited from three randomly chosen counties in Northern California according to the sampling methods listed above, the counties selected were Mendocino, Merced and Placer counties. Results of the pilot survey were reviewed for evidence of confusing questions, misleading information and bias. This review determined the necessary changes resulting in the final survey vehicle.

Use sampling was conducted on randomly selected days, during the "tourist" season (May – August). Thirty (30) to fifty (50) surveys were collected from each of three of the sample sites; Pier 39 in San Francisco (50), the Coast Guard Pier in Monterey (35), and the Santa Cruz Beach Boardwalk (42). It proved difficult to sample at the other two sites as the tourist "traffic" was sparse. A total of thirteen (13) surveys were collected from Pescadero Beach and Fort Cronkite Beach in 6 days of sampling. Sampling was done in person, using a double-bounded dichotomous choice referendum WTP survey. Double-bounded referendum refers to the practice of using two dichotomous choice questions to better define your results, while dichotomous choice refers to a type of survey your answers determine which questions you will answer next (e.g. Will you pay \$5? If Yes go to question 4). This survey type is considered the most reliable (Loomis 1987; Johnson 1998; White et al. 1997; Arrow et al. 1993; McConnell 1990; Mitchell and

Carson 1989), and substantially increases the precision of WTP estimates for any given sample size (Loomis and Ekstrand 1997) because it narrows the range of WTP for each survey respondent. Also, the referendum format is required by the NOAA panel (Arrow et al. 1993).

Non-use values were elicited using a combination mail/phone-survey in the same double-bounded dichotomous choice referendum format. Respondents were selected from Street-Address books leased from Pacific Bell that corresponded to each randomly selected county. These books contain the names, addresses and phone numbers of every phone registered to Pacific Bell customers. The information is sorted by both phone number and address. Although the use of the street address books presents a bias in the survey population (only respondents with listed telephone numbers can be sampled), using these books is the only cost-effective way of getting the required information on survey respondents (Willis 1995; Loomis 1987). The respondents were selected by using 6 digit random numbers (Watts and Halliwell 1996). The first three digits determined the page number, the fourth digit determined which column to select the name from, and the final two digits were used to select the row number of the respondent. This is a similar method to that used by White et al. (1997) to find the economic value of mammal species in Great Britain, and by Whittington et al. (1995), and documented by Loomis (1987). The respondent information was entered in a database from which informational mailings were sent out. The mailings included a cover letter, a copy of the informational part of the survey and a forewarning that a researcher would be calling within a week or so (see Appendix B). Surveys were conducted until twenty (20) responses were collected from

each county. Time constraints prevented the collection of thirty surveys, as had been proposed. The survey response ratio (number of mailed surveys/number of successful responses) from the non-use portion of the pilot survey was used to determine an approximate number of surveys to mail.

Survey Structure

The definition of the hypothetical market, or description of the "good" in question is one of the most difficult parts of creating a CV survey. Carson (2000, 1414) explains that "the respondent should be provided with enough information to make an informed decision but not be overwhelmed with it." The information section of this survey was pre-tested thoroughly. First it was peer reviewed by a Environmental Economics class at San Jose State University, edits were made and then a Pilot Survey was conducted for both use and non-use values in the manner described above. Changes in the survey included mundane edits (survey length, changes in font size, clarification/simplification of certain points), and edits to make the survey more conservative. The assertion that the government was proposing to "kill" seals and sea lions was moved from a stand-alone second paragraph (in the pilot) to a single sentence in the second to last paragraph; the wording "kill sea lions" changed to "control by lethal means". Pretesting the photos indicated that one of the pictures of a harbor seal (Fig. 6) might give too

Fig. 6. Harbor Seal



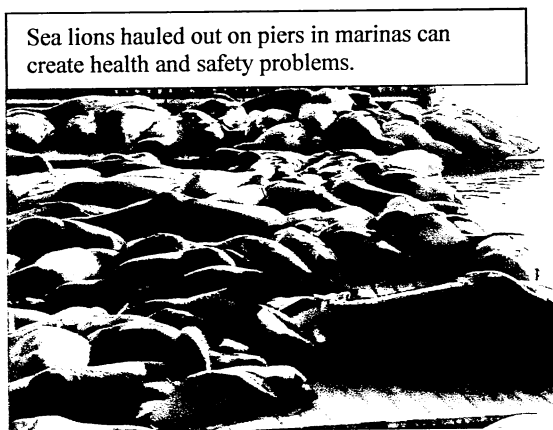


Fig. 7

much of a "warm-glow" effect, it was replaced by a picture and caption describing health and safety issues caused by sea lions (Fig. 7). The final survey was reviewed by the Graduate Studies Department and the College of Social Sciences Board at San Jose State University (SJSU), as well as by

Dr. Douglas Greer, Professor of Economics at SJSU.

The context of valuation was defined as a change to a controversial policy suggested by the NMFS allowing the lethal takes of sea lions by wildlife managers and/or commercial fishermen. Specifically, the survey created a hypothetical "fund" to be paid along with the respondent's taxes, that would compensate fishermen for the economic damages done by seals and sea lions. The valuation questions and payment vehicle were both devised in accordance with the "Best Practice Standards" for CV today. The elicitation format is a double-bounded referendum asking for WTP, with a "No-Answer" option and Yes/No follow-ups, all requirements of the NOAA Panel and considered best practice by many CV practitioners. The main valuation question for this study was worded as follows:

Suppose a fund was created which asked for a yearly donation of \$X to be paid along with your taxes. Rather than allowing the lethal removal of seals and sea lions that damage fishing gear and catch, the fund would compensate commercial and recreational fishermen for damage to their gear and loss of their catch due to damage done by seals and sea lions. Would you be willing to pay that amount each year?

- | | |
|-----|----------------------|
| YES | (GO TO Question 2) |
| NO | (SKIP TO Question 3) |

NO ANSWER/Don't Know

(if you answer "NO ANSWER/Don't Know" please state your reason below)

Why? _____

With \$X being one of three values (\$1, \$2.50, \$5.00). If the respondent answered "Yes" to the main valuation question, a second valuation question was asked doubling the original dollar value (\$2, \$5, \$10).

Respondents were also reminded of "undamaged substitute commodities" before they took the survey;

Funds that would be spent in the manner suggested by this survey could be used for other coastal improvements (beach access, marina improvements, coastal site purchases, habitat improvement etc.)

Additionally, a substitute question was added to the final survey, a result of pilot pretests.

If the situation changed, and the amount that you pledged was going to be used to protect Gray Whale breeding habitat, would you:

- a) Pledge the SAME amount of money
- b) Pledge LESS Money
- c) Pledge MORE money
- d) Pledge NOTHING at all

Finally, cross-tabulations on key demographics and respondents attitudes towards the environment and the subject under scrutiny are also required to help interpret the responses to the primary valuation question (Carson 2000; White et al. 1997; Arrow et al 1993). Respondents were asked demographic questions on age, sex, income, and employment status. Additional information was gathered using a likert-type scale regarding key attitudes towards the subject and the environment and assuring

understanding and agreement with the premises presented by the hypothetical market and context of valuation (See Appendix B for full text of all surveys used).

The data was analyzed using the steps for Contingent Valuation method as listed in Cost-Benefit Analysis and the Environment (Hanley and Spash 1995). Using the raw data, the average and median WTP were calculated first. Next, zero bids were analyzed, removing the protest bids. It is important to distinguish between legitimate zero bids and protest bids (the latter being a bid where the respondent rejects the scenario or the payment vehicle rather than valuing the "good" at \$0). Then, the data was broken down into Use and Non-use values. Bid curves were estimated as a percentage of respondents' WTP, and provided the actual WTP for the population sampled. Behavioral, attitudinal and demographic characteristics were analyzed, and the WTP values were aggregated over what was determined as the relevant population. Finally, an evaluation of the CV exercise was conducted to determine the validity of the study, and ensure that the results seem reasonable.

Limitations

Although this study endeavored to meet with the "Best Practice Standards" for contingent valuation, it is still subject to certain limitations specific to the topic under scrutiny. For instance, it is possible that the value determined in this study was influenced by what is known as the "warm-glow effect". A type of theoretical validity, similar to embedding, the "warm-glow effect" refers to the process of the respondent "getting moral satisfaction from the act of paying for the good independent of the

characteristics of the actual environmental good" (Carson 2000, 1415). This phenomenon is also known as altruism and much research has been done on the subject (Carson 2000; Carson 1998; Vадnjal and O'Connor 1994). Critics of the CV method suggest that respondents preferences for environmental goods are "illegitimate from an economic perspective" (Carson 1998), and reflect a vision of how things ought to be rather than an actual WTP. Some of the respondent comments that indicate the possibility of the "warm-glow" effect are listed below:

- I think that I like having the seals and sea lions around and hate to think of them being killed just because they get in the way.
- Fishermen are invading the sea lions home, they should have to deal with the inhabitants.
- I enjoy seeing and hearing them. They are one of my favorite animals.

Another limitation is sample non-response bias, defined by Mitchell and Carson (1989) as demographically identifiable groups of respondents that might be underrepresented (or overrepresented) as compared to their representation in the population. For instance older respondents, and unemployed respondents might be more likely to answer a phone survey that was conducted during the day.

Another important limitation in this study results from a combination of the choice of actual survey dollar values and the resulting difficulties in interpreting them. Due to the nature of the survey, where a dollar value was presented, and then a positive response resulted in a second valuation question where the dollar value was doubled, the interpretation of the frequency of responses was difficult. For instance, if a respondents

WTP was \$5, it was difficult to interpret if the respondent had said Yes to the \$5 WTP question and No to the \$10 WTP question, or if the respondent had said Yes to the \$2.50 WTP question and Yes again to the \$5 WTP question. This made the interpretation of the WTP results in statistical comparisons to the key demographic and attitudinal variables difficult.

CHAPTER 5

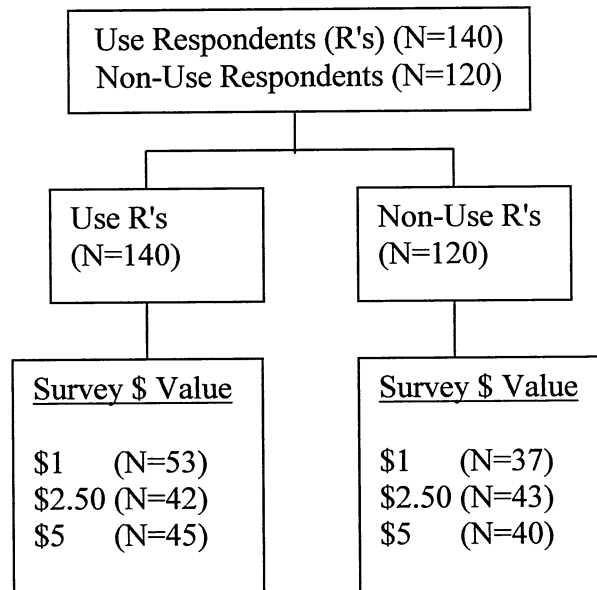
RESULTS

Results

A total of 120 non-use and 140 use responses were collected during the survey period. This gives a total sample size of 260, a size used by other similar studies (White et al 1997; Loomis and Ekstrand 1997; Wang 1997). Fig. 8 provides further breakdown of the sample. For the non-use portion of the survey, calls where the respondent did not answer, the phone was disconnected or phone number changed made up approximately 50% of the total calls placed. Of the 50% of the calls that were actually answered, 50%

Figure 8

Research Design of the Contingent Valuation Study



of those respondents participated in the survey. Only the households where contact is actually made are included in the sample response rate (Loomis and King 1994).

Although only 25% of the mailings sent out resulted in an actual survey taken by the respondent, the sample response rate for the non-use portion of the survey is 50%. The sample response rate for the use portion of the survey was impossible to determine due to the manner in which the surveys were solicited. The item response rate was 100% for all of the valuation questions (N=260). Only a few of the likert-type items, and some of the demographic questions had a response rate of less than 100%.

Using the raw data, the average WTP was \$2.89 with a median WTP of \$2.00. Zero bids must be analyzed and protest bids removed before any further results are presented. Thirty-six (36) protest bids were found where WTP = 0 and question #3, "Please explain briefly why you Would NOT be willing to pay", had an answer that fit one of the guidelines established for protest bids by Loomis and Ekstrand (1997) in their CV study on the Mexican Spotted Owl. Thirty-seven legitimate zero bids remained in the sample, making a revised sample size of 224. Selected answers to question #3 where the zero bid was determined to be a protest bid are listed below:

- Because the fishermen and their market need to find a different way of life, income and alimentation. I don't believe in compensating people to do what is their obligation.
- [I] Don't believe in funding, subsidizing businesses.
- I feel I should not have to pay for the seals damage; it's the fisherman's problem.
- I think it is part of the cost of it, if the seals or sea lions damage something, too bad - fix it don't kill them for it.
- [I] Just don't believe that is the way the situation should be handled.

- No Bigger Government, No - Relocation is the way, too much government waste.
- Nothing should be Mandatory - Keep boats away from them - It's the Government's responsibility.

A bid curve was plotted using the cumulative percentage of the amounts respondents were willing to pay (Figure 9). The adjusted mean WTP of \$3.35 and median WTP of \$2.50 were overlaid on the bid curve (Fig. 9).

Respondents of the "Use" surveys had a higher WTP than those of the "Non-use" surveys. The mean WTP values varied from \$2.75 for the non-use value mean WTP to \$3.98 for the use value mean, a difference of 45% (Table 2). In further analysis, Table 3 which details "Survey type" crosstabulated with "Total WTP" reveals that 35.6% of the "Non-use" survey type respondents had a WTP of \$1.00 or less, while only 8.3% of the "Use" survey type respondents had a similar WTP.

Table 2. Median and Mean WTP Values

	Use Values	Non-Use Values	Total (Combined) Values
Median	\$2.50	\$2.00	\$2.50
Mean	\$3.98	\$2.75	\$3.35

Conversely, 49.5% of the "Use" respondents had a WTP of \$5 or greater, while 21.7% of the "Non-Use" respondents had such a WTP. Moreover, bid curves representing the cumulative percentages of the use and non-use WTP show marked differences. The non-use value bid curve (Figure 10) and has a primarily concave shape, while the use value bid curve (Figure 11) shows a spike at the \$2.00 WTP value that drops sharply to the

Figure 9. Percentage of Respondents Willing to Pay to Compensate Fishermen for Damage Done by Sea Lions (Use and Non-Use Combined)

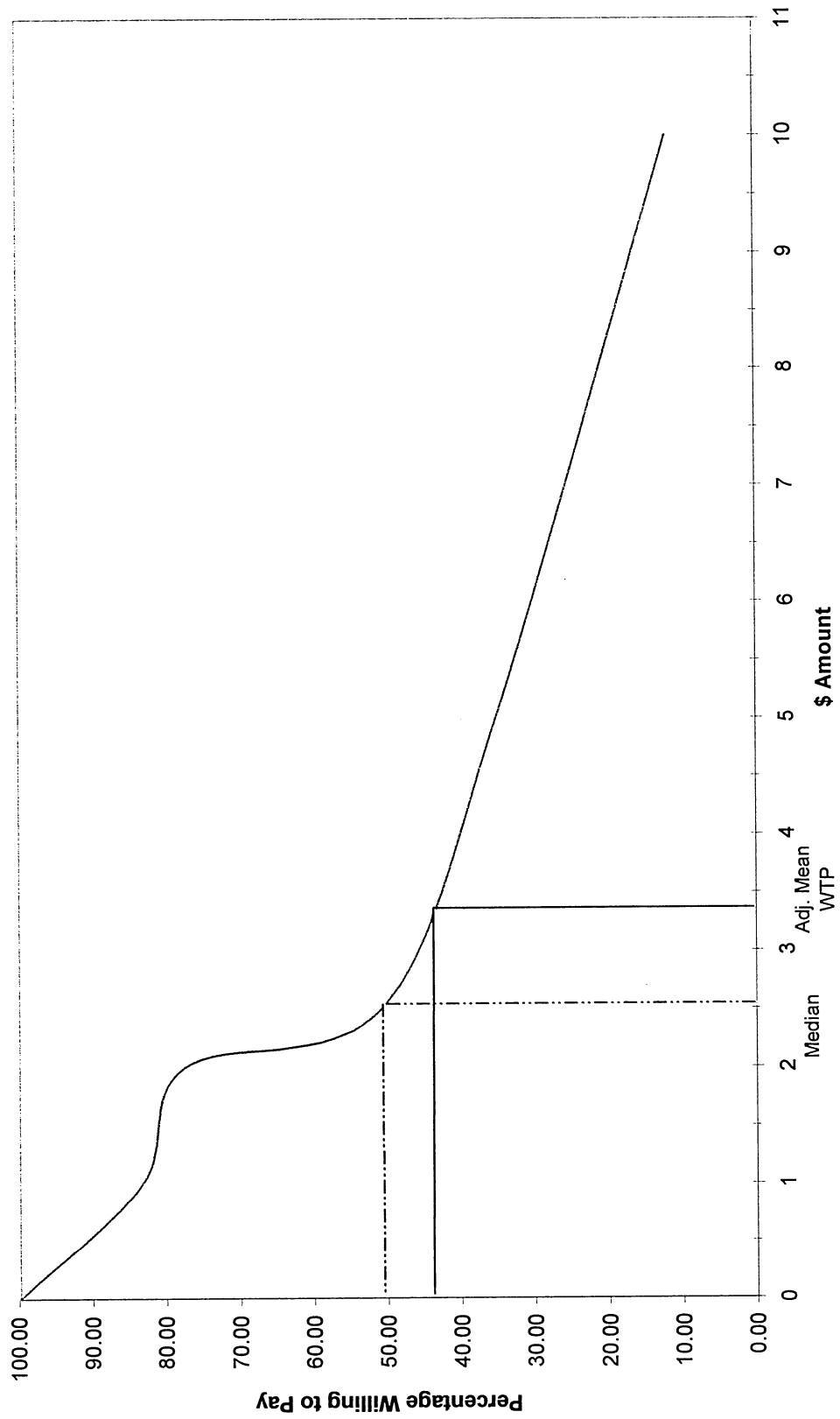


Table 3. Survey Type x Total WTP

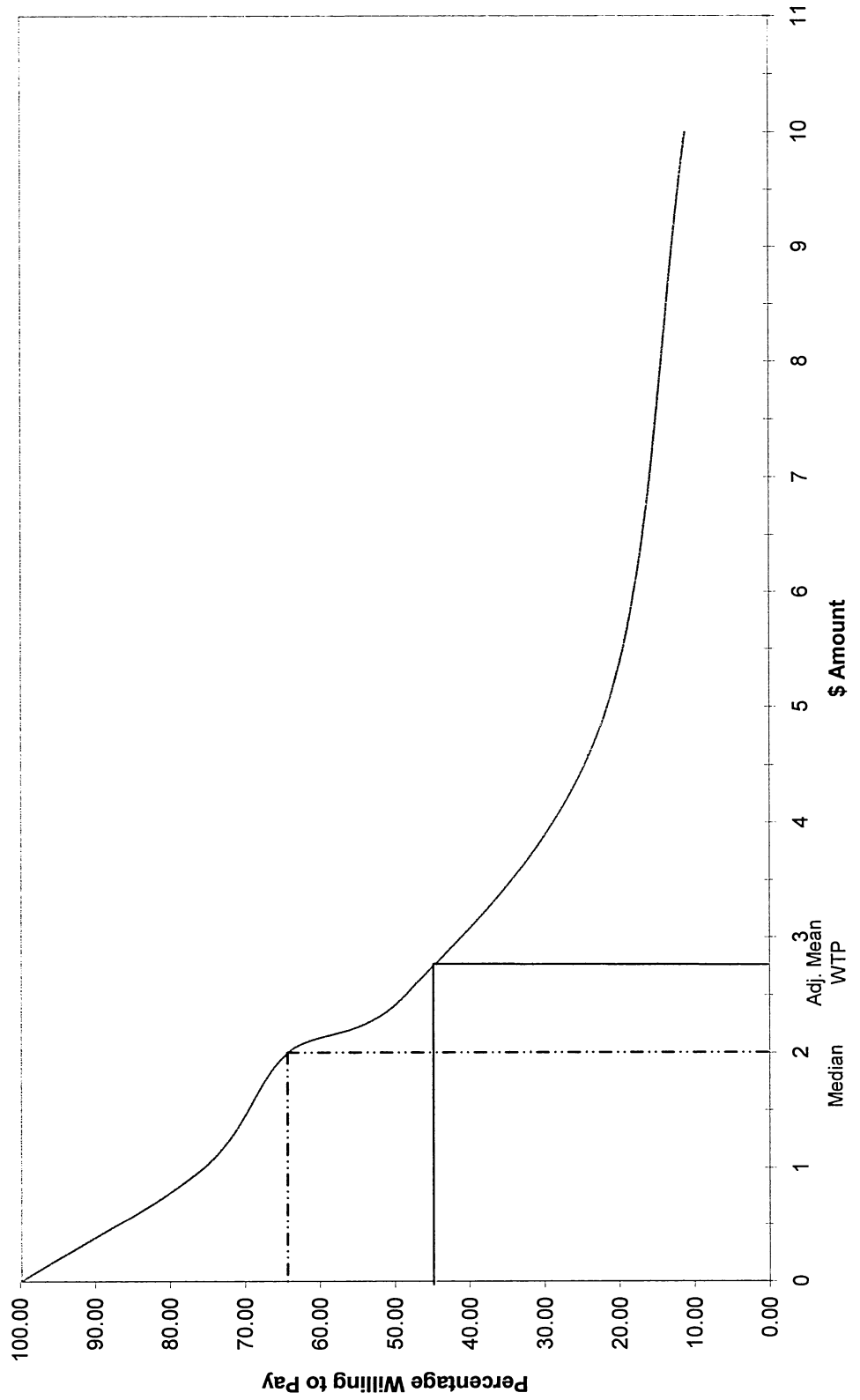
			Survey Type		Total
			Use	Non-Use	
Total WTP	.00	Count	9	28	37
		% within SURVTYPE	8.3%	24.3%	16.5%
	\$1.00	Count		13	13
		% within SURVTYPE		11.3%	5.8%
	\$2.00	Count	42	18	60
		% within SURVTYPE	38.5%	15.7%	26.8%
	\$2.50	Count	4	31	35
		% within SURVTYPE	3.7%	27.0%	15.6%
	\$5.00	Count	40	12	52
		% within SURVTYPE	36.7%	10.4%	23.2%
	\$10	Count	14	13	27
		% within SURVTYPE	12.8%	11.3%	12.1%
Total		Count	109	115	224
		% within SURVTYPE	100.0%	100.0%	100.0%

Chi-Square Tests

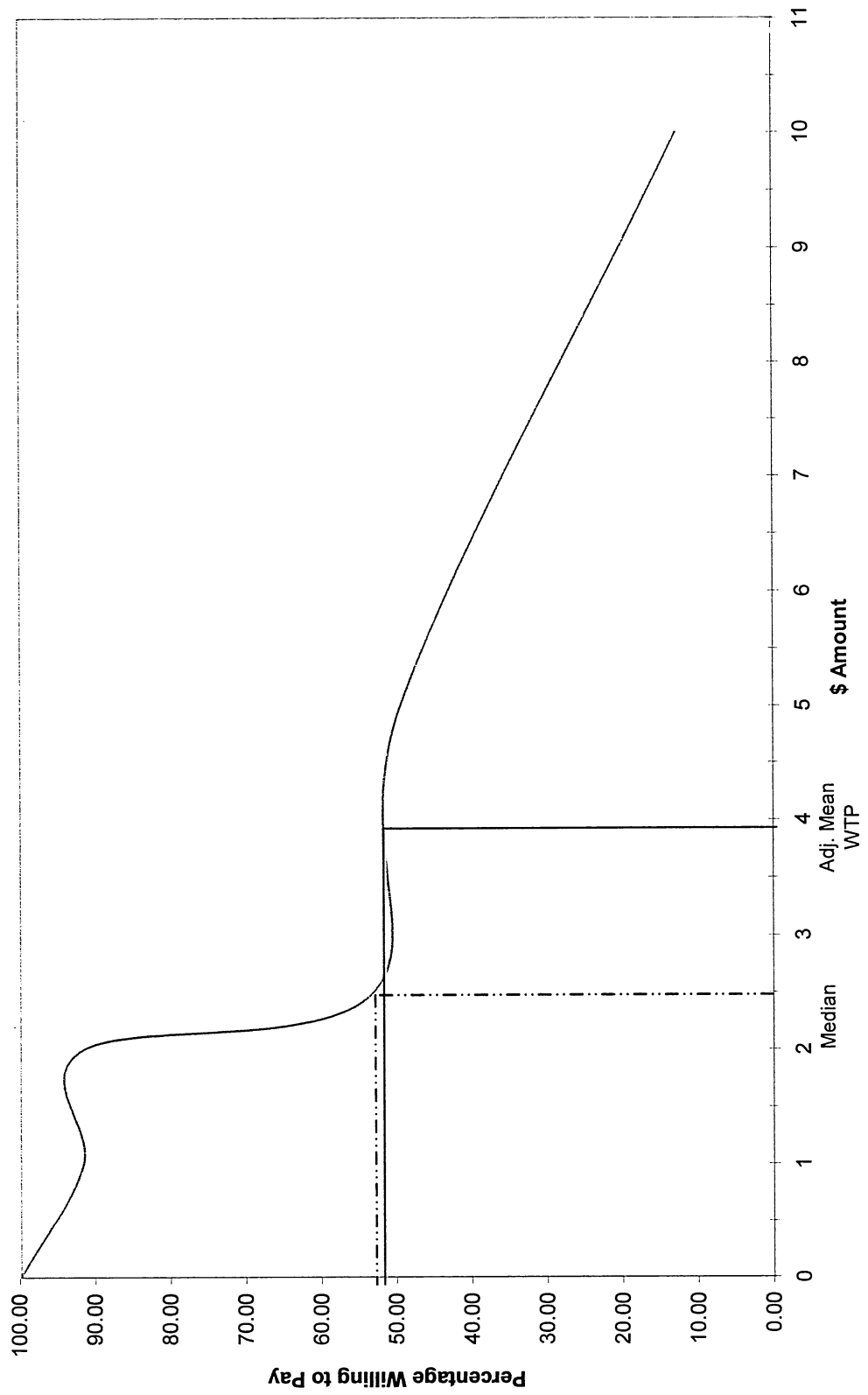
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.187 ^a	5	.000
Likelihood Ratio	77.560	5	.000
Linear-by-Linear Association	9.638	1	.002
N of Valid Cases	224		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.33.

**Figure 10. Willingness to Pay to Compensate Fishermen for Damage Done by Sea Lions
Non-Use Values**



**Figure 11. Willingness to Pay to Compensate Fishermen for Damage Done by Sea Lions
Use Values**



median of \$2.50, and then curves convex, indicating a larger number of higher bids than would be expected in a normal distribution.

There was a clear difference in gender of the survey respondents with females making up 73.4% and males 26.6% of the respondents. There was also a significant difference in incomes of the survey respondents to the general population of California (chi-square = 12.886, df = 3, p = .005), with 49.2% of the respondents belonging to the highest income level versus an expected value of 33.1% (see Table 4). However, there was no significant difference between the age profiles of the respondents and those of the general population of Northern California (chi-square = 3.398, df = 3, p = .334).

Table 4. Comparison of incomes of respondents with that of the California population

Income (\$)	Survey Respondents	California Population
<20,000	15.9	26.3
20,000 - 34,999	20.4	22.4
35,000 - 50,000	14.3	18.1
>50,000	49.2	33.1

The behavioral and attitudinal characteristics of the respondents are shown in Table 5. The majority of respondents (65.8%) disagreed or strongly disagreed that lethal control should be used to stop the sea lions from doing economic damage. A majority also belonged to, or supported, environmental organizations (53.9%), and had heard about this

issue previously (58.3%). The question of whether fishermen should be compensated for damage done by sea lions to their gear or catch was closer, with 45.7% agreeing or agreeing strongly, and 35.2% disagreeing or disagreeing strongly. The highest uncertainty of the attitudinal questions related to this question with 19.2% of the respondents answering "Don't Know." Many of the "Don't Know" respondents expressed discontent with the scenario presented in the survey, but all still had positive WTP amounts. Some examples of their comments are listed below:

- \$5 is reasonable, but if we create "welfare" for the fishermen, we'd have to do that for all occupations that become obsolete.
- To help the seals/sea lion problem temporarily until they find a better way to solve the problem.
- I would pay that amount but you would want some sort of proof of claim to this fund.
- The first amount is enough - I'd like more information on this subject.

Question	Agree (%)	Disagree (%)
Lethal control should be used if necessary	22.1	65.8
Fishermen should be compensated for damage	45.7	35.2
I have heard about this issue before	58.3	26.3
I belong to an environmental organization	53.9	40.1

The NOAA panel also recommended crosstabulations on key demographic variables (Arrow et al. 1993). Gender, age and income significantly affected Total WTP. Females had a significantly higher WTP than males (chi-square = 17.659, df = 5, p = .003), with 42.3% of the females WTP being \$5 or higher, while only 13.6% of the males WTP was in that range (Table 6). Conversely, 33.9% of the males expressed a WTP of \$1.00 or less versus 18.4% of the females. Age also significantly affected WTP (chi-square = 102.104, df = 15, p = .000), with the highest WTP in the 41-55 age bracket. Slightly over half the respondents (50.9%) had a WTP of \$2.50 or more, however 82.8% of the respondents aged 41-55 had a WTP of \$2.50 or more (Table 7). This was not surprising as younger age brackets generally do not make as much money, and respondents older than 55 are likely to be on fixed incomes. WTP was also significantly related to income (chi-square = 73.754, df = 15, p = .000), although the relationship was difficult to interpret (Table 8). The lowest income bracket corresponded directly with the lowest WTP, 70% had a WTP of \$2.00 or less, while only 30% had a WTP of \$5.00 or more. As income rose so did WTP, with 51.3% of those in the \$20,000 - \$34,999 bracket having a WTP of \$5.00 or more, and 63% of those in the \$35,000 - \$50,000 having a WTP of \$5.00 or more. However, the >\$50,000 income bracket had the lowest representation in the \$5.00 or more WTP categories with only 25.8%.

Table 6. Gender x Total WTP

			GENDER		Total
			Male	Female	
Total	.00	Count	14	23	37
		% within GENDER	23.7%	14.1%	16.7%
WTP	\$1.00	Count	6	7	13
		% within GENDER	10.2%	4.3%	5.9%
	\$2.00	Count	21	39	60
		% within GENDER	35.6%	23.9%	27.0%
	\$2.50	Count	10	25	35
		% within GENDER	16.9%	15.3%	15.8%
	\$5.00	Count	6	46	52
		% within GENDER	10.2%	28.2%	23.4%
	\$10	Count	2	23	25
		% within GENDER	3.4%	14.1%	11.3%
Total		Count	59	163	222
		% within GENDER	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.659 ^a	5	.003
Likelihood Ratio	19.346	5	.002
Linear-by-Linear Association	13.822	1	.000
N of Valid Cases	222		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.45.

Table 7. Age x Total WTP

			AGE				Total
			18 - 25	26 - 40	41 - 55	55+	
Total WTP	.00	Count	7	18	3	9	37
		% within AGE	15.9%	24.3%	5.2%	18.8%	16.5%
	\$1.00	Count				13	13
		% within AGE				27.1%	5.8%
	\$2.00	Count	21	19	7	13	60
		% within AGE	47.7%	25.7%	12.1%	27.1%	26.8%
	\$2.50	Count	2	6	21	6	35
		% within AGE	4.5%	8.1%	36.2%	12.5%	15.6%
	\$5.00	Count	12	20	15	5	52
		% within AGE	27.3%	27.0%	25.9%	10.4%	23.2%
	\$10	Count	2	11	12	2	27
		% within AGE	4.5%	14.9%	20.7%	4.2%	12.1%
Total		Count	44	74	58	48	224
		% within AGE	100.0%	100.0%	100.0%	100%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	102.104 ^a	15	.000
Likelihood Ratio	94.964	15	.000
Linear-by-Linear Association	.388	1	.533
N of Valid Cases	224		

a. 4 cells (16.7%) have expected count less than 5. The minimum expected count is 2.55.

Table 8. Income x Total WTP

		INCOME				Total
		<20,000	20,000 - 34,999	35,000 - 50,000	>50,000	
Total	Count	7	12	5	13	37
WTP	% within INCOME	23.3%	30.8%	18.5%	14.0%	19.6%
\$1.00	Count				6	6
	% within INCOME				6.5%	3.2%
\$2.00	Count	14	7	5	21	47
	% within INCOME	46.7%	17.9%	18.5%	22.6%	24.9%
\$2.50	Count				29	29
	% within INCOME				31.2%	15.3%
\$5.00	Count	7	16	17	12	52
	% within INCOME	23.3%	41.0%	63.0%	12.9%	27.5%
\$10	Count	2	4		12	18
	% within INCOME	6.7%	10.3%		12.9%	9.5%
Total	Count	30	39	27	93	189
	% within INCOME	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	73.754 ^a	15	.000
Likelihood Ratio	86.605	15	.000
Linear-by-Linear Association	.199	1	.655
N of Valid Cases	189		

a. 9 cells (37.5%) have expected count less than 5. The minimum expected count is .86.

Aggregation

To develop a total WTP value we ascertained the relevant population value to use in the aggregation of the WTP. In this study, this presented a particular difficulty. The relevant population for the non-use respondents was the population of Northern California at the time of the survey, or 12,174,585 (Appendix A). However, the difficulty was in determining the population to aggregate for the use portion of the survey. Since the use values were elicited at tourist areas where interactions with pinnipeds are common, normally, a yearly total of the tourists that visited the areas surveyed would be used for the aggregation. However, some research indicates the percentage of California tourists that are "local" tourists between 31.6% (Spickard, Hetrick and Bratton 2001) and 84.5% (DK Shifflet and Associates 2001); the data are therefore subject to double-counting. In other words, it is likely that many of the tourists to these coastal sites were already accounted for, as the "Non-use" values elicited represent all Northern California residents. DK Shifflet and Associates (2001) provide by far, the more conservative of the two estimates and actually provide numerical data for the state. They estimate that in 1999, there were 30 million out-of-state visitors to the state of California, and in 2000, there were 7.4 million non-resident visitors to the "Beach/Waterfront". This figure conservatively and realistically represents the population that this study intended to survey.

To determine the final WTP value or range of values for this study, WTP was aggregated over the appropriate population. A range of aggregate WTP values was determined and is presented in Table 9. First, the mean and median non-use WTP values

(Table 2) were multiplied by the non-use population (the population of Northern California at the time of the study) to get a range of Total WTP for the non-users (Table 9). Similarly, the mean and median use WTP value (Table 2) were multiplied by the use population (7.4 million non-resident visitors to the Beach/Waterfront) to get a range of Total WTP for the users (Table 9). The aggregated use and non-use values were summed to arrive at a final Total WTP for the study (Table 9). Additionally, the total (combined) median and mean values from Table 2 were multiplied by the combined population included in the survey (7,400,000 non-resident tourists + 12,174,585 Northern California residents) (Table 10). These calculations provide a range of total WTP values, from almost \$43 million to over \$65 million.

Table 9. Use and Non-Use Median and Mean WTP Aggregation

	Use Values	Non-Use Values	Total WTP (Use + Non-Use)
Median	\$2.50	\$2.00	
Population	7,400,000	12,174,585	
Median x Population	\$18,500,000	\$24,349,170	\$42,849,170
Mean	\$3.98	\$2.75	
Population	7,400,000	12,174,585	
Mean x Population	\$29,452,000	\$33,480,109	\$62,932,109

Table 10. Total (Combined) Mean and Median WTP Aggregation

Median	\$2.50
Population	19,574,585
Median x Population	\$48,936,463
Mean	\$3.35
Population	19,574,585
Mean x Population	\$65,574,860

The median WTP values were chosen for the final determination instead of the means since the median is the lowest, and therefore most conservative value, as well as the most appropriate in a policy context. Since the median value of \$42,849,170, calculated by adding the use and non-use WTP (Table 9), allows for the appropriate weighting for each WTP value it was chosen as the best value to use. As a final conservative measure, non-respondents were assumed to have a WTP of \$0 (Bishop and Boyle 1985; Loomis and Ekstrand 1997). That assumption, calculated with this study's response rate of 50% cut the Total WTP in half, giving a final Total WTP of \$21,424,585. This very conservative value of \$21,424,585 is the most appropriate to be used in a policy context.

Chi-square tests for all of the demographic variables as well as for the attitudinal questions revealed very little noise, as all results were significant. Each of the variables affected the WTP of the survey respondent.

CHAPTER 6

DISCUSSION AND SUGGESTIONS FOR FURTHER RESEARCH

Discussion

Although contingent valuation is generally accepted as the only method to measure non-use values there is still much debate regarding the results. The complexity of the contingent valuation methodology produces a range of results, frequently over at least one order of magnitude (Colgan 1995). Furthermore, precision is not "a strong point" for CV studies resulting in debate over whether the results can be useful in the policy arena (Colgan 1995; Bishop et al. 1995). However, passing the tests of reliability and validity including the trio of validity measurements (content, criterion, and construct validity) can dramatically narrow the range of uncertainty.

In the context of contingent valuation, reliability is a purely statistical description. It refers to "the extent to which the variance of a response or estimate is a result of random sources, or noise" (Mitchell and Carson 1989). It is determined by statistical analysis, with researchers commonly using the chi-square test. Although the standard presentation of the chi-square statistic includes the chi-square value, DF (degrees of freedom) and p-value, only the p-value is of consequence in determining reliability. Results are deemed to be significant if $p \leq .05$. The significant results on the attitudinal questions Lethal Control ("If Federal Wildlife Managers determine that it is necessary to kill problem sea lions to stop them from causing economic damage, they should be allowed to do so") and EcoOrg ("I belong to or support environmental or environmentally related

organization(s)") revealed that respondents' answers to these questions affected their WTP as well. Overall, the significance of the variables indicates that the study passes the test of reliability.

Validity, or bias, is a more subjective measure that describes the "extent that an instrument measures the concept under investigation" (Mitchell and Carson 1989). Due to the nature of CV, bias is often unavoidable. In the process of the description of the hypothetical situation and during the interviews with respondents, researchers will inevitably encounter issues that must be resolved based on personal judgement. Current practices prescribe using the "conservative choice" in these instances to underestimate WTP, thus avoiding the prevalent issue of the overestimation of WTP. However, this introduction of "downward bias" may actually be a departure from normal scientific practice (Bishop et al. 1995). Nevertheless, extreme care should be used in the survey design so that it contains as little bias as possible (Ajzen, Brown and Rosenthal 1996). Finally, while a bias-free survey is likely to be unattainable, strict adherence to the tests of reliability and the three validity tests (content, criterion, and construct) may improve the results.

Although various researchers espouse different methods for evaluating content validity, these methods can be categorized as qualitative or quantitative. For our purposes, the qualitative evaluation refers to an evaluation of the actual survey or the content of the survey, including the descriptions of the good, vehicle for payment, and context of the hypothetical market. The ideal is to achieve the delicate balance between providing enough information to enable the respondent to form an accurate WTP amount

without overwhelming him with information. Quantitative evaluations of content validity will include measurements of sample and response rates and comparison of these values to similar studies, and the use of the proper econometrics to measure mean and aggregate WTP and other pertinent statistics. Ultimately, however, the determination of content validity is completely subjective and based upon a thorough evaluation of the survey content, elicitation procedures and final results.

For this survey, pre-tests, a pilot, and a thorough peer review were the primary tools used to ensure qualitative content validity. The survey was initially pre-tested by a class of 27 environmental economics students. They were asked to fill-out the survey and comment on all aspects including the use of photos, the amount of information, and the wording of the valuation questions. Edits were made to this version of the survey and it was reviewed by Dr. Douglas Greer, Professor of Economics at San Jose State University (SJSU), the Department of Graduate Studies at SJSU, and the College of Social Sciences Board at SJSU. Further edits were made before the survey pilot, which included both use and non-use respondents, as described in Chapter 4. The pilot survey resulted in a third set of edits that produced the final survey.

Quantitatively, sample and response rates were compared to studies for similar amenities, including: Loomis and Ekstrand's 1997 study of the "Economic Benefits of Critical Habitat for the Mexican Spotted Owl: A Scope Test Using a Multiple-Bounded Contingent Valuation Survey" (n = 218, n = 205, response rate = .56, .57), and White et al.'s 1997 study of the "Economic Values of Threatened Mammals in Britain: A Case Study of the Otter (*Lutra lutra*) and the Water Vole (*Arvicola terrestris*)" (n = 315,

response rate = .64). The econometrics used to determine the individual and aggregate WTP were constructed in accordance with the "Best Practice Standards" for CV today. All procedures in both survey design and elicitation were derived using recommendations from such well-known names in the CV field as Robert Cameron Mitchell, Richard T. Carson, John Loomis, Richard C. Bishop, and the NOAA Panel (Arrow et al. 1993).

Additionally, key variables were analyzed to ensure that respondents had sufficient levels of understanding of the good, the policy context, and the payment vehicle. Four questions regarding respondents' understanding of the scenarios were posed. In three of the four questions, 80% or more of the respondents indicated that they understood the scenario (Fig. 12, Fig. 13, Fig. 14). These questions referenced understanding of how the average value was to be determined, a check on family financial situations, and general understanding of the conflict. The fourth understanding question " I understand that this survey will be used to determine how consumers value the sea lions that might be harmed due to the economic damage that they cause" had 64.3% of respondents agreeing or agreeing strongly (Fig 15). One possible explanation is that the other three questions were more straightforward while this question may have been unclear. Notice the high value of "Missing" responses (28.1%). Conversely, this question could be representative of the actual level of understanding of the survey, while the other questions reflect simpler topics.

The scope of this project prevented it from the criterion validity test. Criterion validity compares the hypothetical WTP derived by the CV method to an actual cash payment or "simulated market values" (suggested by some researchers as having promise

Fig. 12 Understanding of Calculation of Total Economic Value

Question: I also understand that the total economic value will be determined by taking an average of all the amounts that the survey participants are willing to pay

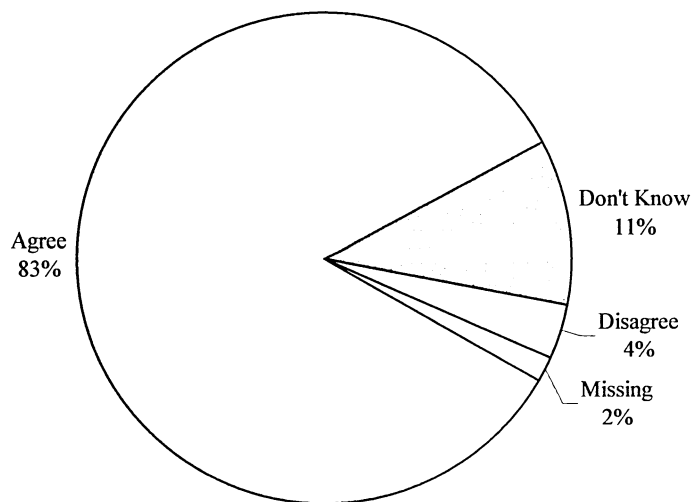


Fig. 13. Consideration of Family Budget Question

Question: I have considered my family budget and still feel that I am financially able to contribute the amount that I pledged to the fund in this survey

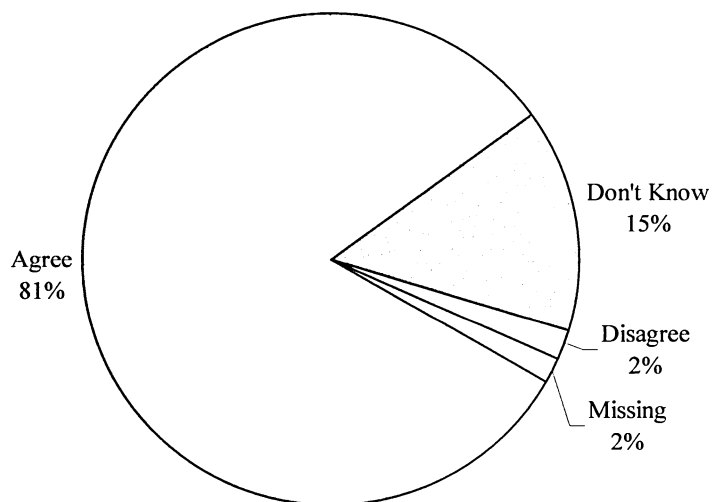


Fig. 14. Understanding of Conflict Question

Question: I have a good understanding of the conflicts between seals, sea lions and fishermen that are presented in this survey

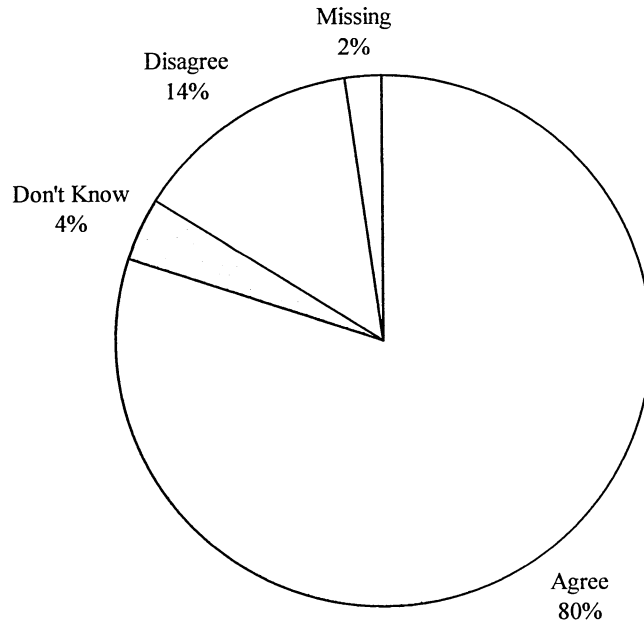
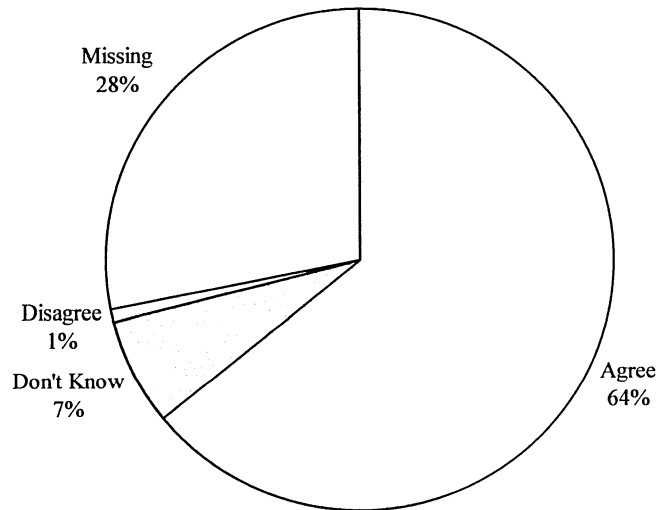


Fig. 15. Understanding of Survey Question

Question: I understand that this survey will be used to determine how consumers value the sea lions that might be harmed due to the economic damage that they cause



in judging the validity of the CV method (Bishop et al 1995)), and is often out of scope in a CV study. Loomis et al. (1996) point to this as a common failing of CV studies, while Bishop et al. (1995) elaborate on the difficulties inherent in creating a simulated market. Mitchell and Carson (1989) reference several experiments of the same scope as a CV study, by noted researchers, to discern criterion validity.

There are two forms of construct validity, convergent and theoretical. Convergent validity measures the correspondence between the hypothetical construct of the contingent valuation survey and similar theoretical constructs. To distinguish convergent validity from criterion validity, consider that criterion validity uses a similar WTP methodology, while convergent validity makes use of the alternative environmental economic valuation techniques described in Chapter 3, the travel-cost method, hedonic pricing or random utility modeling. Clearly, tests for convergent validity are beyond the scope of this paper as well.

Bishop et al. (1997, 71) conclude that CV studies that "display strong theoretical validity ought to be considered superior to those that display weaknesses in these respects or do not include theoretical validity tests in their study design at all." There are several types of theoretical validity tests. Tests of scope, in which the expectation is that respondents would have a higher WTP for higher levels of an amenity or conversely, a lower WTP for less of an amenity. In this case, if a WTP study on the entire population of sea lions was completed and the aggregate WTP was similar to that found by our study, it would fail the scope test. Information on donations to NGO's might also be another source of theoretical validity. Locally, yearly donations to organizations such as

the Marine Mammal Center in Sausalito, a hospital for wounded marine mammals, might coincide with valuations placed on the lethal takes of sea lions.

Another test for theoretical validity is the examination of key socioeconomic and attitudinal variables and a determination if WTP values correspond as the researcher would expect (Mitchell and Carson 1989; Bishop et al. 1995). Remember, whereas reliability tests using the chi-square are statistical in nature, these validity tests are subjective and require an interpretation of the results. Crosstabulations were performed on two key attitudinal variables, support for environmental organizations, and support for lethal control. Wording of the questions is presented below. Respondents were asked if they agreed or disagreed on a 5-level Likert scale.

- I belong to or support environmental or environmentally related organization(s).
- If Federal Wildlife Managers determine that it is necessary to kill problem sea lions to stop them from causing economic damage, they should be allowed to do so.

As expected, WTP was directly related to the Support for Environmental Organizations variable, i.e. those who supported environmental organizations had a higher WTP than those who did not. Of the respondents that did not belong to or support environmental organizations, 63.2% of them had a WTP of \$2.00 or less, compared to the 49.8% that would be expected (Table 11). Those respondents that did support environmental organizations had a WTP breakdown similar to what was expected as well. There was a lower percentage than expected in the lower WTP amounts (\$0, \$1.00, \$2.00 and \$2.50) and a higher than expected percentage in the \$5.00 and \$10.00 WTP brackets (Table 11).

Table 11. Support for Environmental Organizations x Total WTP

			I belong to an environmental organization			Total
			Agree	Don't Know/NA	Disagree	
Total WTP	.00	Count	12	3	22	37
		% within TOTWTP	32.4%	8.1%	59.5%	100.0%
		% within ECOORG	10.3%	23.1%	25.3%	17.1%
\$1.00		Count	6		7	13
		% within TOTWTP	46.2%		53.8%	100.0%
		% within ECOORG	5.1%		8.0%	6.0%
\$2.00		Count	28	4	26	58
		% within TOTWTP	48.3%	6.9%	44.8%	100.0%
		% within ECOORG	23.9%	30.8%	29.9%	26.7%
\$2.50		Count	15	2	18	35
		% within TOTWTP	42.9%	5.7%	51.4%	100.0%
		% within ECOORG	12.8%	15.4%	20.7%	16.1%
\$5.00		Count	40	4	8	52
		% within TOTWTP	76.9%	7.7%	15.4%	100.0%
		% within ECOORG	34.2%	30.8%	9.2%	24.0%
\$10		Count	16		6	22
		% within TOTWTP	72.7%		27.3%	100.0%
		% within ECOORG	13.7%		6.9%	10.1%
Total		Count	117	13	87	217
		% within TOTWTP	53.9%	6.0%	40.1%	100.0%
		% within ECOORG	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.047 ^a	10	.002
Likelihood Ratio	31.910	10	.000
Linear-by-Linear Association	15.852	1	.000
N of Valid Cases	217		

a. 6 cells (33.3%) have expected count less than 5. The minimum expected count is .78.

In fact, 72.7% of the respondents with a WTP of \$10, and 76.9% of the respondents with a WTP of \$5 supported environmental organizations. Conversely, we would expect the opposite for the Lethal Control question. Again, as expected, the respondents that supported lethal control had a substantially lower WTP than those who did not support lethal control. Seventy-one and three-tenths percent of those who supported lethal control had a WTP of \$2 or less (Table 12), while only 16.3% had a WTP of \$5 or more. These results indicate that the study is likely to be theoretically valid.

Uses for Economic Values in Environmental Policy

The conflicts between humans, salmonids and pinnipeds are complex and varied. This research focuses, from an economic perspective, on the operational conflicts created by increasing pinniped populations competing with commercial fishermen for declining salmonid resources. It uses Contingent Valuation to estimate the value of the pinnipeds that might be killed due to these operational conflicts.

In this localized, yet global, highly emotionally charged issue, the economic losses of commercial fishermen are used as justification for instituting lethal takes of offending pinnipeds. However, an economic evaluation of this management action must also include the value for the loss of the pinnipeds. Such a value would be a significant contribution to the debate and part of a complete a cost-benefit analysis, as is required in cases of natural resource damage assessments. Using contingent valuation, this study determined the recreational and inherent value users and non-users place on pinnipeds.

Table 12. Agree with Lethal Controls x Total WTP

			Lethal control should be used if necessary			Total
			Agree	Don't Know/NA	Disagree	
Total	.00	Count	18	1	18	37
		% within LETHAL	36.7%	3.7%	12.3%	16.7%
WTP	\$1.00	Count	6		7	13
		% within LETHAL	12.2%		4.8%	5.9%
	\$2.00	Count	11	8	41	60
		% within LETHAL	22.4%	29.6%	28.1%	27.0%
	\$2.50	Count	6	7	22	35
		% within LETHAL	12.2%	25.9%	15.1%	15.8%
	\$5.00	Count	8	8	36	52
		% within LETHAL	16.3%	29.6%	24.7%	23.4%
	\$10	Count		3	22	25
		% within LETHAL		11.1%	15.1%	11.3%
Total		Count	49	27	146	222
		% within LETHAL	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.185 ^a	10	.000
Likelihood Ratio	37.528	10	.000
Linear-by-Linear Association	15.591	1	.000
N of Valid Cases	222		

a. 5 cells (27.8%) have expected count less than 5. The minimum expected count is 1.58.

Conservatively, that value is \$21 million, but less conservative methods would put it as high as \$65 million. While wide, this range of values is important to the controversy because it is an important piece of the economic picture that has been overlooked thus far.

Another element to consider, is the role of public participation or public opinion in policy decisionmaking. There is no doubt that in a democratic society, public participation is sought after, and rules are embedded in the policy process to ensure that it is considered. Environmental policy is no different. Mangel et al. (1996) list "taking account of the motives, interests, and values of all users and stakeholders" in their "Principles for the Conservation of Wild Living Resources". Contingent valuation promotes the public participation process. By involving the "average" citizen, and asking his or her opinion on a particular policy that may be unfamiliar, you get an almost unbiased view of whether or not it should be promulgated. Whereas, public participation, in the form of a comment period, will likely be biased by those participants who have a stake in the process. The participants in forums where this issue would be discussed would likely be polarized, either strong fisheries advocates or strong wildlife advocates. This study purely represents the opinions of the public, both those who use the resource and those who don't.

The final hurdle is whether the information is justified by the method, or is the value reasonably sound. "CV has been in use for over 35 years, and there are now over 2000 papers and studies dealing with the topic" (Carson 1995). Carson (2000) further states that the process has matured, and the "theoretical foundations and limits to its uses are

now better understood.” Although CV still has detractors, generally, it is a broadly accepted method for determining the value of non-market resources, provided the study is well-thought out and meets the "Best Practice Standards" for contingent valuation.

Further Research

Further research on the topic of both operational conflicts between pinnipeds and fisheries, and biological conflicts between pinnipeds and salmonids is necessary. The NMFS (1999) states that further research on pinniped deterrents, the effects of pinnipeds on coastal ecosystems, coastal ecosystem functions, population dynamics/predator prey interactions and pinniped food habits is necessary. Modelling techniques, such as those suggested by the Benguela Ecology Programme Workshop on Seal-Fishery Biology Interactions (Punt and Butterworth 1995), could provide valuable insight into the pinniped/salmonid predator/prey relationship. If they were conducted using variables such as reduced salmon takes and improved habitat indices they might present a more plausible solution to the current decline in salmonid resources.

Further economic studies on the value of pinnipeds could be conducted to add to what this manuscript has produced, for instance, tests on theoretical validity or a comparison of various economic values related to the controversy,

- donations to "pinniped friendly" NGO's as discussed in Chapter 5,
- contingent valuation study of pinnipeds in general,
- a comparison of these values to that of the economic damages incurred in "operational conflicts".

In addition, research on the contribution of pinnipeds to eco-tourism and related enterprises would be valuable. In 2000, the State of California had over 40 million visitors to its beaches and waterfront areas (DK Shifflet and Associates 2001). Sea World, San Diego and the Monterey Bay Aquarium are both listed under California's Top Ten Theme Parks pulling in \$4.1 million and \$1.725 million in revenues respectively in 2001 (DK Shifflet and Associates 2001). Pier 39, billed as San Francisco's #1 attraction, is a multi-million dollar retail/entertainment complex that relies heavily on its sea lion residents to attract visitors from all over the world. Pier 39 research shows that 80% of the tourists who visit Pier 39 come for the sea lions (Pier 39 Visitor Survey 1998). Furthermore, their research also states that while the visitors come for the sea lions, nearly all see another attraction, generating additional revenue.

Further salmonid research should be undertaken regarding more long-term solutions such as habitat restoration to recover salmonid stocks, rather than the short term "band-aid" approaches such as lethal controls of pinniped populations. For instance, the NMFS allocated \$1.2 million per year to research pinniped/salmonid interactions, and yet all federal register salmonid listings document habitat destruction as the primary cause of salmonid declines. Lower fishing quotas should be researched and discussed with local fishermen as consensus based policy at a local level has had successes in other similar cases. Habitat preservation should become a vital issue, and man-made structures which block historical spawning/migration routes should allow for the passage of salmonids. These issues, if addressed properly, could provide a cost-effective long-term solution to

the problems of declining salmonid stocks that would be satisfactory to all parties involved.

Conclusion

Wagner (1996), in response to Mangel et al.'s "Principles for the Conservation of Wild Living Resources," sets forth a causal chain of policy formulation as such:

Societal Values → Management Goals → Public Policies → Management Programs

Implying that we manage resources according to human values, and that science is often left out of the equation. In managing environmental resources according to the dictates of economics, we replace biological science with the science of commerce. Yet, even the science of economics must follow certain rules. The costs of any policy must be weighed against the benefits, and policy and law requires that all benefits be measured. When confronted with policy decisions, resources should be allocated incorporating all possible uses to all levels of society, not just a few select stakeholders.

This study provides a previously overlooked piece of information to the contentious debate regarding lethal takes of pinnipeds due to operational fishery conflicts. This economic value of the sea lions, determined to be between \$21 million and \$65 million, is not meant to be a solution, but rather the beginning of a discourse heading towards a solution. Wickens et al. (1992, 773) illustrate the difficulties inherent in finding a solution by listing the definition of operational interactions -- from the pinnipeds point of view -- "operational interactions include mortality or injury from being shot or maimed by fishermen, entanglement in discarded fishing gear and drowning in nets." The economic

value of the proposed changes in the sea lion populations suggests that lethal control measures may not be the best option, and that the sea lions have a real value that must be considered before any decisions are made. This study brings the debate closer to considering non-lethal methods by showing the economic value placed on sea lions by California residents and tourists to the California coastline.

REFERENCES

- Alberini, Anna. 1995. "Optimal Designs for Discrete Choice Contingent Valuation Surveys: Single-Bound, Double-Bound, and Bivariate Models." *Journal of Environmental Economics and Management* 28: 287-306.
- Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner and H. Schuman. 1993. "Report of the NOAA Panel on Contingent Valuation." *Federal Register* 58, no. 10: 4601-4614.
- Azjen, Icek, Thomas C. Brown, and Lori H. Rosenthal. 1996. "Information Bias in Contingent Valuation: Effects of Personal Relevance, Quality of Information, and Motivational Orientation." *Journal of Environmental Economics and Management* 30: 43-57.
- Bateman, Langford. 1997. "Non-users Willingness-to-Pay for National Parks; Applications and Critiques of Contingent Valuation Method." *Regional Studies* 31, no. 6: 571-582.
- Best, P. B., R. J. M. Crawford, and R. P. Van Der Elst. 1997. "Top Predators in Southern Africa's Marine Ecosystems." *Transactions of the Royal Society of South Africa* 52, no. 1: 177-255.
- Bishop, Richard C., Patricia A. Champ, Thomas C. Brown, and Daniel W. McCollum. 1997. Measuring non-use values: theory and empirical applications. In *Determining the Value of Non-Marketed Goods*, ed. R. J. Kopp, W.W. Pommerehne, and N. Schwartz, 59-81. Norwell, Massachusetts: Kluwer Academic Publishers.
- Black, M. 1994. "Recounting a century of failed fishery policy toward California's Sacramento River Salmon and Steelhead." *Conservation Biology* 8, no. 3: 892-894.
- Butterworth, D.S. 1992. "Will more seals result in reduced fishing quotas?." *South African Journal of Science* 88: 414-416.
- Butterworth, D. S., D. C. Duffy, P.B. Best, and M. O. Bergh. 1988. "On the Scientific Basis for Reducing the South African Seal Population." *South African Journal of Science* 84: 179-188.
- California Resources Agency 1997. California Environmental Resources Evaluation System (CERES), Land Use Planning Information Network (LUPIN) by California Resources Agency. <http://ceres.ca.gov/planning/counties/counties.html>

- Carretta, James V., Karin A. Forney, Marcia M. Muto, Jay Barlow, Jason Baker, and Mark Lowry. 2003. *Draft U.S. Pacific Marine Mammal Stock Assessments: 2003*. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-SWFSC – Draft.
- Carson, Richard T. 1997. Contingent valuation surveys and tests of insensitivity to scope. In *Determining the Value of Non-Marketed Goods*, ed. R. J. Kopp, W.W. Pommerehne, and N. Schwartz, 121-159. Norwell, Massachusetts: Kluwer Academic Publishers.
- Carson, Richard T. 1998. "Valuation of Tropical Rainforests: Philosophical and Practical Issues in the use of Contingent Valuation." *Ecological Economics* 24: 15-29.
- _____. 2000. "Contingent Valuation: A User's Guide." *Environmental Science and Technology* 34, no. 8: 1413-1418.
- Colgan, Charles. 1995. Introduction: economics, science and the shaping of new approaches to environmental policy. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 1-19. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Comprehensive Environmental Response, Compensation, and Liability Act. U.S. Code.* 1980. sec. 301.
- Crocker, Thomas D., Jason F. Shogren, and Mark Agee. 1995. Valuing non-point pollution impacts on coastal habitats: providing more content. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 105-130. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Cummings, Ronald, and G. Harrison. 1994. "Contingent Valuation." In *The Encyclopedia of the Environment*, ed. R.A. Eblen and W.R. Eblen 115-117. Boston: Houghton Mifflin.
- Diamond, Peter. 1996. "Testing the Internal Consistency of Contingent Valuation Surveys." *Journal of Environmental Economics and Management* 30, no. 3: 337-347.
- Diamond, P., J. Hausman, G. Leonard, and M. Denning. 1992. Does contingent valuation measure preferences? Experimental evidence. In *Contingent Valuation: A Critical Assessment*. Cambridge, MA: Cambridge Economics. Quoted in Nick Hanley and Clive L. Spash. 1995. *Cost-Benefit Analysis and the Environment*. Hants (England): Edward Elgar.

- Desvouges, W., F. Johnson, R. Dunford, K. Boyle, S. Hudson, and K. Wilson. 1992. Measuring natural resource damages with contingent valuation: tests of validity and reliability. In *Contingent Valuation: A Critical Assessment*. Cambridge, MA: Cambridge Economics. Quoted in Nick Hanley and Clive L. Spash. 1995. *Cost-Benefit Analysis and the Environment*. Hants (England): Edward Elgar.
- DK Shifflet and Associates. 2001. Domestic Leisure Travel to California 1998 - 2001. Sacramento, CA: California Tourism. Internet. <http://www.visitcalifornia.com>.
- DK Shifflet and Associates. 2001b. California Fast Facts 2002 Statewide and Regional Tourism Facts and Figures. Sacramento, CA: California Tourism. Photocopied.
- DuVair, Pierre, and John Loomis. 1993. "Household's Valuation of Alternative Levels of Hazardous Waste Risk Reductions: an Application of the Referendum Format Contingent Valuation Method." *Journal of Environmental Management* 39: 143-155.
- Endangered Species Act. U.S. Code. 1973. secs. 1532-1533.*
- Edwards, Steven. 1986. *An Economics Primer for Coastal Zone Management: Basic Concepts and Methods from Microeconomics, Public Finance, and Environmental Resource Economics*. Woods Hole, MA: Woods Hole Oceanographic Institute.
- Fischhoff, B. and L. Furby. 1988. "Measuring Values: A Conceptual Framework for Interpreting Transactions with Special Reference to Contingent Valuation of Visibility." *Journal of Risk and Uncertainty* 1: 147-184. Quoted in Mullarkey, Daniel J. and Richard C. Bishop. 1995. Toward assessing the validity of contingent valuation of wetlands. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 57-86. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Freeman, A. Myrick. 1995. The economic valuation of coastal resources supporting recreation. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 87-104. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Gearin, Patrick J., Robert Pfeifer, Steven J. Jeffries. 1986. *Control of California Sea Lion Predation in Winter-run Steelhead at the Hiram M. Chittenden Locks, Seattle, December 1985- April 1986 with Observations on Sea Lion Abundance and Distribution in Puget Sound*. Seattle, WA: Washington Department of Game Fishery Management, Report No. 86-20.
- Gearin, Patrick J., Robert Pfeifer, Steven J. Jeffries, Robert L. DeLong, Michael A. Johnson. 1988. *Results of the 1986-1987 California Sea Lion-Steelhead Trout*

Predation Control Program at the Hiram M. Chittenden Locks. Seattle, WA: Northwest and Alaska Fisheries Center, NMFS, U.S. Dept. of Commerce, NWAFC Processed Report 88-30.

Goodman, Sandra, Helen Daniel, Shabbar Jaffry, and William Seabrooke. 1997. "Using Public Surveys to Estimate the Total Economic Value of Natural Resources." *The Coastal Society Bulletin* 19, no. 1 & 2: 12-23.

Gottlieb, Robert. 1993. *Forcing the Spring*. Washington D.C.: Island Press.

Hanan, D.A. and M.J. Fluharty. 1997. "Sea Lion Interactions in the Commercial Salmon Troll and Commercial Passenger Fishing Vessel Fisheries." *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*. Boston, MA: New England Aquarium and Monterey Bay Aquarium.

Hanan, D.A., L. Jones and R. Read. 1989. "California Sea Lion Interaction and Depredation Rates with the Commercial Passenger Fishing Vessel Fleet Near San Diego." *CalCOFI Rep.* 30: 122-126.

Hanemann, W. Michael. 1995. Contingent valuation and economics. In *Environmental Valuation New Perspectives*, ed. K.G. Willis and J.T. Corkindale, 79-117. Wallingford, Oxon, U.K.: CAB International.

Hanley, Nick and Clive L. Spash. 1995. *Cost-Benefit Analysis and the Environment*. Hants (England): Edward Elgar.

Hanrahan, T.P., D.D. Dauble and D.R. Geist. 2004. "An estimate of chinook salmon (*Oncorhynchus tshawytscha*) spawning habitat and redd capacity upstream of a migration barrier in the upper Columbia River." *Canadian Journal of Fisheries and Aquatic Sciences* 61: 22-33.

Hanson. 1997. "Central California Coastal Coho Salmon,"; Quoted in "Final Rule: Endangered and Threatened Species; Threatened Status for Central California Coast Coho Salmon Evolutionary Significant Unit (ESU), 61-FR-56138) *National Marine Fisheries Service, NOAA*, 29 March 1998; available from <http://kingfish.ssp.nmfs.gov/tmcintyr/fish/cacoho/html>.

Harvey, J. and M. J. Weise. 1997. "Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids in Monterey Bay, California." *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*. Boston, MA: New England Aquarium and Monterey Bay Aquarium.

- Hoehn, John P. and John B. Loomis. 1993. "Substitution Effects in the Valuation of Multiple Environmental Programs." *Journal of Environmental Economics and Management* 25: 56-75.
- Hoehn, John P. and Alan Randall. 1987. "A Satisfactory Benefit Cost Indicator from Contingent Valuation." *Journal of Environmental Economics and Management* 14: 226-247.
- Hutchinson, W. George, Susan M. Chilton and John Davis. 1995. "Measuring Non-use Value of Environmental Goods Using Contingent Valuation Method: Problems of Information and Cognition and the Application of Cognitive Questionnaire Design Methods." *Journal of Agricultural Economics* 46, no. 1: 97-112.
- Jeffries, S. and J. Scordino. 1997. Efforts to protect a winter steelhead run from California sea lion predation at the Ballard Locks. In *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*, ed. Gregory Stone, Jennifer Goebel, and Steven Webster, 107-115. Boston, MA: New England Aquarium and Monterey Bay Aquarium.
- Johnson, Robert, Professor, Environmental and Natural Resource Economics. November 12, 1998. 12 November 1998. Phone Call. University of Rhode Island.
- Kahneman, Daniel and Jack L. Knetsch. 1992. "Valuing Public Goods: The Purchase of Moral Satisfaction." *Journal of Environmental Economics and Management* 22: 57-70.
- Kahneman, D. and A. Tversky. 1982. "The simulation heuristic." In D. Kahneman, P. Slovic and A. Tversky, eds. 1982. *Judgement under uncertainty: Heuristics and biases* (pp. 201-208). New York: Cambridge University Press.
- Kier (William M.) Associates. 1995. Watershed Restoration - A Guide for Citizen Involvement. Silver Spring, MD: NOAA Coastal Ocean Office.
- Kline, Benjamin. 1997. *First Along the River*. San Francisco: Acada Books.
- Kondolf, G.M. 2000. "Some Suggested Guidelines for Geomorphic Aspects of Anadromous Salmonid Habitat Restoration Proposals." *Restoraton Ecology* 8(1): 48-56.
- Kopp, Raymond J. 1992. "Why Existence Value Should Be Used in Cost-Benefit Analysis." *Journal of Policy Analysis and Management* 11, no. 1, Winter: 123-130.

- Kopp, Raymond J. and Katherine A. Pease. 1997. Contingent valuation: economics, law and politics. In *Determining the Value of Non-Marketed Goods*, ed. R. J. Kopp, W.W. Pommerehne, and N. Schwartz, 7-58. Norwell, Massachusetts: Kluwer Academic Publishers.
- Krutilla, John. 1967. "Conservation Reconsidered." *American Economic Review* 57:787-796. Quoted in Mitchell, Robert Cameron and Rachel T. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Resources for the Future.
- Levy, Daniel S., James K. Hammitt, Naihli Duan, Theo Downes-LeGuin, and David Friedman. 1995. *Conceptual and Statistical Issues in Contingent Valuation: Estimating the Value of Altered Visibility in the Grand Canyon*, MR-344-RC. Rand. Santa Monica, CA.
- Li, Chuan-Zhong and Leif Mattsson. 1995. "Discrete Choice under Preference Uncertainty: An Improved Structural Model for Contingent Valuation." *Journal of Environmental Economics and Management* 28: 256-269.
- Lipton, Douglas W., Katharine F. Wellman, Isobel C. Sheifer, and Rodney F. Weiher. 1995. *Economic Valuation of Natural Resources A Handbook for Policymakers*. Silver Spring, MD: U.S. Department of Commerce, NOAA.
- Loomis, John B. 1987. "Expanding Contingent Valuation Sample Estimates to Aggregate Benefit Estimates: Current Practices and Proposed Solutions." *Land Economics* 63, no. 4: 396-402.
- Loomis, John B., Thomas Brown, Beatrice Lucero, and George Peterson. 1996. "Improving Validity Experiments of Contingent Valuation Methods: Results of Efforts to Reduce the Disparity of Hypothetical and Actual Willingness to Pay." *Land Economics* 72, no. 4: 450-461.
- Loomis, John and Earl Ekstrand. 1997. "Economic Benefits of Critical Habitat for the Mexican Spotted Owl: A Scope Test Using a Multiple Bounded Contingent Valuation Survey." *Journal of Agricultural and Resource Economics* 22, no. 2: 356-366.
- Loomis, John and Michael King. 1994. "Comparison of Mail and Telephone-Mail Contingent Valuation Surveys." *Journal of Environmental Management* 41: 309-324.
- Loomis, John, Michael Lockwood and Terry DeLacy. 1993. "Some Empirical Evidence on Embedding Effects on Contingent Valuation of Forest Protection." *Journal of Environmental Economics and Management* 24: 45-55.

Magnuson-Stevens Fishery Conservation and Management Act. U.S. Code. 1996. sec. 2.

Mangel, Marc, Lee Talbot, Gary K. Meffe, M. Tundi Agardy, Dayton L. Alverson, Jay Barlow, Daniel Botkin, Gerardo Budowski, Tim Clark, Justin Cooke, Ross H. Crozier, Paul K. Dayton, Danny L. Elder, Charles W. Fowler, Silvio Funtowicz, Jarl Giske, Robert Hoffman, Sidney J. Holt, Stephen Kellert, Lee A. Kimball, Donald Ludwig, Kjartan Magnusson, Ben S. Malayang III, Charles Mann, Elliot Norse, Simon P. Northridge, William F. Perrin, Charles Perrings, Randall M. Peterman, George B. Rabb, Henry A. Regier, John E. Reynolds III, Kenneth Sherman, Michael P. Sissenwine, Tim D. Smith, Anthony Starfield, Robert J. Taylor, Michael F. Tillman, Catherine Toft, John R. Twiss Jr., James Wilen, and Truman P. Young. 1996. "Principles for the Conservation of Wild Living Resources." *Ecological Applications*. 6, no. 2: 338-362.

Marine Mammal Protection Act. U.S. Code. 1994. sec. 1389.

McConnell, K. E. 1990. "Models for Referendum Data: The Structure of Discrete Choice Models for Contingent Valuation." *Journal of Environmental Economics and Management* 18: 19-34.

Mendelsohn, Robert O. 1985. *The Benefits of Preserving Endangered Species: With Special Attention to the Humpback Whale (Including Comments and Response)*. Honolulu, HI: National Marine Fisheries Service, Southwest Fisheries Center Honolulu Laboratory. Administrative Report H-85-9.

Mitchell, Robert Cameron and Rachel T. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Resources for the Future.

Mossop, Brent and Michael Bradford. 2004. Importance of Large Woody Debris for Juvenile Chinook Salmon Habitat in Small Boreal Forest Streams in the Upper Yukon River Basin, Canada." *Canadian Journal of Forest Research* 34(9):1955-1966.

Mullarkey, Daniel J. and Richard C. Bishop. 1995. Toward assessing the validity of contingent valuation of wetlands. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 57-86. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.

National Environmental Protection Act (NEPA). U.S. Code. 1969. Secs. 102(2)(B).

National Environmental Protection Act (NEPA). U.S. Code. 1978. Secs. 1502.23.

- NMFS. 1996. Final Rule. Endangered and Threatened Species; Threatened Status for Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU). *Federal Register* 61, no. 212 (31 October): 56138.
- NMFS. 1997a. Final Rule. Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon. *Federal Register* 62, no. 87 (6 May): 24588.
- NMFS. 1997b. Proposed Rule. Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coast Coho Salmon. *Federal Register* 62, no. 227 (25 November): 62741.
- NMFS. 1998. Final Rule. Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California. *Federal Register* 63, no. 53 (19 March): 13347.
- NMFS. 1999a. Final Rule. Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs) in California. *Federal Register* 64, no. 179 (16 September): 50393.
- NMFS 1999b. Final Rule. Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon. *Federal Register* 64, no. 86 (5 May): 24049.
- NOAA. 1996. *NOAA Strategic Plan: A Vision for 2005*. U.S. Department of Commerce, National Oceanic Atmospheric Administration, Washington, D.C. 210 pp.
- NOAA. 1997. *Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon and California*. Washington, D.C.: U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-NWFSC-28.
- NOAA. 1998. "Federal Endangered Species Act Listing for Two West Coast Steelhead Populations; California, Oregon Plans Will Protect Three Others," *National Oceanic and Atmospheric Administration*, 25 March 1998; available from <http://www.noaa.gov/public-affairs/pr98/mar98/noaa98-r114.html>.
- NOAA. 1999. *Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and West Coast Ecosystems*. Washington, D.C.: U.S. Department of Commerce, NOAA.
- NOAA Fisheries. 2004. *Endangered Species Act Status of West Coast Salmon and Steelhead*. Washington, D.C.: U.S. Department of Commerce, NOAA. Accessed online 2/15/04 www.nwr.noaa.gov/1salmon/salmesa/pubs/1pgr.pdf.

- Pier 39 Visitor Survey. 1998. San Francisco, CA: Pier 39 Limited Partnership.
- Punt, A. E. and D. S. Butterworth. 1995. "The Effects of Future Consumption by the Cape Fur Seal on Catches and Catch Rates of the Cape Hakes. 4. Modelling the Biological Interactions between Cape Fur Seals (*Arctocephalus pusillus pusillus*) and the Cape Hakes (*Merluccius capensis* and *M. pradoxus*)." *South African Journal of Marine Science* 16: 255-285.
- Riesman, David. 1958. Some observations on the interviewing in the teacher apprehension study. In *The Academic Mind: Social Scientists in a Time of Crisis*. ed. Paul Lazarsfeld and Wagner Thielens Jr.. Glencoe, IL: Free Press. Quoted in Nick Hanley and Clive L. Spash. 1995. *Cost-Benefit Analysis and the Environment*. Hants (England): Edward Elgar.
- Smith, Jerry, Professor of Biology, San Jose State University. 1998a. Interview by author, 20 March, San Jose, CA. Written Notes. San Jose University, San Jose, CA.
- Smith, Jerry. 1998b. "Distribution and abundance of Juvenile Coho and Steelhead in Gazos, Waddell and Scott Creeks in 1997 and the Implications for the Status of Southern Coho." San Jose, CA: San Jose State University, Department of Biological Sciences. Photocopied.
- Smith, V. K. 1992. "Arbitrary Values, Good Causes, and Premature Verdicts." *Journal of Environmental Economics and Management* 22: 71-89.
- Spickard, Steven E., Matthew A. Hetrick, and David Bratton. 2001. "Tourism Works for San Francisco" A top-line summary of visitor statistics and economic benefits of San Francisco tourism in the year 2000. San Francisco, CA: San Francisco Convention and Visitors Bureau. Photocopied.
- Steele, Jim. 1998. "Land Use Conservation Principles for Salmonid Protection at the Watershed Level," *California Department of Fish and Game*, 29 March 1998; available from <http://ceres.ca.gov/>.
- Stewart, B.S. 1997. "California Pinnipeds: Population Trends, Trans-Jurisdictional Migrations, and Ecological Function in Large Marine Ecosystems of the Eastern North Pacific Ocean", *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*. Boston, MA: New England Aquarium and Monterey Bay Aquarium.
- Thompson, Cynthia. 1998. NMFS Economist. Interview by author, 30 June, Santa Cruz, CA. Written Notes. University of Santa Cruz, Santa Cruz, CA

- Townsend, Ralph E. 1995. Economic assessment of impacts of environmental changes on shellfish resources. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 131-144. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Trites, A.W. 1997. "The Role of Pinnipeds in the Ecosystem", *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*. Boston, MA: New England Aquarium and Monterey Bay Aquarium.
- Vadnjal, Dan and Martin O'Connor. 1994. "What is the Value of Rangitoto Island?", *Environmental Values* 3: 369-380.
- U.S. President. 1993. Proclamation. *Federal Register* 58, no. 17 (4 February): 12866.
- Wang, Hua. 1997. "Treatment of "Don't Know" Responses in Contingent Valuation Surveys: A Random Valuation Model." *Journal of Environmental Economics and Management* 32: 219-232.
- Watts, Simon and Lyndsay Halliwell, eds. 1996. *Essential Environmental Science; Methods and Techniques*. New York: Rutledge.
- Weise, Michael J. and James T. Harvey. 1999a. *Food Habits of California Sea Lions (Zalophus californianus) and Their Impact on Salmonid Fisheries in Monterey Bay, California*. Monterey, CA: Moss Landing Marine Laboratories, MLML Technical Publication No. 99-01
- Weise, Michael J. and James T. Harvey. 1999b. *Pinniped Predation on Adult Winter-run Salmonids in the San Lorenzo River and Scott Creek, CA 1998 and 1999*. Monterey, CA: Moss Landing Marine Laboratories, MLML Technical Publication No. 99-03
- White, Piran C. L., Keith W. Gregory, Patrick J. Lindley and Glenn Richards. 1997. "Economic Values of Threatened Mammals in Britian: A Case Study of the Otter (*Lutra lutra*) and the Water Vole (*Arvicola terrestris*)." *Biological Conservation* 82: 345-354.
- Whittington, Dale, Elizabeth MCClelland, Glenn Cassidy, Deborah Amaral, Hua Wang, and Christine Poulos. 1995. The economic value of improving the environmental quality of Galveston Bay. In *Sustaining Coastal Resources Economics and the Natural Sciences*, ed. Charles S. Colgan, 19-56. Portland, Maine: Edmund S. Muskie Institute of Public Affairs, University of Southern Maine.
- Wickens, P. A., D. W. Japp, P. A. Shelton, F. Kriel, P. C. Goosen, B. Rose, C. J. Augustyn, C. A. R. Bross, A. J. Penney and R. G. Krohn. 1992. "Seals and

Fisheries in South Africa - Competition and Conflict." *South African Journal of Marine Science* 12: 773 - 789.

Willis, Ken. 1995. Contingent valuation in a policy context: the National Oceanic and Atmospheric Administration Report and its implications for the use of contingent valuation methods in policy analysis in Britain. In *Environmental Valuation New Perspectives*, ed. K.G. Willis and J.T. Corkindale, 118-152. Wallingford, Oxon, U.K.: CAB International.

Young, Sharon B. and Victoria Nichols. 1997. "Killing Pinnipeds to Protect Fish: Solution or Sophistry", *Pinniped Populations, Eastern North Pacific: Status, Trends and Issues*, 174-177. Boston, MA: New England Aquarium and Monterey Bay Aquarium.

APPENDIX A

HUMAN SUBJECTS-INSTITUTIONAL REVIEW BOARD APPROVAL



San José State
UNIVERSITY

**Office of the Academic
Vice President**
*Associate Vice President
Graduate Studies and Research*
One Washington Square
San José, CA 95192-0025
Voice: 408-924-2480
Fax: 408-924-2477
E-mail: gstudies@wahoo.sjsu.edu
<http://www.sjsu.edu>

TO: Tracy Rouleau
3400 Richmond Pkwy, #2414
Richmond, CA 94806

FROM: Nabil Ibrahim, *N. Ibrahim*
Acting AVP, Graduate Studies & Research

DATE: May 4, 1999

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Estimating an Economic Value for Pinnipeds
using Contingent Valuation Method"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to any and all data that may be collected from the subjects. The Board's approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Nabil Ibrahim, Ph.D., immediately. Injury includes but is not limited to bodily harm, psychological trauma and release of potentially damaging personal information.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at
(408) 924-2480.

The California State University:
Chancellor's Office
Bakersfield, Chico, Dominguez Hills,
Fresno, Fullerton, Hayward, Humboldt,
Long Beach, Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San Jose, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

APPENDIX B

SAMPLING STRATEGY FOR NON-USER VALUES

Sampling Strategy for Non-User Values

<u>County</u>	<u>1/1/1998</u>	<u>1/1/1999</u>		<u>Cumulative Totals</u>
ALPINE	1,190	1,190		1,190
SIERRA	3,340	3,220		4,410
MODOC	9,975	9,925		14,335
MONO	10,550	10,800		25,135
TRINITY	13,200	13,200		38,335
MARIPOSA	16,000	16,100		54,435
COLUSA	18,600	18,550		72,985
PLUMAS	20,450	20,450		93,435
GLENN	26,580	26,950		120,385
DEL NORTE	28,100	28,100		148,485
AMADOR	33,300	34,050		182,535
LASSEN	33,650	34,050		216,585
CALAVERAS	38,100	37,800		254,385
SISKIYOU	44,200	44,350	<i>Small(<225,000)</i>	298,735
SAN BENITO	46,950	47,850		346,585
TUOLUMNE	52,500	53,100		399,685
LAKE	55,100	55,300		454,985
TEHAMA	54,900	55,700		510,685
YUBA	60,800	60,400		571,085
SUTTER	76,400	76,700		647,785
<i>MENDOCINO</i>	<i>86,100</i>	<i>87,100</i>	<i>Pilot 35 surveys</i>	734,885
NEVADA	89,200	89,600		824,485
MADERA	114,100	115,800		940,285
NAPA	121,900	124,600		1,064,885
HUMBOLDT	126,000	128,100		1,192,985
EL DORADO	148,800	150,800		1,343,785
YOLO	155,500	158,800		1,502,585
SHASTA	164,100	165,400		1,667,985
BUTTE	199,100	201,900	<i>Interval 1(I1) = 1/6 pop.</i>	1,869,885
<i>MERCED</i>	<i>203,200</i>	<i>206,900</i>	<i>Pilot 35 surveys</i>	2,076,785
<i>PLACER</i>	<i>219,400</i>	<i>225,900</i>	<i>Pilot 35 surveys</i>	2,302,685
MARIN	244,100	247,900		2,550,585
SANTA CRUZ	249,000	252,800		2,803,385
SOLANO	382,000	390,100	<i>Med. (225,000 - 750,000)</i>	3,193,485
STANISLAUS	428,300	433,000		3,626,485
SONOMA	436,700	443,700		4,070,185
SAN JOAQUIN	546,900	554,400		4,624,585
SAN MATEO	716,500	722,800	<i>I2,I3 = 1/3 pop.</i>	5,347,385

SAN FRANCISCO	783,400	790,500		6,137,885
FRESNO	781,900	793,800	<i>Large (>750,000)</i>	6,931,685
CONTRA COSTA	906,500	916,400		7,848,085
SACRAMENTO	1,156,500	1,177,800		9,025,885
ALAMEDA	1,413,400	1,433,300		10,459,185
SANTA CLARA	1,686,400	1,715,400	<u>I4,I5,I6 = 1/2 pop.</u>	12,174,585

Interval "I" (Total Pop./6) = 2,029,097.50

BOLD indicates county was randomly chosen for survey purposes

Source: State of California, Department of Finance, *Historical City/County Population*

Estimates, 1991-1999, with 1990 Census Counts. Sacramento, California, May 1999.

APPENDIX C

SAMPLE SURVEYS AND SUPPORTING DOCUMENTS

Use Survey Table Display Piece

Did you know that seals and sea lions cause damage to the gear of commercial and recreational fisherman, and can create conflicts with humans at fishing grounds and in marinas?



The government is proposing that state and federal wildlife managers be allowed to kill sea lions that are causing repeated conflicts in marinas and at fishing grounds. The government is also proposing that Congress *consider* allowing fishermen to kill sea lions that are causing damage to fishing gear or caught fish. This would only be allowed when the seals or sea lions cannot be stopped by non-lethal means.

Non-Use Survey Enclosure

October 28, 2004

Dear Fellow Californian,

Seals and sea lions are currently protected by the Marine Mammal Protection Act, a federal law. However, there is a report before Congress that suggests changing the Marine Mammal Protection Act so that these protections are removed in certain situations. One of these situations is when seals and/or sea lions are doing damage to fishermen's gear or interfering with their catch. Fishermen lose money due to these types of interactions with seals and sea lions. The report before Congress recommends that seals and sea lions could be lethally removed (killed) by fisherman to prevent economic losses to the fishermen's gear or catch.

Although seals and sea lions create economic losses, they also have an economic value. Besides the value that they bring to tourism and recreational areas they have a value to individuals such as yourself and your family. This value is hard to measure because seals and sea lions are not "bought" and "sold" in a market like other similar items such as cameras, beachwear or tenting equipment.

Your household is one of a small number in which people are being asked to give their opinion on these matters. It was chosen randomly from a sample covering all of Northern California. In a few days, a researcher will be calling you to ask you some questions about this issue. If you are not interested in participating, please inform the researcher at the beginning of the phone call. If you are interested in participating, please read the following pages, which describe the issue in more detail. Feel free to involve your family in discussions about this issue, however only an adult member of the household over age 18 may take the phone call. Please remember that in order for the results to truly represent the thinking of the people of Northern California it is important that you take part in this survey.

You can be assured of complete confidentiality. This poll is for research purposes only, some demographical information will be asked during the survey (i.e. age, sex) but this and all survey answers will be kept separate from your name and address. Participation in this survey is completely voluntary, if you feel uncomfortable about answering any of the survey questions, you can withdraw from the survey at anytime. Questions about the research can be addressed to Tracy Rouleau at (510) 243-0497. Complaints about the research may be presented to the Acting Environmental Studies Department Chair, Lynne Trulio, Ph.D. at (408) 924-5450. Questions about research, subject's rights, or research-related injury may be presented to Nabil Ibrahim, Ph.D. Acting Associate Vice President for Graduate Studies and Research at (408) 924-2480.

The government makes economic decisions every day. Your family's opinion should be considered. It is important information needed to better understand how people value our coastal resources, such as seals and sea lions. If you would like a copy of the results, please inform the researcher after the survey is complete. At that time the researcher can also answer any questions that you might have.

Thank you in advance for your assistance.

Sincerely,

Tracy L. Rouleau
Graduate Researcher
San Jose State University

Non-Use Survey Introduction

Hello my name is Tracy Rouleau,

About a week ago, I sent your family a letter regarding the conflict between the sea lions and the salmon fishermen.

Is this _____?

Could you please help me out by answering a few questions about this issue?

Did you get a chance to read the letter?

IF NO: Surveyer Reads:

Seals and sea lions are currently protected by the Marine Mammal Protection Act, a federal law. However, there is a report before Congress that suggests changing the Marine Mammal Protection Act so that these protections are removed in certain situations. One of these situations is when seals and/or sea lions are doing damage to fishermen's gear or interfering with their catch. Fishermen lose money due to these types of interactions with seals and sea lions. The report before Congress recommends that seals and sea lions could be lethally removed (killed) by fisherman to prevent economic losses to the fishermen's gear or catch.

Although seals and sea lions create economic losses, they also have an economic value. Besides the value that they bring to tourism and recreational areas they have a value to individuals such as yourself and your family. This value is hard to measure because seals and sea lions are not "bought" and "sold" in a market like other similar items such as cameras, beachwear or tenting equipment.

FOR ALL:

The questions that you will be asked are designed to determine how you, as a taxpayer and a consumer, value the current level of sea lion populations in monetary terms. You will not be asked to contribute or donate any money at the conclusion of this survey. This survey is for research purposes only.

Also Please feel free to ask questions at anytime.

Use Survey Introduction

Surveyer Reads:

Seals and sea lions are currently protected by the Marine Mammal Protection Act, a federal law. However, there is a report before Congress that suggests changing the Marine Mammal Protection Act so that these protections are removed in certain situations. One of these situations is when seals and/or sea lions are doing damage to fishermen's gear or interfering with their catch. Fishermen lose money due to these types of interactions with seals and sea lions. The report before Congress recommends that seals and sea lions could be lethally removed (killed) by fisherman to prevent economic losses to the fishermen's gear or catch.

Although seals and sea lions create economic losses, they also have an economic value. Besides the value that they bring to tourism and recreational areas they have a value to individuals such as yourself and your family. This value is hard to measure because seals and sea lions are not "bought" and "sold" in a market like other similar items such as cameras, beachwear or tenting equipment.

You have been chosen randomly to give your opinion on these matters. If you are interested in participating you must be over 18 years of age. Are you over 18?

(If Yes)

Please read the following pages, which describe the issue in more detail.

You can be assured of complete confidentiality. This poll is for research purposes only, some demographical information will be asked during the survey (i.e. age, sex) but this and all survey answers will be kept anonymous, we will not even ask for your name. Participation in this survey is completely voluntary, if you feel uncomfortable about answering any of the survey questions, you can withdraw from the survey at anytime. Questions about the research can be addressed to Tracy Rouleau at (510) 243-0497. Complaints about the research may be presented to the Acting Environmental Studies Department Chair, Lynne Trulio, Ph.D. at (408) 924-5450. Questions about research, subject's rights, or research-related injury may be presented to Nabil Ibrahim, Ph.D. Acting Associate Vice President for Graduate Studies and Research at (408) 924-2480.

If you would like a copy of the results, please inform me when you are finished with the survey. At that time I would also be happy to answer any questions that you might have.

Thank you in advance for your assistance.

Pilot Survey

Did you know that seals and sea lions cause damage to the gear of commercial and recreational fisherman, and can create conflicts with humans at fishing grounds and in marinas?

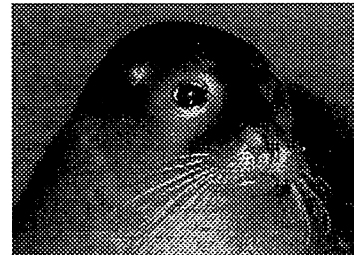
The government is proposing that state and federal wildlife managers be allowed to kill sea lions that are causing repeated conflicts in marinas and at fishing grounds. The government is also proposing that Congress *consider* allowing fishermen to kill sea lions that are causing damage to fishing gear or caught fish. This would only be allowed when the seals or sea lions cannot be stopped by non-lethal means.

This is a questionnaire on your feelings about these issues.

Seals and sea lions have interacted closely with coastal human populations for many centuries. Historically, they were harvested for their pelts and meat, and today they are still harvested by certain peoples on a subsistence basis. Hunters had reduced their population to around 5,000 by 1950. The Marine Mammal Protection Act (MMPA) of 1972 ensured the recovery of many seal and sea lion species, causing an increase in their populations in California waters. Currently, California sea lion populations are estimated at 165,000.



California sea lion
mother and pup



Harbor seal

Human populations near the coastlines of the United States have also increased greatly. More than half the population of the United States lives in the 10% of the land defined as coastal, and that proportion is steadily increasing. Increases in coastal development and economic activity that cause changes in wildlife habitat have accompanied this expansion of the coastal population. These changes often result in a decline in the density of many commercially valuable species due to an increase in competition for limited marine resources. Conflicts erupt

between humans and animals for these limited resources. This course of events is well illustrated in the conflict between salmon, seals, sea lions and fisherfolk on the Central California Coast.

A steep decline in salmon populations has occurred. Twenty-four populations of pacific salmon are now listed as threatened or endangered under the Endangered Species Act (ESA). Population declines have been caused by many factors including: habitat loss and degradation; inadequate riverine passage and flows due to dams, agriculture, logging and other developments; overfishing; and environmental fluctuations such as El Niño, drought and flooding. At the same time, there have been increasing commercial and recreational fishing and increasing seal and sea lion populations. This has created a conflict in the states of Washington, Oregon and California.

Sea lions hauled out on piers in marinas can create health and safety problems.



California sea lions are a very visible predator of salmon and often will fight with commercial and recreational fishermen over a particular salmon. Sea lions have been observed feeding on young salmon smolts at rivermouths, and cause monetary damage to commercial salmon fishermen and commercial passenger fishing vessels. This damage is in the form of lost fish and damage to fishing nets and gear. In an attempt to provide a solution to the problem of declining salmon populations and alleviate the economic losses to fishermen, the National Marine Fisheries Service issued a report to Congress recommending that some seal and sea lion populations be controlled by lethal means. Killing troublesome sea lions could result in less predation on salmon, and a reduction of the economic losses currently suffered by commercial and recreational fishermen, although neither of these outcomes is guaranteed.



A male sea lion, possibly entangled in monofilament fishing line.

It is also important to note that the report issued by the National Marine Fisheries Service found insufficient data to connect seal or sea lion predation to declining salmon stocks. They "could not determine if either" seals or sea lions are "having a significant negative impact on any wild salmonid population", with the single exception of Ballard Locks, a river system where

salmon passage is restricted by a human-made structure (boating locks). Furthermore, one researcher found that there is no scientific evidence that reducing the number of seals and sea lions would increase the number of fish. A reduction of seal and sea lion populations could increase the population of other predators that consume proportionately larger amounts of salmon. Also, many investigators agree that although seals and sea lions can have a significant effect on salmon populations in certain circumstances, overall marine mammal predation is a *minor* factor in salmon declines. It is also important to remember that as predators, seals and sea lions play an important role in the coastal ecosystem, culling out unfit individuals and strengthening the populations of species that they eat.

This ends the Information part of this survey, thank you for participating. In a few days a researcher will call to ask you some questions about this issue. Feel free to take notes on this sheet or write down any questions that you may have and ask the researcher before answering the survey questions.

The questions that you will be asked are designed to determine how you, as a taxpayer and a consumer, value the current level of seal and sea lion populations in monetary terms.

While answering the survey questions please remember the following items:

- The survey is designed to determine a value for the *change* in seal and sea lion populations that would possibly result from the proposed regulations that will permit the shooting of the seals and sea lions. This economic value will be determined by the answers received by you and the other participants in this survey.
- Funds that would be spent in the manner suggested by this survey could be used for other coastal improvements (beach access, marina improvements, coastal site purchases, habitat improvement etc.).
- **You will not be asked to contribute or donate any money at the conclusion of this survey. This survey is for research purposes only.**

Please indicate your agreement/disagreement with the following statements:

Strongly Agree (SA), Agree (A), Don't Know/Not Applicable (DK), Disagree (D) Strongly Disagree (SD)

I have a good understanding of the conflicts between seals, sea lions and fisherfolk that are presented in this survey SA A DK D SD

I have heard or read about this issue before SA A DK D SD

The questions on the following pages are designed to determine how you, as a taxpayer and a consumer, value the current level of seal and sea lion populations in monetary terms.

While answering the survey questions please remember the following items:

- The survey is designed to determine a value for the *change* in seal and sea lion populations that would possibly result from the proposed regulations that will permit the shooting of the seals and sea lions. This economic value will be determined by the answers received by you and the other participants in this survey.
- Funds that are spent in the manner suggested by this survey could be used for other coastal improvements (beach access, marina improvements, coastal site purchases, habitat improvement etc.).
- You will not be asked to contribute or donate any money at the conclusion of this survey.

1. **Suppose a fund was created which asked for a yearly donation of \$5 to be paid along with your taxes. Rather than allowing the lethal removal of seals and sea lions that damage fishing gear and catch, the fund would compensate commercial and recreational fisherfolk for damage to their gear and loss of their catch due to damage done by seals and sea lions. Would you be willing to pay that amount each year?**

YES

NO

NO ANSWER/Don't Know

(if "NO ANSWER/Don't Know" please state your reason below)

Why? _____

If YES continue to Question 2

If NO continue to question 3

2. **What if the fund asked for a yearly donation of \$10 to be paid along with your taxes. The purpose of the fund again being for compensation to commercial and recreational fisherfolk for damage to their gear and loss of their catch due to damage by seals and sea lions instead of shooting them. Would you be willing to pay that amount each year?**

YES

NO

NO ANSWER/Don't Know

(if "NO ANSWER/Don't Know" please state your reason below)

Why? _____

(Skip to question 4)

3. Please explain briefly why you would not be willing to pay: _____

4. Please indicate your agreement/disagreement with the following statements

Strongly Agree (SA), Agree (A), Don't Know/Not Applicable (DK), Disagree (D) Strongly Disagree (SD)

I understand the intent of this survey SA A DK D SD

I have considered my family budget and still feel that I am financially able to contribute the amount that I pledged to the fund in this survey SA A DK D SD

I belong to or support environmental or environmentally related organization(s) SA A DK D SD

5. Please explain briefly why you offered the amount that you did: _____

6. Do you think that fishermen should be compensated for damage done to their gear or catch by seals and sea lions or other marine mammals?

YES NO

7. Do you or any member of your immediate family receive income as a direct result of commercial or recreational fishing activities?

YES NO

8. For Demographic Statistics please fill in the following information:

Age: _____

Sex: _____

Are you presently (Choose One): Employed Unemployed Retired

 Full-time Homemaker Student

City and State: _____

Country (if other than USA): _____

Family Income:

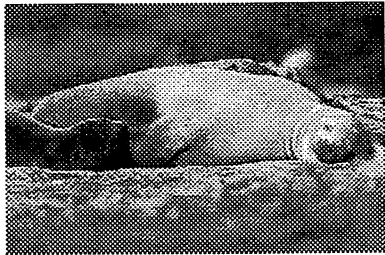
Less than \$20,000 \$20,000 - \$34,999 \$35,000 - \$50,000 More than \$50,000

Thank you for your time in participating in this survey. Please remember that this survey is for research purposes only, and that all answers will remain confidential. If you would like to receive a copy of the results after tabulation or a list of the references cited, please notify the survey administrator.

Use Survey

*This is a questionnaire on **your** feelings about these issues.*

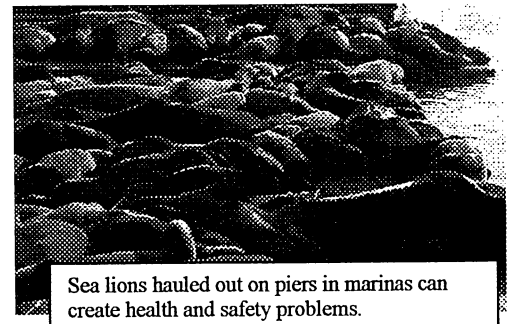
Seals and sea lions have interacted closely with coastal human populations for many centuries. Historically, they were harvested for their pelts and meat, and today they are still harvested by certain peoples on a subsistence basis. Hunters had reduced their population to around 5,000 by 1950. The Marine Mammal Protection Act (MMPA) of 1972 ensured the recovery of many seal and sea lion species, causing an increase in their



populations in California waters. Currently, California sea lion populations are estimated at 165,000.

A steep decline in salmon populations has occurred. Twenty-four populations of pacific salmon are now listed as threatened or endangered under the Endangered Species Act (ESA). Population declines have been caused by many factors including: habitat loss and degradation; inadequate river passage and flows due to dams, agriculture, logging and other developments; overfishing; and environmental fluctuations such as El Niño, drought and flooding. At the same time, there have been increasing commercial and recreational fishing and increasing seal and sea lion populations. This has created a conflict in the states of Washington, Oregon and California.

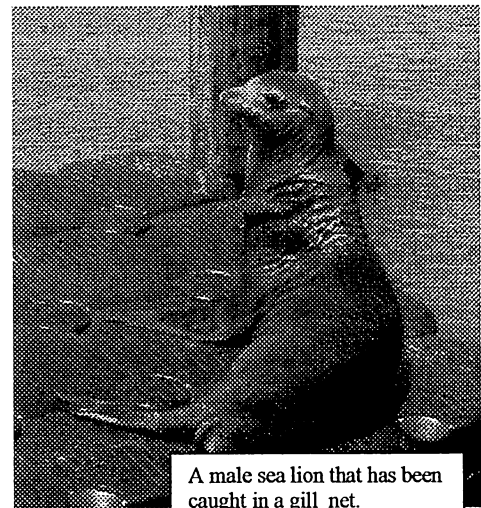
California sea lions are a very visible predator of salmon and often will fight with commercial and recreational fishermen



Sea lions hauled out on piers in marinas can create health and safety problems.

over a particular salmon. Sea lions have been observed feeding on young salmon smolts at rivermouths, and cause monetary damage to commercial salmon fishermen and commercial passenger fishing vessels. This damage is in the form of lost fish and damage to fishing nets and gear. In an attempt to provide a solution to the problem of declining salmon populations and alleviate the economic losses to fishermen, the National Marine Fisheries Service issued a report to Congress recommending that some seal and sea lion populations be controlled by lethal means. Killing troublesome sea lions could result in less predation on salmon, and a reduction of the economic losses currently suffered by commercial and recreational fishermen, although neither of these outcomes is guaranteed.

It is also important to note that the report issued by the National Marine Fisheries Service found insufficient data to connect seal or sea lion predation to declining salmon stocks. They "could not determine if either" seals or sea lions are "having a significant negative impact on any wild salmonid population", with the single exception of Ballard Locks, a river system where salmon passage is restricted by a human-made structure (boating locks). Also, many investigators agree that although seals and sea lions can have a significant effect on salmon populations in certain circumstances, overall marine mammal predation is a *minor* factor in salmon declines.



A male sea lion that has been caught in a gill net.

Non-Use Survey

*This is a questionnaire on **your** feelings about these issues.*

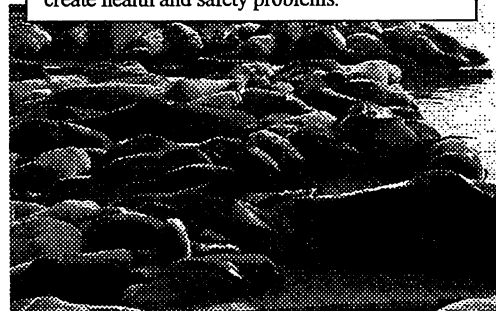
Seals and sea lions have interacted closely with coastal human populations for many centuries. Historically, they were harvested for their pelts and meat, and today they are still harvested by certain peoples on a subsistence basis. Hunters had reduced their population to around 5,000 by 1950. The Marine Mammal Protection Act (MMPA) of 1972 ensured the recovery of many seal and sea lion species, causing an increase in their populations in California waters. Currently, California sea lion populations are estimated at 165,000.



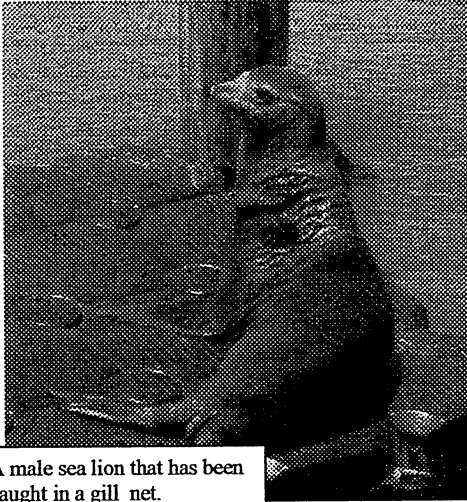
A steep decline in salmon populations has occurred. Twenty-four populations of pacific salmon are now listed as threatened or endangered under the Endangered Species Act (ESA). Population declines have been caused by many factors including: habitat loss and degradation; inadequate river passage and flows due to dams, agriculture, logging and other developments; overfishing; and environmental fluctuations such as El Niño, drought and flooding. At the same time, there have been increasing commercial and recreational fishing and increasing seal and sea lion populations. This has created a conflict in the states of Washington, Oregon and California.

California sea lions are a very visible predator of salmon and often will fight with commercial and recreational fishermen over a particular salmon. Sea lions have been observed feeding on young salmon smolts at rivermouths, and cause monetary damage to commercial salmon fishermen and commercial passenger fishing vessels. This damage is in the form of lost fish and damage to fishing nets and gear. In an attempt to provide a solution to the problem of declining salmon populations and alleviate the economic losses to fishermen, the National Marine Fisheries Service issued a report to Congress

Sea lions hauled out on piers in marinas can create health and safety problems.



recommending that some seal and sea lion populations be controlled by lethal means.



A male sea lion that has been caught in a gill net.

Killing troublesome sea lions could result in less predation on salmon, and a reduction of the economic losses currently suffered by commercial and recreational fishermen, although neither of these outcomes is guaranteed.

It is also important to note that the report issued by the National Marine Fisheries Service found insufficient data to connect seal or sea lion predation to declining salmon stocks. They "could not determine if either" seals or sea lions are

"having a significant negative impact on any wild salmonid population", with the single exception of Ballard Locks, a river system where salmon passage is restricted by a human-made structure (boating locks). Also, many investigators agree that although seals and sea lions can have a significant effect on salmon populations in certain circumstances, overall marine mammal predation is a *minor* factor in salmon declines.

This ends the Information part of this survey, thank you for participating. In a few days a researcher will call to ask you some questions about this issue. Feel free to take notes on this sheet or write down any questions that you may have and ask the researcher before answering the survey questions.

The questions that you will be asked are designed to determine how you, as a taxpayer and a consumer, value the current level of seal and sea lion populations in monetary terms.

While answering the survey questions please remember the following items:

- The survey is designed to determine a value for the **change** in seal and sea lion populations that would possibly result from the proposed regulations that will permit the shooting of the seals and sea lions. This economic value will be determined by the answers received by you and the other participants in this survey.
- **You will not be asked to contribute or donate any money at the conclusion of this survey. This survey is for research purposes only.**

Survey Questions

1. Suppose a fund was created which asked for a yearly donation of \$X to be paid along with your taxes. Rather than allowing the lethal removal of seals and sea lions that damage fishing gear and catch, the fund would compensate commercial and recreational fishermen for damage to their gear and loss of their catch due to damage done by seals and sea lions. Would you be willing to pay that amount each year?

YES (GO TO Question 2)

NO (SKIP TO Question 3)

NO ANSWER/Don't Know

(if you answer "NO ANSWER/Don't Know" please state your reason below)

Why? _____

2. What if the fund asked for a yearly donation of \$2X to be paid along with your taxes? The purpose of the fund again being for compensation to commercial and recreational fishermen for damage to their gear and loss of their catch due to damage by seals and sea lions instead of shooting them. Would you be willing to pay that amount each year?

YES (SKIP TO Question 4)

NO

NO ANSWER/Don't Know

(if you answer "NO ANSWER/Don't Know" please state your reason below)

Why? _____

3. Please explain briefly why you Would NOT be willing to pay: _____

(SKIP TO Question 5)

4. Please explain briefly WHY you offered the amount that you did: _____

5. Do you or any members of your immediate family receive income as a direct result of commercial or recreational fishing activities?

YES NO

6. If the situation changed, and the amount that you pledged was going to be used to protect Gray Whale breeding habitat, would you:

a) Pledge the SAME amount of money

b) Pledge LESS Money

- c) Pledge **MORE** money
- d) Pledge **NOTHING** at all

7. Please indicate your agreement or disagreement with the following statements using the codes listed below:

Strongly Agree (SA), Agree (A), Don't Know/Not Applicable (DK), Disagree (D) Strongly Disagree (SD)

I understand that this survey will be used to determine how consumers value the sea lions that might be harmed due to the economic damage that they cause	SA A DK D SD
I also understand that the total economic value will be determined by taking an average of all the amounts that the survey participants are willing to pay	SA A DK D SD
I have considered my family budget and still feel that I am financially able to contribute the amount that I pledged to the fund in this survey	SA A DK D SD
I have a good understanding of the conflicts between seals, sea lions and fishermen that are presented in this survey	SA A DK D SD
If Federal Wildlife Managers determine that it is necessary to kill problem sea lions to stop them from causing economic damage, they should be allowed to do so	SA A DK D SD
I have heard or read about this issue before	SA A DK D SD
Fishermen should be compensated for damage done to their gear or catch by seals, sea lions, or other marine mammals	SA A DK D SD
I belong to or support environmental or environmentally related organization(s)	SA A DK D SD

8. For Demographic Statistics please fill in the following information:

Age: _____

Sex: _____

Are you presently (Choose One): Employed Unemployed Retired

Full-time Homemaker Student

City and State: _____ Country (if NOT USA): _____

Family Income:

Less than \$20,000 \$20,000 - \$34,999 \$35,000 - \$50,000 More than \$50,00