Towards an Understanding of the Public's Attitudes and Preferences for Protecting Steller Sea Lions

By Daniel K. Lew

A group of Steller sea lions hauled out on an Alaska rookery.

STELLER SEA LIONS (*Eumetopias jubatus*) live in the North Pacific Ocean and consist of two distinct populations, the western stock and eastern stock, which are geographically separated at long. 144°W. As a result of large declines in the populations since at least the early 1970s, the Steller sea lion (SSL) was listed as threatened throughout its range under the U.S. Endangered Species Act (ESA) in April 1990. The decline continued through the 1990s for the western stock in Alaska, which was declared endangered in 1997, while the eastern stock remained listed as threatened.

Steller sea lions consume commercially valuable groundfish species, such as walleye pollock, Atka mackerel, and Pacific cod, which puts them in competition with commercial fishermen for food. As a result, numerous Steller sea lion protection measures are linked to commercial fishery regulations, such as gear restrictions to minimize incidental harm to SSLs and spatial and temporal restrictions on commercial harvests to increase the availability of Steller sea lion prey. Because SSL protection is linked to fishery management, resource managers must comply with several federal laws and executive orders in addition to the ESA when managing SSL protection, including the Magnuson-Stevens Fishery Conservation and Management Act. One of the applicable executive orders governing regulatory planning and development is Executive Order 12866 (58 FR 51735), which requires regulatory agencies to consider costs and benefits in deciding among alternative management actions. It states:

> In deciding whether and how to regulate, agencies 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.

This poses a considerable information challenge for managing some public resources, such as threatened and endangered species like the Steller sea lion. The costs of alternative SSL protection measures are often feasible to quantify from information on the market value of the fish not harvested as a result of regulatory requirements and the economic costs of complying with area restrictions and gear restrictions. However, the benefits of alternative protection measures are often much more difficult to estimate, particularly quantitatively, because many of the benefits are not measurable using market information. Although some benefits may translate to market activity, most benefits the public receives for protecting Steller sea lions are the non-consumptive values people attribute to such protection. Non-consumptive values (as the name implies) of a resource or good such as protection of a threatened or endangered species do not arise from consuming it in any physical way. Instead, these values arise from active use values associated with viewing them, passive use values from reading or seeing films about them, or from existence values.

Having information on the benefits of protecting Steller sea lions and improving our understanding of the public's attitudes toward efforts to increase Steller sea lion stock sizes or improve the species' listing

status can aid decision makers in evaluating protection actions for more efficient management and protection of these resources.

A Role for Non-Market Valuation

Protection of Steller sea lions in the form of improvements to its population or ESA status can be classified as a non-market good since it is not traded in markets with observable prices and, thus, cannot be valued using standard market analysis. However, this does not mean its value cannot be quantified. Over the last several decades, economists have developed a set of tools capable of measuring the value of non-market goods. These non-market valuation methods have in common the goal of revealing one or more constructs related to consumer theory that explain an individual's behavior and choices with respect to the non-market good that can be used to estimate the value the individual places on the good, often measured in terms of the individual's willingness to pay (WTP).

Non-market valuation methods can be categorized into two types: revealed preference (RP) and stated preference (SP) methods. Revealed preference methods utilize information on observed behavior to reveal the value of non-market goods. Stated preference methods, on the other hand, rely on data consisting of what people say in responses to carefully constructed survey questions. Stated preference questions involve hypothetical market scenarios where respondents' preferences and values for the non-market good are revealed through their responses. For example, to value "X" using the commonly-used SP question called a dichotomous choice contingent valuation question, respondents are asked one or more yes/no questions of the form: "Would you pay \$Y for X?" A "yes" response indicates the respondent's WTP for X is at least as large as \$Y, while a "no" response reveals that the respondent's WTP is lower than \$Y. For responses to questions of this type where \$Y varies across the sample, statistical methods can be used to indirectly estimate the WTP by estimating the preference function assumed to underlie the observed choices.

For many non-market goods, such as protection of Steller sea lions, there is no observed behavioral information available to reveal public benefits; thus, researchers must rely on stated preference methods in order to quantify them. These methods have been used to estimate the economic values of protection, preservation, and population increases, among other aspects, related to a variety of threatened and endangered marine species, including Atlantic salmon, loggerhead sea turtles, humpback whales, gray whales, Mediterranean monk seal, and Hawaiian monk seals.

A Public Survey

A mail-based stated preference survey was developed by members of the Alaska Fisheries Science Center's (AFSC) Economics and Social Science Research Program and collaborators at the University of Washington and Stratus Consulting, from Boulder, Colorado. The purpose of the survey was to collect information on attitudes toward threatened and endangered species and Steller sea lions, and preferences for protecting Steller sea lions that can be used to estimate the public benefits of providing additional protection to Steller sea lions, above and beyond current protection measures. Additionally, the collected information is intended to shed light on public attitudes toward threatened and endangered species in general and Steller sea lions in particular. The survey was developed and carefully tested with the aid of a series of focus groups and cognitive interviews held in cities across the United States including Alaska. The survey also incorporated input from several Steller sea lion biologists and experts in stated preference techniques and survey design and methodologies.

The survey is divided into several sections. The first section sets the broader stage of threatened and endangered species by describing the ESA, how and what it protects, definitions for "threatened species" and "endangered species," and reasons why people may be interested in protecting threatened and endangered species (i.e., benefits of protection) or not protecting them (i.e., costs of protection). The section also lists the number of species by type (e.g., mammals, reptiles, birds) protected by the ESA. The second section identifies other seal and sea lion species that may be similar or related (taxonomically and in appearance) to Steller sea lions and provides information on population sizes and trends of these species. Presentation of this information is critical to respondents whose preferences for protecting Steller sea lions

are dependent in some way on what is going on with other species they view as similar. It also serves as a reminder that other species may need protection while respondents answer stated preference questions about paying for additional Steller sea lion protection. In this fashion, this information acts as a reminder that their money is limited and spending it on additional Steller sea lion protection makes it unavailable for other uses (i.e., there are opportunity costs to spending more money on Steller sea lion protection). Such budget reminders are important in stated preference surveys to reduce the chance that respondents will overstate how much they are willing to pay.

The subsequent section presents information on Steller sea lions specifically, including their size and appearance, diet, distribution, and a description of the population declines over time. The section also describes potential causes behind the observed declines and efforts taken to protect Steller sea lions, both historically and presently, and the outlook for the two stocks if current protection and population trends continue. The next section discusses the possibility of additional protection measures and the potential positive and negative effects of these actions on the eastern and western stocks of Steller sea lions, fishing interests, and U.S. households. This provides the set-up for the stated preference questions, which are asked in the next section following instructions on answering the questions. The SP questions and the analysis of the responses to them are described in detail in this article. Following the SP questions, the survey concludes with questions about the respondent and the respondent's household.

A total of 5,000 randomly selected U.S. households were mailed a survey in 2007, comprised of 800 Alaska households and 4,200 other or "rest of U.S. households." Of these 5,000 household mailings, 238 were undeliverable, and 26 of the intended recipients were deceased. Excluding the undeliverables and deceased, the final overall response rate was 62.1%. The individual stratified sample response rates were 60.7% for the random sample of rest of U.S. households and 70.6% for the sample of Alaska households. These response rates are generally high compared to other mail-based public surveys.

Of concern in survey research is the potential for non-response bias. This can

Table 1. Sample and population demographics of Alaska and "rest of U.S." households. Census data are from the U.S. Census Bureau's American Community Survey (ACS). ACS-based race percentages do not add up to 100% due to exclusion of mixed/multiple and "other" race percentages.

Characteristic	Rest of U.S. respondents	2006 ACS–U.S.	Alaska respondents	2006 ACS–Alaska
Educational attainment				
Some high school or less	5.70%	16.0%	3.8%	10.3%
High school graduate or equivalent	25.4%	30.2%	24.2%	28.7%
Some college or Associate's degree	30.1%	26.9%	34.2%	34.2%
College degree or higher	38.9%	27.0%	37.9%	26.9%
Median age (18 and older)	53	35 to 44	53	35 to 44
Mean household size	1.74	2.61	1.72	2.82
Percent male (18 and older)	58.4%	48.6%	69.6%	51.5%
Race				
Asian	2.8%	4.4%	3.5%	4.5%
American Indian/Alaska Native	2.0%	0.8%	12.9%	13.1%
Black/African American	6.3%	12.4%	0.6%	3.2%
Native Hawaiian/Other Pacific Islander	0.7%	0.1%	0.6%	0.6%
White/Caucasian	84.3%	73.9%	81.5%	68.7%
Household income				
Less than $10,000	4.6%	8.0%	3.1%	4.7%
$10,000 to $49,999	36.0%	43.3%	26.6%	37.2%
$50,000 to $99,999	37.8%	30.9%	42.7%	35.5%
$100,000 to $149,999	13.5%	10.9%	19.7%	14.3%
$150,000 to $199,999	3.9%	3.6%	3.4%	5.2%
$200,000 or more	4.2%	3.4%	4.5%	3.1%

occur when specific types of individuals do not respond to the survey (unit non-response) or to specific questions (item non-response). This bias is minimized when overall survey response rates and response rates to individual questions are high. In this survey, item non-response rates were low, with almost all questions having item non-response rates lower than 5% of the overall sample.

Table 1 presents the demographic information for each sample and the corresponding population numbers from the U.S. Census Bureau. Both the "rest of U.S." and Alaska respondents were different from the population in terms of education, age, household size, gender, race, and income. Compared to the population estimates, the samples of respondents overall tended to be more educated, older, live in households with fewer residents, consist of more males, have fewer minorities, and be more afflu-

ent. These differences are discussed below with respect to their potential impact on the results of the analysis.

Public Attitudes Toward Steller Sea Lions

The survey includes several questions intended to assess the respondent's attitudes toward Steller sea lions. After being presented with information about the western and eastern stocks, survey respondents were asked to indicate how concerned they are about each stock. Until recently, the western stock population as a whole has been decreasing, while the eastern stock has been increasing slowly for years. As reported in the 2008 January-March AFSC Quarterly Report, over 40% of respondents in each sample (44% of Alaska respondents and 41% of other U.S. respondents) indicated they are "very concerned" or "extremely

concerned" about the western stock. In contrast, the proportion of respondents in each sample that is "very concerned" or "extremely concerned" about the eastern stock is lower (23% of Alaska respondents and 25% of other U.S. respondents).

The survey also included two questions that qualitatively gauge respondents' preferences for the need for further protection actions. Respondents were asked the extent to which they agreed or disagreed with two statements: "Even if it costs us more money, we should do more so the western stock is no longer endangered" and "So long as the eastern stock recovers, it doesn't matter to me if the western stock remains endangered," where "recover" refers to a species improving to the point it is taken off the endangered species list. More than 60% of respondents in each sample indicated they "strongly agree" or "somewhat agree" with the first statement (62% of Alaska respon-

dents and 61% of other U.S. respondents), indicating the majority of each sample believe more should be spent to ensure the western stock is no longer endangered. A similarly large proportion of respondents in each sample indicated they "strongly disagree" or "somewhat disagree" with the second statement (74% of Alaska respondents and 67% of other U.S. respondents), suggesting the majority of respondents feel protecting the western stock is independent of how the eastern stock is doing.

These sample results generally indicated very little difference between the attitudes toward Steller sea lions held by Alaska households and those held by other U.S. households. However, given the differences in several demographic characteristics between the samples and populations and between the samples themselves, a more formal analysis using ordered probit analyses was conducted for each question. Ordered probit analyses are used to determine to what extent factors like demographics affect the choices that are observed. The role that demographics play in attitude formation is analyzed by estimating an attitude function assumed to underlie the responses to the attitude question. The estimated attitude function can thus be used to adjust predicted attitudes in cases where the demographics of the sample and population differ. To extend the sample results to the population, the estimated ordered probit models were evaluated for the "average" Alaska and rest of U.S. households and a distribution of predicted attitudinal responses was simulated using Monte Carlo methods (based on 10,000 iterations). Specifically, the probit functions were evaluated at the average characteristics of each population to get estimates of the distribution of attitudinal responses at the population level (Figs. 1-3). A comparison of the resulting 95% confidence intervals around the mean predicted percentages selecting each response further supports similarity of attitudes between average Alaska households and average rest of U.S. households toward the ESA, threatened and endangered species protection, and Steller sea lions.

Public Preferences and Values

The attitudes analysis suggests that attitudes toward Steller sea lions and their protection are very similar between Alaska and other U.S. households. Moreover, the dis-

tributions of attitudinal responses to questions about Steller sea lions appear to reflect a stated desire to do more to protect the western stock beyond the current measures to aid in its recovery. Since these attitudes help shape the preferences that individuals hold for specific programs that would provide additional protection to Steller sea lions, we would expect the average individual in both samples to have a positive WTP for such programs.

To estimate monetary estimates of WTP for additional protection measures, and hence information on the benefits of additional protection, three stated preference questions were included in each survey. In the stated preference questions, respondents are asked to choose their most preferred and least preferred choice between three alternatives, Alternatives A, B, and C. These alternatives differ in the level of protection provided to Steller sea lions, as measured by results the program would have in 60 years on population sizes and the ESA listing status of each stock, and in their costs (Fig. 4). Alternative A in each question reflects the results from the status quo level of protection, while Alternatives B and C cost more, but provide more protection than Alternative A, leading to increased population sizes or an improved ESA listing status. This stated preference format is a type of attribute-based choice experiment question, often simply called a stated choice question. These types of SP questions are commonly used in the marketing and transportation
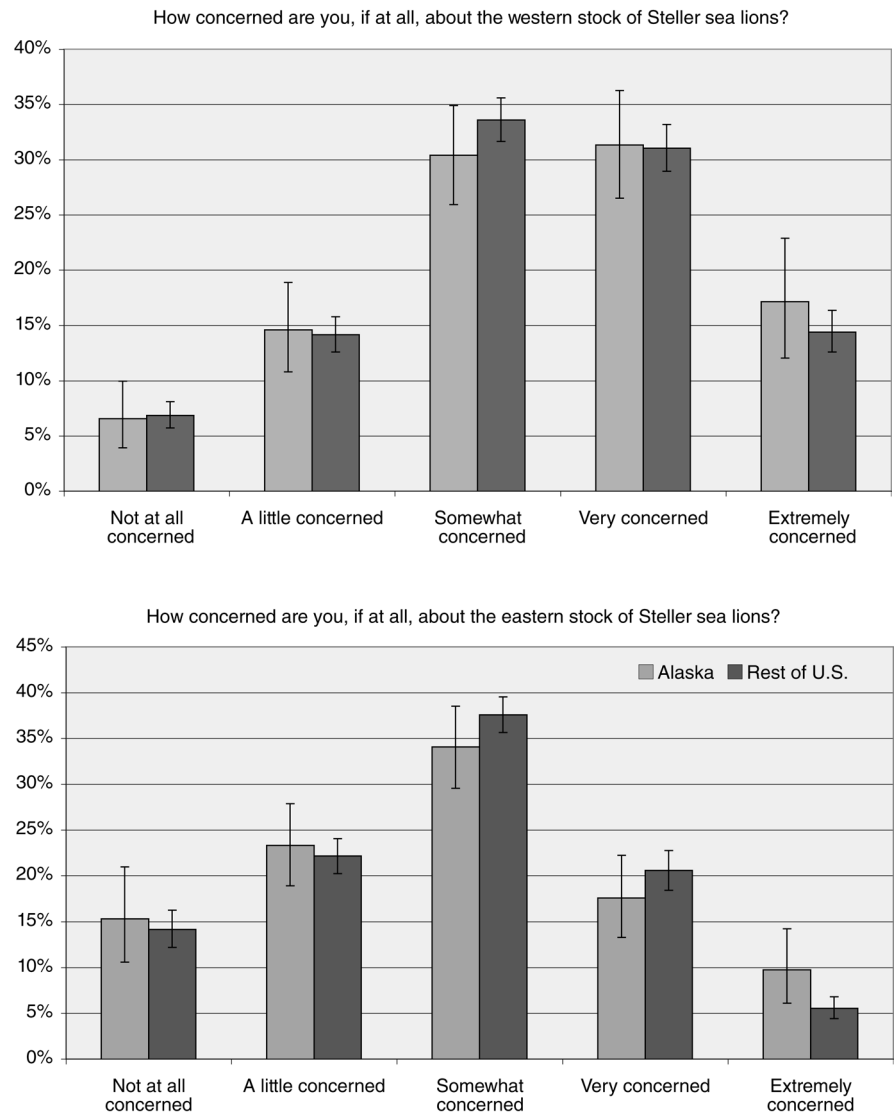

Figure 1. Predicted (simulated) distribution of concern of "average" Alaska households and rest of U.S. households for the western stock and eastern stock with 95% confidence intervals around mean percentages of each concern level.
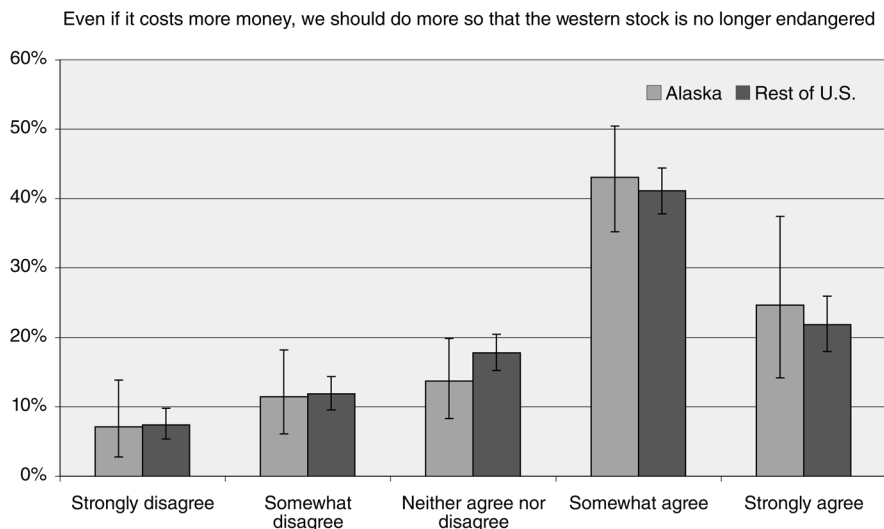
Even if it costs more money, we should do more so that the western stock is no longer endangered

Figure 2. Predicted (simulated) distribution of attitudes of "average" Alaska households and rest of U.S. households for spending more money on protection activities for the western stock with 95% confidence intervals around mean percentages of each response.
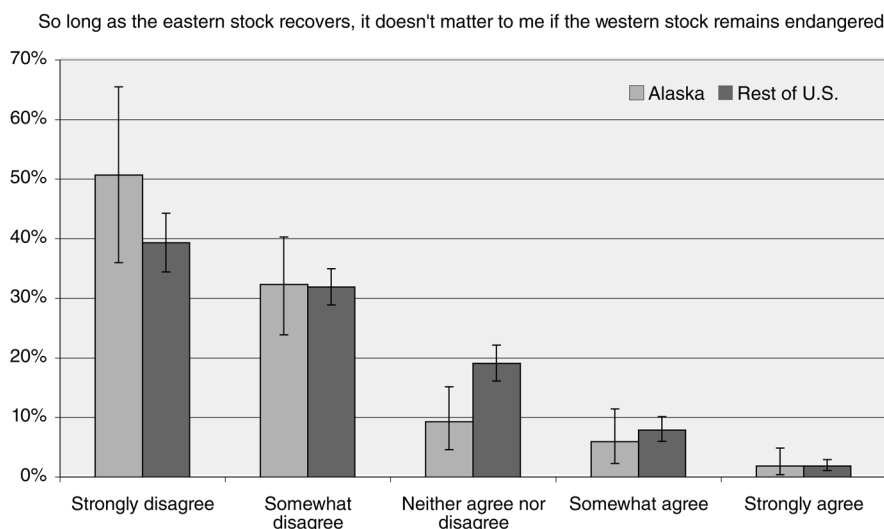
So long as the eastern stock recovers, it doesn't matter to me if the western stock remains endangered

Figure 3. Predicted (simulated) distribution of attitudes of "average" Alaska households and rest of U.S. households towards protecting the western stock even if the eastern stock recovers with 95% confidence intervals around mean percentages of each response.

research literature, as well as increasingly in non-market valuation of environmental goods and services.

An important consideration in constructing the surveys and the SP questions was how to deal with the uncertainty of the future regarding the western stock population trend (i.e., whether it will in fact stabilize, increase, or even decrease with current protection actions in the future). This has implications on the interpretation and utility of the WTP estimates since the estimates are measures of the economic value people place on a set of protection action results that are measured as changes from

a baseline that is not known with certainty because it occurs in the future. To deal with this uncertainty, several survey versions that present different baseline futures for the western stock were constructed to allow estimates from each of these surveys to bound the likely range of economic values under different possible futures and, therefore, provide information to decision makers and policy analysts usable for a range of assumptions that may be made about future western stock population levels when evaluating potential management measures.

Based on input from biologists, three main survey versions were developed to

cover the range of plausible future populations under the current set of protection actions. The decreasing version assumes under Alternative A that the western stock population will decrease in the future from its current population of 45,000 to 26,000 and remain endangered in 60 years. Alternative A in the stable version assumes the western stock population will stabilize over time, but will likewise remain endangered. And Alternative A in the increasing version assumes an increasing western stock population in the future, from 45,000 to 60,000, but will be relisted as threatened. In all versions, the eastern stock of Steller sea lions is assumed to be recovered in 60 years, which appears to be the consensus among biologists and is consistent with the SSL Recovery Plan and recent population trends in the stock. Projected populations of the eastern and western stock under each alternative baseline are displayed in Figure 5.

For each of these three survey versions and for both the Alaska and rest of U.S. subsamples, separate preference models and WTP have been estimated (for a total of six models). These model and WTP results are preliminary and are undergoing formal peer review at this time and, thus, cannot be considered final until the results have been through that process. They are included here to illustrate the type of benefit information this stated preference survey can provide.

The estimated stated preference choice models used to calculate WTP presented in this article assume preferences for providing additional protection to the western stock and eastern stock that depend upon the results of the protection on the population sizes and ESA statuses of the stocks. The models account for potential heterogeneity of preferences across different people (by employing a random parameters mixture modeling approach) and the fact that respondents provide a full rank ordering of their preferences for each of the three protection alternatives in each question.

The preliminary model results for both the Alaska and rest of U.S. models suggest a context-specific effect in each model based on the presentation of the expected future baseline (i.e., what ESA status and population size the western stock will achieve in 60 years under current protection). Respondents appear to hold values for programs that improve conditions to

Below the table, indicate which of these three alternatives you most prefer, and which you least prefer.			
	Results in 60 years for each alternative		
	Alternative A **Current program**	**Alternative B**	**Alternative C**
Western stock			
Population status................ (Endangered now)	Endangered	Endangered	Threatened
Population size.................. (45,000 now)	26,000	30,000	75,000
Eastern stock			
Population status............... (Threatened now)	Recovered	Recovered	Recovered
Population size.................. (45,000 now)	60,000	80,000	60,000
Added cost to your household each year for 20 years.............	$0	$20	$40
	Alternative A	**Alternative B**	**Alternative C**
Which alternative do you **prefer the most?** *Check one box*------>	☐	☐	☐
Which alternative do you **prefer the leas**t? *Check one box*------>	☐	☐	☐

Figure 4. Example of choice experiment question from Decreasing Version of survey.

the next one or two status levels from the status quo future baseline ESA status level, but exhibit an apparent "wait and see" attitude towards spending for multiple status level improvements. For example, for the rest of U.S. decreasing version, there is value to increasing the western stock if the status remains endangered, and to improving conditions to reach a threatened status level, but diminished incremental value to a program that increases populations once at a threatened status level or to the recovered status level. Similarly, for the rest of U.S. stable version baseline, there is value to increasing the western stock population size so long as its status remains endangered, and to improvements that result in achieving a threatened status, but to a lesser extent to achieve a recovered status level. Moreover, there is little or no value, at this time, for increases in stocks within the improved status levels. For the rest of U.S. increasing baseline, where the scenario presents stocks as increasing and likely to be uplisted to threatened in the future, further improvements to the western stock while at the threatened level and improving to a recovered status, adds value, but im-

proving stocks beyond the minimum level required to reach the Recovered status adds little or no additional value. The Alaska data models revealed very similar patterns of preferences. Also, the model results generally suggest increases in the eastern stock population are valuable but are worth less than improvements to the western stock.

All the model results suggest that preferences for initial improvements to the western stock population size and status vary over the population, as indicated by significant estimated standard deviations on the random parameters associated with these improvements. This result indicates the presence of individuals who have strong preferences for protecting Steller sea lions, as well as those with strong preferences for not providing additional protection to the species.

To illustrate the range of economic benefits associated with improvements to the western stock population and ESA status, mean annual household WTP estimates and associated 95% confidence intervals were calculated for several hypothetical policy scenarios using the preliminary results from each of the six models. The estimated

models can be used to evaluate numerous possible improvements to the western stock status and population, but for this article, four scenarios were selected as a reasonable subset of possible policy scenarios of interest. Scenario 1 corresponds to the case where the western stock remains at its current level (45,000) and status (endangered). This scenario is exactly the assumed baseline future in the stable version, and hence no change beyond the status quo efforts need be made to achieve it in that version of the survey. In Scenario 2, a population of 50,000 western stock sea lions results in 60 years, but the status remains endangered. Since only improvements in Steller sea lion protection are valued, Scenarios 1 and 2 cannot be calculated for the increasing version samples since the baseline future in that version assumes the western stock is in better shape than would be achieved in the scenarios. In Scenario 3, the western stock population increases to 70,000, a level assumed to be in the threatened status range. The final scenario (Scenario 4) represents the case where the western stock reaches a population size of 90,000, a level assumed to be above the level needed for the stock to
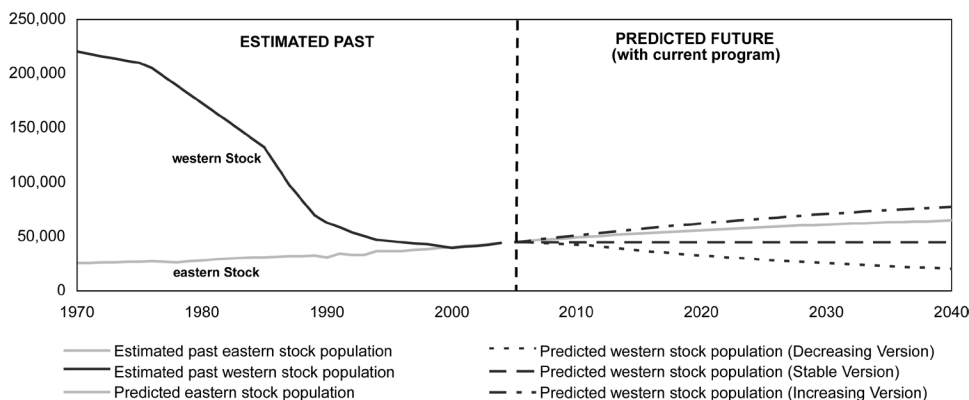
Figure 5. Estimated past and predicted future Steller sea lion populations under alternative survey versions

be removed from the ESA list of threatened and endangered species (i.e., the western stock recovers).

Table 2 presents the preliminary estimates of annual mean household WTP and 95% confidence intervals for each scenario and for both the rest of U.S. and Alaska household model results for the decreasing version, stable version, and increasing version. Assuming the western stock population declines and remains endangered in 60 years, the mean annual WTP for maintaining a stable population at its current level is $88 per household for rest of U.S. households and $112 for Alaska households. Under the same assumption, increasing the stock by 5,000 sea lions adds about $23 to rest of U.S. households' mean WTP and about $29 to Alaska households' mean WTP. Assuming the western stock will remain at its current population size and endangered in 60 years yields mean household WTP estimates for Scenario 2 of approximately $36 and $20 for rest of U.S. and Alaska households, respectively. Increasing the western stock to 70,000 and having it up-listed to a threatened status is annually worth between $35 ($33) and $151 ($236) on average to rest of U.S. (Alaska) households, depending upon the assumed future population and status of the western stock under the current protection program. Again, depending upon the assumed future baseline for the western stock, rest of U.S. (Alaska) households are willing to pay on average between $84 ($110) and $155 ($337) each year for a western stock that is no longer on the ESA species list with a population of 90,000.

Several interesting patterns emerge in the results. First, the 95% confidence intervals around the mean WTP estimates for the

rest of U.S. household sample and Alaska household sample overlap considerably, and in many cases the mean Alaska household WTP confidence interval completely contains the rest of U.S. WTP confidence interval. This provides evidence that WTP estimates are similar across the Alaska and rest of U.S. samples, and further supports the similarities found in the analysis of the attitudinal data. Second, these preliminary results suggest that WTP for additional Steller sea lion protection actions is sensitive to the projected future baselines. We would expect that for a given scenario, the WTP for the decreasing version would be greater than the stable version since a given scenario represents a larger improvement for the decreasing version than for the stable version because of the differing baseline levels. Similarly, one would expect the increasing version WTP estimates to be smaller than either of the other two versions. For small changes, as reflected in Scenario 2, the WTP does follow this expected pattern. Moreover, in Scenarios 3 and 4, the decreasing version WTP estimates are greater than the increasing version values. Counter-intuitively, however, the stable version WTP values appear to exceed the decreasing version values. However, the importance of this deviation from our expectations is mitigated by the fact that the confidence intervals of the mean WTP values of the decreasing and stable versions overlap considerably, suggesting they are not statistically different from one another in these scenarios. Third, public values for protecting Steller sea lions are positive and large, with maximum mean annual household WTP of about $151 for rest of U.S. households and $337 for Alaska households across all scenarios. It should

be noted though that the WTP does appear to level out for larger, nonincremental improvements, at least when taking account of the error bounds around the mean WTP amounts.

Because these sample estimates of the average household WTP are preliminary, no attempt to generate an estimate of the total aggregate public benefits of any particular scenario has been made yet. However, considerations for adjusting the sample results to the population due to the demographic differences between the samples and corresponding populations are being investigated, but initial efforts suggest that the WTP for Steller sea lion protection does not vary systematically with demographics in a statistically significant way.

Summary and Further Research

This article has described a survey and related analyses intended to provide information about the public's attitudes toward Steller sea lions, as well as information on preferences for providing additional protection to Steller sea lions that can be used to estimate the public's WTP for these protection improvements. Both Alaska households and other U.S. households were sampled to enable separate analyses of the attitudes and preferences held by each population.

The analysis of the attitudinal data revealed similarities between Alaska and rest of U.S. households in terms of their attitudes toward the Steller sea lion, even after factoring in differences in demographics between the two populations. It showed a general support for additional protection measures, above and beyond the ones currently in place, for SSLs. In our analysis of the stated preference data, these attitudes translated to positive and large mean WTP amounts for each type of household. The estimated preference functions under alternative assumptions about what is likely to occur to the western stock in the future reveal that households are willing to pay for marginal improvements to Steller sea lion protection, but are willing to pay incrementally less for larger-scale changes. This seems to reflect a "wait and see" attitude towards spending for multiple status level improvements.

This research may be useful to resource managers as it provides economic benefit information for a species whose protection

Table 2. Preliminary sample mean annual household "willingness to pay" (WTP) for hypothetical policy scenarios representing improvements to Steller sea lions.

Scenario in 60 years (Eastern stock assumed to recover in each)	Decreasing Version Western stock declines to 26,000 and remains endangered	Stable Version Western stock remains at 45,000 and remains endangered	Increasing Version Western stock increases to 60,000 and is threatened
Scenario 1. Maintain western stock population at 45,000 and endangered			
a) Rest of United States	**$87.89** ($72.55, $105.55)	**$0**	n/a
b) Alaska	**$112.03** ($75.22, $157.74)	**$0**	n/a
Scenario 2. Western stock population increases to 50,000 and is endangered			
a) Rest of United States	**$111.12** ($91.95, $131.65)	**$35.81** ($26.33, $45.48)	n/a
b) Alaska	**$141.65** ($97.02, $192.21)	**$20.15** (-$79.18, $86.33)	n/a
Scenario 3. Western stock increases to 70,000 and is threatened			
a) Rest of United States	**$151.13** ($128.02, $175.48)	**$123.02** ($101.96, $144.63)	**$34.94** ($29.03, $41.16)
b) Alaska	**$186.86** ($135.34, $243.72)	**$235.64** ($78.03, $501.49)	**$33.30** ($20.92, $49.06)
Scenario 4. Western stock increases to 90,000 and is recovered			
a) Rest of United States	**$132.11** ($93.40, $168.65)	**$155.16** ($126.28, $182.61)	**$83.80** ($66.73, $100.94)
b) Alaska	**$226.87** ($131.80, $327.36)	**$336.64** (-$11.25, $692.10)	**$110.27** ($87.45, $135.89)

* Confidence intervals are calculated using simulation methods.

and management affects other species and industries and, thus, has large economic consequences. The economic costs of protecting the species are generally estimable and, thus, more easily incorporated in policy discussions. Still, this research has shown the benefits of alternative management actions that affect a public resource like the Steller sea lion can be quantified as well using carefully constructed and implemented stated preference survey methods. As the economic benefit results presented here are preliminary and further work on calculating aggregate values remains to be done, readers should view the results less as exact value estimates, and more as indicative of the likely range of economic benefits

associated with providing additional protection to SSLs and of the types of benefit information SP studies can provide to decision makers and policy analysts.

In closing, it should be noted that the use of non-market valuation in fisheries-related applications is expected to expand in the future as the creation of an inventory of non-market values for protected species, essential fish habitat, and ecosystems is included in the National Marine Fisheries Service (NMFS) Strategic Plan for Fisheries Research. Thus, it is not surprising that other non-market valuation research involving-protected species recently has been undertaken by economists at the AFSC and NMFS.

Additional Reading

Freeman, A. Myrick (2003) The Measurement of Environmental and Resource Values: Theory and Methods, Second edition, Resources for the Future: Washington, D.C.

Loomis, John B. and Douglas S. White (1996) "Economic Benefits of Rare and Endangered Species: Summary and Meta-analysis." Ecological Economics, 18: 197-206.

National Marine Fisheries Service (2007) "NMFS Strategic Plan for Fisheries Research," U.S. Department of Commerce, NOAA.