Report on NOAA Fisheries
2011 Recreational Fisheries Data and Model Needs Workshop

June 2013

Sabrina Lovell
NOAA Fisheries
Office of Science and Technology
Economics and Social Analysis Division
Silver Spring, MD

Contents

I. Introduction

A better understanding of the social and economic aspects of recreational fishing is as an essential component of improved stewardship of the Nation's fishery resources. The Economics and Social Sciences program within NOAA Fisheries' Office of Science and Technology (OST) collects economic data, develops economic models, and conducts analyses to describe the economic impacts associated with marine recreational fisheries; estimate the level and distribution of the net benefits derived from those fisheries; understand and predict the behavior of recreational fisheries participants; and understand the outcomes of alternative management actions on recreational fisheries and their participants.

A number of different laws require NOAA Fisheries to collect economic data on both commercial and recreational fisheries. Foremost amongst them is the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Others include the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), Executive Order 12866 (E.O. 12866), and the Regulatory Flexibility Act (RFA). The Magnuson-Stevens Fishery Conservation and Management Act (MSA) grants statutory authority to the Secretary of Commerce (Secretary) to manage federal fisheries in the United States. NOAA Fisheries is the federal agency with delegated authority from the Secretary for fishing activities in federal waters. Most notably, the MSA provides the authority to collect economic data.

Basic economic data are required to meet a number of the ten National Standards outlined in the MSA. Similarly, basic economic data are required to meet some of the MSA-required provisions for each fishery management plan (FMP) prepared by any Regional Fisheries Management Council, or by the Secretary [Sec. 303(a)]. For example, one requirement calls for a description of the recreational and for-hire fishing sectors that participate in the fishery and the

associated economic impacts of those sectors. Another requirement specifies that if rebuilding plans or other conservation and management measures are developed that reduce the overall harvest in a fishery, then consideration must be given to the economic impact of the harvest restrictions or recovery benefits on the fishery participants in each sector affected, including recreational anglers and the for-hire fishing sector of the fishery.

The National Environmental Policy Act requires Federal agencies to use a systematic, interdisciplinary approach in planning and decision-making, including the identification of the direct and indirect effects of proposed policy changes, including the effects on environmental amenities such as recreational fishing. NEPA explicitly requires that all environmental impact statements produced include information on biological, ecological, economic, and social consequences. For recreational fisheries, economic data, and the models they support, are necessary for conducting the economic analyses required by NEPA for predicting the behavioral responses of recreational fishermen to proposed regulatory change.

Recreational economic data and the economic models they support are needed to conduct the economic analyses required by E.O. 12866 and the RFA for proposed regulations expected to affect recreational fisheries. E.O. 12866 requires NOAA Fisheries to conduct an assessment of costs and benefits of available regulatory alternatives for proposed regulations. Further, it states that alternatives that maximize net benefits should be chosen unless prohibited by other applicable law and that along with other information, decisions should be based on the best reasonably obtainable economic data. The RFA requires NOAA Fisheries to consider the impact of a proposed rule on small entities and any alternatives that minimize adverse economic impacts.

NOAA's 2010 Recreational Saltwater Fisheries Action Agenda called for a gap analysis of current recreational economic data programs at NOAA Fisheries and a subsequent workshop to discuss the findings of the gap analysis. NOAA Fisheries' Office of Science and Technology, the Science Centers across the Nation, NOAA Fisheries' Regional Offices in the Pacific Islands, Alaska, and the Southeast, and the Atlantic Highly Migratory Species Management Division (AHMS) of the NOAA Fisheries Office of Sustainable Fisheries participated in the data gap analysis during 2010 and a workshop held in July 2011 in Silver Spring, Maryland.

The gap analysis identified economic data gaps for six NOAA Fisheries regions (Northeast, Southeast, Southwest, Northwest, Pacific Islands, Alaska) and AHMS, challenges related to data collection, and suggestions for improving data collection. This report summarizes the discussions and findings of the *2011 NOAA Fisheries Recreational Fisheries Data and Model Needs Workshop*. The following sections highlight the types of recreational economic data required to prepare economic models and analyses that support well-informed decisions concerning marine recreational fisheries. The recreational economics data collection program at NOAA Fisheries collects economic data to support four general types of models that are typically used in analyses of recreational fishing. However, the program does not limit data collection or analyses to these four types, but also receives input from constituents for special projects and data collections, as needed. The report is organized into sections based on the four standard modeling approaches. This report starts with a discussion of Regional Impact Models that are used to estimate the economic impacts of recreational fishing or the changes in these impacts as a result of management actions. The second section discusses data and models based on the actual behavior of anglers, known as revealed preference (RP) models. Next, we discuss data and models specifically targeted at the recreational for-hire industry. We conclude with a

discussion of stated preference (SP) data and models which are used to elicit angler preferences over management options.

II. Regional Economic Impact Models

Applications to Management Needs

As discussed above, a number of federal laws and policies require NOAA Fisheries to provide an analysis of the economic impacts associated with proposed changes in fisheries regulations and policies. Economic impact models are used to estimate how policy actions or environmental factors would be expected to affect the economy of a region. The types of questions appropriately answered by economic impact models are those related to the distributional effects of short-term policy changes, questions on the economic contributions of recreational fishing to a region, and questions on the effects to the local economy as a result of changes in fishing-related business activities.[1]

The economic impacts of marine recreational fishing arise from changes in expenditures made by recreational anglers as a result of policy changes, natural changes affecting the marine environment, or other actions that may cause a change in spending by anglers. When anglers spend money on fishing trips or for fishing related goods, the effects of that spending can be classified as direct, indirect, or induced. Direct effects are those that occur in the retail and service oriented businesses where anglers purchase goods or services directly related to their marine fishing activities (e.g, bait and tackle shops, marinas, charter fishing trips, grocery stores). Indirect effects occur when these retail and service businesses purchase supplies from

[1] In the discussion here, the term economic contribution refers to the economic activity in a region generated by recreational fishing under the status quo. Economic impacts refer to the change in economic activity generated by recreational fishing under changed conditions (such as a new fisheries policy or environmental disaster).

wholesale trade businesses and manufacturers, and pay operating expenditures (indirect effects continue between all industries in a region connected by the initial purchase). Induced effects are measured by the purchases made by employees in the direct and indirect sectors in the normal course of household consumption. Aggregating over the direct, indirect and induced effects gives the total level of economic impacts in a region.

The ratio of total impacts to direct angler expenditures is referred to as the economic impact multiplier and shows how $1 spent by an angler cycles through the regional economy. Economic impacts are measured in terms of business sales (referred to as "output"), labor income, employment, and value-added related to recreational fishing. Sales are the gross sales by businesses within the economic region affected by an activity. Labor income includes personal income (wages and salaries) and proprietors' income (income from self-employment). Employment includes both full-time and part-time jobs. Value-added is the contribution made to gross domestic product from commercial or recreational fishing.

Description of Data

Data on angler trip expenditures, purchases of durable goods, angler characteristics, and details of the fishing trip are required elements for building economic impact models. Different survey methods have been used by NOAA Fisheries to collect expenditure data, angler characteristic data, and trip data. These include add-on questions to the Access Point Angler Intercept Survey (APAIS)[2], a combination of mail and phone follow-ups to the intercept survey, telephone only surveys, and mail only surveys. Starting in 2006, nationwide expenditure surveys have been conducted on a 5-year schedule. Table 1 lists the expenditure surveys conducted since 1998.

[2] This survey is part of NOAA Fisheries' Marine Recreational Information Program (MRIP). Previous versions of this program were referred to as the Marine Recreational Fisheries Statistics Survey.

Table 1: Economic Impact Surveys

Region	Survey Year
AHMS	**2011**
Alaska	**2002, 2007, 2012**
Northeast	**1998, 2006, 2011**
Northwest	**2000, 2006, 2011**
Pacific Islands	**2006, 2011**
Southeast	**1999, 2003/2004, 2006, 2011**
Southwest	**2000, 2006, 2011**

Table 2 summarizes the different types of data that are routinely collected for use in regional impact modeling and analyses. Many of the data categories listed are also used in the other economic models described in the following sections, in particular information related to trip details and angler characteristics.

Table 2: Data Collected for Regional Impact Models

Trip Expenditures	Trip Details	Annual Expenditures	Angler Characteristics
Transportation	Date	Tackle	State of Residence
Boat Fuel	Location	Rods and Reels	Zipcode of Residence
For-hire Fees	Mode of Fishing	Other Fishing Gear	Household Income
Bait	Target Species	Fishing Licenses	Age
Ice	Number and Type of Fish Caught and Released	Other Gear	Gender
Parking/Site Access	Purpose of Trip	Subscriptions	Education Level
Food and Drink	Gear Used	Boats	Fishing Experience
Lodging	Day Trip or Multi-Day	Vehicles	Race and Ethnicity
	Number of Anglers	Second Homes	

Description of Models

The methodology used to estimate economic impacts is either a form of a Social Accounting Matrix (SAM) Input-Output (I/O) model or a computable general equilibrium model (CGE). The most common economic impact model used by NOAA Fisheries for analyzing recreational fishing is an I/O model that uses the software IMPLAN as a platform. Input-output models are designed to show how the demand for final goods and services in a regional economy is related to the supply of intermediate goods and services. Input-output models are capable of tracking quantities and purchasing locations of expenditures by anglers, support businesses, and employees in the affected industries. The IMPLAN-based model also captures transactions between government and households and between capital and households. The limitations of this model are that prices and commodity input structures are fixed, it cannot model changes over time, has constant returns to scale, does not include supply constraints, and cannot produce

welfare estimates that are necessary for a cost-benefit analysis. CGE models do not suffer from some of these limitations, but the number of sectors that can be modeled is more constrained than with an IMPLAN model due to a general lack of elasticity information for each sector that is required to run a CGE model. If a CGE model was used instead of the typical IMPLAN model, then welfare estimates associated with a policy change could also be calculated. For determining how recreational fishing contributes to the economy under existing regulations and policies, there is no difference between a SAM IO model like IMPLAN and a CGE model in terms of estimating regional impacts. For estimating economic impacts related to proposed policy changes, a CGE model entails more realistic assumptions about the production process (via price changes and substitution) but the differences will be minimal if the proposed actions would not be expected to affect prices.

Using data from the 2006 and 2011 nationwide survey, OST developed economic impact models for each coastal state.[3] These models have been used to estimate the economic contributions of marine recreational fishing in NOAA Fisheries' annual series *Fisheries Economics of the United States*. In addition to these estimates and models, some regions have developed their own economic impact models for use in their regulatory review analyses. In the Northeast region, economic impact models are frequently used to analyze the impacts associated with changes in annual catch limits and to determine the impacts of various management actions. The Southeast region has made extensive use of the results of the economic impact models developed by OST. Plans are underway to develop custom regional models for specific regulatory review purposes in the Southeast and Southwest regions. In the Northwest region, a

[3] B. Gentner and S. Steinback. The Economic Contribution of Marine Angler Expenditures in the United States, 2006. U.S. Department of Commerce, NOAA, NOAA Fisheries. NOAA Technical Memorandum NOAA Fisheries-F/SPO-94. November 2008.

cost and earnings survey for for-hire vessels is being used as the data source for estimating economic contribution and impacts of the for-hire industry. Future work in the Northwest will use data collected in the 2011 expenditure survey to develop a model of the economic impacts changes in fishing effort of recreational anglers. In the Alaska region, a CGE model has been developed to look at the economic impacts of harvest policies (Lew and Seung, 2010).

Challenges

Workshop participants noted a number of challenges related to both the collection of expenditure data and issues related to use of the models.

Data Collection

The NMFS nationwide angler expenditure survey done every five years provides a standard set of data across all states and for consistent time periods. By conducting the survey nationwide versus regionally, NMFS has reduced the amount of time, money, and staff effort that is required to collect the data. However, there are still challenges associated with collecting expenditure data, as follows:

- a high level of funding is required; typically two years of the recreational economic program's budget (the 2011 survey cost approximately $910 thousand dollars);
- development, implementation, and analysis requires a significant amount of staff time (although this should decrease each successive time the survey is implemented);
- response rates in some states are low when broken out by fishing mode and resident status; and
- in the Southeast, the headboat sector is not included in angler expenditure surveys and resulting economic impact models because headboat data is collected through a separate NOAA Fisheries Southeast headboat survey of vessels.

Modeling

Challenges that often arise related to the economic impact models include the following:

- software is expensive to purchase and update regularly;
- a basic underlying knowledge of IO is required to run the models;
- time required to set up and run the models can be significant;
- analyzing the change in economic impacts as a result of proposed policy changes requires information on potential changes in fishing effort or participation, which is often unavailable or challenging to estimate;
- the frequency of purchases of "semi-durable" goods (fishing tackle, rods, reels) and durable goods (boats) that are purchased more infrequently than on an annual basis makes it hard to analyze how sales of these items would be affected by changes in management policies, large scale closures, and environmental events (such as oil spills or natural disasters);
- for CGE models, sectors are highly aggregated, there is a lack of data on elasticities, and the time required to set up and run CGE models is longer than for I/O models ;
- impacts to coastal economies and small communities are hard to estimate given the state-level nature of the data; and
- results of regional impact analysis are often confused with economic efficiency, or benefits analysis, by non-economists.

Potential Improvements

A number of suggestions for improving data on angler expenditures and the associated use of economic impact models were provided at the workshop. These included improvements in

survey methods, survey sampling, and use of the data. The following recommendations were made:

Data Collection

- improve survey design to increase response rates and reduce the potential for both recall and non-response bias;
- increase sample sizes within mode, targets species, and resident status categories;
- obtain data on location of purchases within a state in order to produce impact estimates for different areas within a state;
- further refine expenditure categories on survey questionnaires to enable a better match with IMPLAN industry and commodity categories;
- standardize data collection across California, Oregon, and Washington to ensure that angler catch and trip characteristic data is consistent;
- include surveys of in-river salmon and steel-head anglers in California;
- include non-US-bound for-hire anglers in Southern California and expand coverage of boats leaving from private docks in California;
- include for-hire patrons in the Pacific Islands; and
- subsample high expenditure anglers focusing on big game and tournaments.

Modeling

- For impact analyses, increase the use of NOAA Fisheries estimates of changes in effort and participation to determine changes in angler expenditures, and then use these new expenditure levels as input into regional impact models.

III. Revealed Preference Models

Applications to Management Needs

Revealed preference (RP) models provide insight into the behavior of recreational anglers and the economic value of recreational fishing trips. RP models are based on the underlying theory that the demand for, and value of, a recreational trip or its' elements can be inferred from the observed choices of recreational anglers. Broadly speaking, there are four potential types of applications of RP models. RP models are useful for answering questions related to fisheries management, evaluating projects that affect fisheries (such as dam removal), for conducting natural resource damage assessment (such as an oil spill), and for informing ecosystem management decisions. In a fisheries management context, these models may be used to show the economic effects of different management alternatives under consideration, to analyze the rebuilding of fish stocks, or provide the information on angler behavior that are needed as inputs for regional impact assessments.

More generally, the results of RP models may be included in NOAA Fisheries studies to provide context and interpretation of fisheries trends. They also may be useful for obtaining insights into angler behavior. For example, the results of these models are used to explain how fishing effort would be expected to vary across fishing modes, target species, and sites; how the cost of a trip affects fishing effort; the relationship between demographic characteristics and participation; and how effort is influenced by changes in management options such as bag limits, seasonal closures, or size limits. One question that has not been well addressed to date, but has been put forward as a need, is how changes in regulations in one fishery may affect effort in another fishery. RP models could potentially be used in this context, as well.

Description of Data

The types of data required by this class of models are similar to those collected for use in regional economic impact models as shown in Table 2. These include data on the actual fishing patterns of anglers such as where and when they went fishing, angler demographics, and details of the actual fishing trip (such as target species, species caught, gear used). Additionally, RP models require information about the characteristics of the alternative fishing sites both those chosen by the angler and those not chosen by the angler (such as expected catch or distance from home residence). RP models may also make use of information on non-participants. Data for RP models have been collected fairly routinely in the Northeast and Southeast since the 1990s and in the Pacific Islands regions (2003-2009), by the APAIS and CHTS, and economic add-ons to those surveys. The APAIS routinely collects information on effort, catch, mode of fishing, gear used, fishing site location, and the zipcode of the angler's primary residence. The CHTS is used primarily to produce estimates of effort and participation. Economic add-ons typically have collected information on length of the fishing trip, primary reason for the entire trip away from home if the fishing trip was an overnight trip (i.e., fishing, vacation, business), household income, boat ownership, and whether or not the angler took time off work to take the trip.

In the Southwest (California) and Northwest (Washington and Oregon), some trip information (catch and effort data) is collected routinely in surveys sponsored by the states, but most angler characteristic data are not part of these surveys. In 1998 and 2001, revealed preference studies were conducted in both the Southwest and Northwest regions. In 2009, a limited amount of RP data was collected in the Southwest. The state of Alaska collects catch and effort data on a yearly basis via a mail survey, but does not collect angler characteristic or other economic data. From 2000-2009, three surveys sponsored by the Alaska Fishery Science Center have collected data on angler and trip characteristics. Data collected as part of the 2006 and

2011 NOAA Fisheries nationwide expenditure surveys also provide both trip and angler characteristic information. Table 3 shows the various economic data collections between 1998 and 2011 that provide data for RP models.

Table 3: Revealed Preference Surveys

Region	Survey Year
AHMS	**2011**
Alaska	**2002, 2004, 2006, 2011**
Northeast	**1999, 2000, 2006, 2009, 2011**
Northwest	**1998, 2001, 2006, 2011**
Pacific Islands	**2006, 2011**
Southeast	**1999, 2000, 2003/2004, 2006, 2009, 2011**
Southwest	**1998, 2001, 2006, 2009, 2011**

Description of Models

The standard RP models that have been applied to characterize recreational anglers' demand for marine recreational fishing include the simple travel cost demand model, the random utility model (RUM), and the hedonic travel cost (HTC)/hedonic price (HP) model. Each of these general categories of models utilize different types of fisheries-related information to answer both specific and overlapping questions that can be used to characterize a fishery and shed light on the potential effects of changes in economic, fishery, environmental or regulatory conditions.

The travel cost model is based on the economic theory that the number of recreational trips that an angler takes (or demands) is driven by the cost of a trip in addition to other 'fishing'

related factors like expected catch. The travel cost demand system model can be applied to a single type of fishing trip or to a system of several types of trips that are distinct yet interrelated, such as shore-based and boat-based trips. This class of models can be used to estimate how the total number of recreational trips or participants may vary with conditions affecting the fishery or economy. Travel cost demand system models additionally provide information regarding the relationship between trip options.

The HTC/HP model uses prices from market transactions, and is based on the theory that the attributes of a good determine variations in its market price. In terms of recreational fishing trips, a HP model can be used to show how for-hire fishing trip fees vary according to differences in the relative attributes of the for-hire fishing trip choices, such as catch rates and length of trip. HTC/HP models can be used to estimate the marginal value of an additional fish or the marginal value of other trip attributes.

Recreational fisheries management needs differ across the NOAA Fisheries regions and the use of RP models in the management process in these regions has varied. A RUM model based on NOAA Fisheries-collected trip and angler characteristic data was first developed for the Northeast region in 1999 using data collected in 1994. This model allowed the angler to choose between four target species groups, three modes, and multiple fishing site alternatives. The model aggregated fish species into small game, bottomfish, flatfish, and big game, and had three modes (for-hire, private/rental boat, and shore). This model has subsequently been modified by other NOAA Fisheries regions to fit other locations, species, and years.

The Southeast region has used both RUM and HP models extensively to estimate the effects of proposed management changes on recreational anglers. A hedonic price model for the for-hire sector was recently developed for the Southeast (2009) and used in the regulatory review

of management options for red grouper.[4] The motivation for the development of these models has been a need to evaluate the effects of current policy changes and anticipation of future policy needs. The development of these models in the Southeast has often been initiated though the Marine Fisheries Initiative (MARFIN), which is a Federal cooperative assistance program that funds research projects related to U.S. marine fishery resources. However, because of the time and effort involved with creating these models, the results of these studies have often been used for multiple years and there is a question regarding how long the results may be relevant.[5]

In the Southwest, the results of RP models have been used to analyze the effects of removing Klamath Dam by estimation of the benefits for an angler day of ocean recreational salmon fishing and via benefits transfer for in-river salmon fisheries. Demand models are currently being developed for analyzing the demand for for-hire trips in Southern California. Once developed, these trip demand models for Southern California will be used to forecast effort, to produce estimates of economic benefits, and as input into economic impact models.

For the Pacific Islands, there have been a very limited number of recreational studies over the past ten years. There have been two studies done by academic institutions related to small boat fishing in Hawaii, initiated by NOAA Fisheries and conducted through contracts. However, these models have not yet been used for policy analysis in the region. In Alaska federal management of recreational fisheries is limited to halibut. As a result, there has been very little

[4] Carter, D.W., J. J. Agar, and J. R. Waters. Economic Framework for Fishery Allocation Decisions With An Application To Gulf Of Mexico Red Grouper. NOAA Technical Memorandum NMFS-SEFSC-576. September 2008.

[5] For example, the most recent model developed was completed in 2009 using data from 2000 (MARFIN Grant #NA06NMF4330055)
http://econ.appstate.edu/marfin/MARFIN%20NA06NMF4330055%20Final%20Report.pdf

need for or development and use of revealed preference models in federal management decisions, although research on RP models to estimate fishing trip values is being undertaken.[6]

Challenges

A number of issues exist that often make it challenging to obtain some types of RP data, or to collect RP data in certain regions, or to collect RP data for certain groups of anglers. These include the following:

Data Collection

- respondents often do not feel comfortable providing data on their household income or hours worked per week;
- defining a sample frame is a problem in regions that do not participate in the MRIP catch and effort surveys;
- cost of collecting data is high in regions without existing NMFS sponsored catch and effort surveys;
- separating recreational fishing from either commercial or subsistence fishing is difficult in many cases;
- in the Southwest and Northwest:
    - variations in catch and effort surveys make it hard to collect data in a consistent manner,
    - there is incomplete collection of angler and trip characteristics, and
    - there is a lack of documentation, such as weighting methods, included in state data collection procedures; and

[6] Lew, D. K. and D. M. Larson. 2011. A repeated mixed logit approach to valuing a local sport fishery: the case of Southeast Alaska salmon. Land Econ. 87:712-729.

- in the Pacific Islands Region:
    - the majority of noncommercial fishing activity is limited to state waters, which raises jurisdictional issues; and
    - there are currently are no state licensing or reporting requirements, making definition of a sample frame problematic.

<u>Modeling</u>

- a significant amount of data transformation has to be done before running the models;
- a limited number of NOAA Fisheries economics staff who have the expertise and/or time available to develop RP models;
- for the Northeast, Southeast, and Hawaii, use of the data requires a detailed knowledge of the MRIP program;
- response rates to RP questions are low in some states or in certain modes within a state;
- for a single target species, there are often insufficient numbers of observations;
- a lack of variation in the data in many cases, such that only an estimate of the average value of an additional fish or the average value of site access is available from the models, rather than values over a range of quality characteristics;
- a lack of consistent site-specific data on attributes of fishing sites; and
- little information on how regulatory changes influence angler perceptions of fishing quality.
- In the Pacific Islands, sampling concerns have been raised with the catch and effort data collected by the NOAA Fisheries-sponsored program and, therefore, has not been used to date for modeling and management analyses.

These issues often limit the usefulness of RP models for regulatory analyses except in the context of large scale policy changes or to frame management issues. For example, estimates of changes in angler benefits over a range of policy options are needed for many regulatory analyses, but often only the change in the average benefit can be calculated from available data.

Potential Improvements

Workshop participants identified additional types of data or modeling that could increase the use of RP models across NOAA Fisheries. These include the following:

Data Collection

- the attributes of each fishing site (such as number of boat ramps, presence of a marina or tackle shop, available parking options);
- the value of alternative recreational activities;
- the purpose of a trip for multi-day trips;
- data on angler occupation to use as a substitute for household income;
- information on why anglers chose a particular target species (particularly for AHMS);
- data on angler and trip characteristics for in-river salmon and steelhead trout/salmon trips; and
- demographic characteristics for both households that go fishing and those that do not, for use in participation modeling.

Regarding the first point above, data on site attributes for the sites in the APAIS could be obtained in order to have a consistent data set for catch, effort, and quality attributes for sites in the Northeast, Southeast, and Hawaii. Currently, information on boat ramps, marinas, tackle

shops, etc., is not collected as part of the APAIS data but its collection may be feasible in the future in partnership with the MRIP program. The AHMS office has developed an Android App ("Mako"), which allows anglers to send information about live shark releases directly from Android-based smartphones. This use of cutting-edge technology eliminates the need for an angler to go back to a computer to input the information onto the AHMS Live Release website and, hopefully, increases voluntary participation for this project and the collection of better RP data on highly migratory species (e.g., trip date, location, and species targeted).

Modeling

The following improvements were suggested related to modeling and analysis:

- use existing angler demographic data for participation modeling, for community impacts analysis, and for targeting decisions (in particular for highly migratory species);
- use RP data to forecast fishing effort;
- create a consistent dataset on travel costs and fishing quality that varies across time and space and is easily accessible to economists both inside and outside NOAA Fisheries;
- develop a publication of "best practices" for RP models; and
- develop a decision support tool for council and regional office staff for calculating the economic effects of policy changes.

A study conducted by NOAA Fisheries in 2012 on a wide variety of ocean recreational activities will provide information on the value of alternative recreational activities. This survey will

capture all marine recreational activities and provide additional information for participation and effort models.

IV. For-Hire Models

Applications to Management Needs

The for-hire component of recreational fisheries includes for-hire boats, headboats, and guideboats. Models of the for-hire sector are useful for a number of management questions such as the contribution of the industry to a regional economy and the economic impacts and changes in economic benefits related to changes in management policies, natural disasters, or other environmental changes. In that regard, of particular interest for management needs is the collection of data on the prices charged to anglers for for-hire trips. Price is an important statistic that provides information on the demand for and supply of for-hire trips. The price of a for-hire trip is a market price that will vary depending on both the demand for trips by the anglers and the supply of trips provided by the for-hire industry. Collecting trip price data is equivalent to collecting ex-vessel fish price data in the commercial fishing sector. Having data for many years and across geographic locations enables the analysis of price changes over time resulting from changes in such things as a change in the allowable recreational harvest. The regular collection of for-hire price data would enable the construction of for-hire price indices and measures of both the economic health and the economic impacts of the industry.

Description of Data and Models

Models addressing the for-hire industry include both supply and demand models and economic impact models. To construct models of the for-hire industry, information on the costs and earnings of for-hire vessels is essential and includes information on revenue for for-hire fishing operations, other revenue (such as sightseeing tours), variable costs, and fixed costs.

Additionally, information on quantities of variable inputs (such as gallons of fuel), employment, catch, vessel characteristics, vessel identification number, owner and crew demographics, and owner and crew identification numbers are important for analyses of the for-hire sector.

Data on the for-hire industry are not as plentiful as data on angler and trip characteristics. Some basic for-hire data (such as vessel identification number) are regularly available in the Northeast and Southeast regions as part of the MRIP for-hire surveys but, in general, economic data for the for-hire sector is collected intermittently across most regions. In 2011, 86% of the six NOAA Fisheries regions and AHMS had available trip harvest data. Data on revenues, fixed costs, and variable costs was only available for 29% of the regions and AHMS and demographic data was available for only 5%. Table 4 shows the for-hire surveys funded by NOAA Fisheries from 2000-2011.

Table 4: For-Hire Surveys

Region	Survey Year
AHMS	
Alaska	**2012**
Northeast	**2011**
Northwest	**2001, 2006**
Pacific Islands	
Southeast	**2002, 2009, 2010**

Challenges

Data Collection

Collecting for-hire economic data is challenging for the following reasons:

- lack of a systematic means of collecting annual cost and earnings data from owners and operators of for-hire vessels;
- lack of a systematic means of collecting prices paid by for-hire patrons;
- resistance by the industry to provide data because of survey length, time constraints, distrust of the government, and survey fatigue; and
- lack of mandatory reporting requirements resulting.

To date, only the Northeast and Southeast regions have used economic for-hire related analyses in management decisions on a fairly regular basis. Other regions have been limited by a lack of the necessary economic data. The workshop participants did not note any major challenges with the standard models used to analyze for-hire economic data collection.

Potential Improvements

Data Collection

Options for improving data on the for-hire industry include:

- identification of the types of data that can be successfully obtained from voluntary surveys;
- determination of the feasibility of a limited mandatory reporting system;
- data collection via logbook or observer programs;
- use of in-person interviews conducted by trained interviewers;
- standardization of recreational data collection methods across states;
- increased funding for implementation of surveys to increase frequency of data collection and use of trained interviewers;
- and improved relations with the for-hire industry to improve response rates.

A regular data collection on for-hire trip price information could be integrated into existing data collection efforts focusing on the number and characteristics of trips. Collecting the trip price data via a regular trip-level survey has the added value of linking the price data to trip characteristics data. This opens the possibility of a wider range of economic analyses such as hedonic analysis and the development of more accurate price indices. For-hire trip price data could also be generated from information on trip revenue and the number of anglers for randomly selected trips.

On the last point, there have been increased efforts to expand outreach to the industry before surveys are implemented and in the collaboration with industry groups in the design of

cost and earnings surveys. In almost every region, the level of outreach to the industry has been greatly expanded via in-person attendance at industry group meetings, visits with individual operators and owners, outreach materials (brochures, fact sheets, articles in the press), and collaboration with industry stakeholder associations.

V. Stated Preference Models

Application to Management

Stated preference (SP) models are used to elicit consumer consumption behaviors. Stated preference studies can be used for the same purposes as RP studies, including the identification of patterns in angler behavior, gauging reactions to management and stock changes, examining species trade-offs, evaluating large-scale environmental issues or policies, valuation of fish or angling trips, and cost-benefit analyses. The results of SP studies may be used to provide context for management issues or as predictive assessments of potential policy changes. Unlike RP studies, SP techniques can be used when there are no natural sources of variation because choice scenarios presented to respondents are hypothetical. For example, the effect of new bag limit changes on angler behavior can be evaluated for bag limits that have not been implemented previously in a fishery.

Description of Data

Data for SP studies have not been routinely collected across all regions. The type of information collected in SP studies varies by survey, but generally includes respondent demographics (age, race, household income), qualitative attitude assessments, and preferences regarding hypothetical fishing trips. Table 5 lists the SP studies that have been conducted by NOAA Fisheries.

Table 5. Stated Preference Data Holdings 2002-2011

Region	Year	Species Included
AHMS		
Alaska	2002, 2006, 2011	rockfish, salmon, halibut
Northeast	2002	summer flounder
	2009	cod, haddock, pollock
	2010	black sea bass, bluefish, summer flounder, striped bass, weakfish, scup
Northwest	2006	rockfish, salmon, halibut
Pacific Islands	2006	bluefin tuna, ahi tuna, mahi mahi
Southeast	2003	grouper, red snapper, king mackerel, dolphinfish
	2009	groupers, snappers, king mackerel, dolphin fish,
	2010	cobia, Spanish mackerel
Southwest	2009	rockfish, salmon, and other species

Description of Models

Stated preference methods are particularly useful for gathering data regarding opinions and values in cases when there are no suitable market equivalents or when other data are nonexistent or insufficient for measuring the policy or environmental change in question. Many natural resources do not have explicit price associations because they are not sold or traded in any markets. Individuals may place values on such resources or amenities but these values cannot be measured using price-based techniques, including RP methods. Stated preference surveys are

conducted to obtain market equivalents for these types of natural resources and acquire information regarding unobservable values and tradeoffs by asking respondents to name the amount of money they would be willing to pay to maintain the level of some resource or environmental feature or the amount of money they would be willing to accept in compensation for the loss of some resource or environmental service.

Contingent valuation (CV) and a class of techniques commonly known as conjoint analysis are the two main SP techniques used by NOAA Fisheries. The referendum CV method that has been used by NMFS in prior surveys asks respondents "Would you be willing to pay $Y for product or service X?". This method elicits an indirect measure of someone's willingness-to-pay (WTP) for a particular environmental product or service.[7] The CV method is based on random utility theory, which looks for correlations between the level of an environmental good or service and the probability that the WTP equals a specific value.

Conjoint analysis techniques span a variety of survey instrument designs. All conjoint surveys present respondents with alternatives comprised of different levels of environmental goods or services. Each environmental good or service is broken down into several attributes or characteristics that vary between the alternatives. For example, one choice could be a trip that resulted in 15 landed fish with an average size of 10 pounds and a cost of $75, while a second choice could be a trip with 20 landed fish, an average size of 7 pounds, and a cost of $80. Depending on the type of survey instrument used, respondents may be asked to select the best alternative, select the best and worst alternatives, or rank or rate the alternatives.

[7] In another method, known as payment card CV, respondents are shown tables or "cards" with an array of values and asked to select the value that is the maximum amount they would be willing to pay for a product or service. However, NMFS has not used this format for the CV question.

NOAA Fisheries has only used SP models to inform management decisions for a limited number of regions and species. Most of the regions, including the Southeast, Northeast, and Northwest, have used SP studies to predict effort changes in response to proposed management for some species.

Challenges

Stated preference studies are challenging to conduct and to analyze. They typically involve a more complex survey design than revealed preference, expenditure, and for-hire based surveys. Some of the challenges are as follows:

Data Collection

- lack of mandatory reporting requirements and/or necessary infrastructure to create a standing survey panel;
- without a standing survey panel, significant time and effort is required to generate a sample frame for each survey conducted;
- complex nature of SP surveys require higher administration costs than other types of surveys; and
- approval process by the Office of Management and Budget for stated preference surveys can be longer and more uncertain than with other types of surveys.

Modeling

- creating and analyzing SP surveys is time-intensive; and
- not all of the NOAA Fisheries regions nor the AHMS program have economists trained in SP methods.

Potential Improvements

Data Collection

Stated preference studies conducted by NOAA Fisheries could be improved by both collection of additional data elements and changes in survey procedures:

- collect data on seasonal factors ;
- collect data on interactions between euryhaline[8] species and fresh or salt water trip choices;
- include questions on cultural preferences;
- incorporate data on social networks;
- collect RP data on SP surveys;
- test alternative survey modes such as internet based surveys; and
- develop and maintain a standing survey panel for each region.

The collection of these additional data would improve location choice modeling, sociocultural valuations, participation and effort estimates, assessments regarding the impact of social networks on angling and for-hire decisions, and allow for greater usage of models that combine aspects of both revealed and stated preference models. Developing and maintaining a survey panel for each region could decrease administration costs, improve sampling frames, reduce high variations in item and unit response rates, and allow more frequent and repeat surveys to be conducted (enabling assessments of changes in angler behavior and preferences).

Modeling

Suggestions for improvements in modeling included

[8] Euryhaline organisms are able to adapt to a wide range of salinities.

- expand the use of bioeconomic models on a regional basis;
- conduct behavioral analyses regarding differences between catch-and-keep anglers and catch-and-release or tournament anglers;
- test mode effects in survey responses (for-hire versus private boat versus shore anglers); and
- expand the number of models that examine the impact of changes in regulatory tools (season closures, bag limits, size limits, etc.).

VI. Conclusions

This report presents the discussions of an internal NOAA Fisheries workshop on the economic data and models currently being used for economic analysis of marine recreational fisheries. This report details the data holdings and use of different models for six NOAA Fisheries regions (Northeast, Southeast, Southwest, Northwest, Pacific Islands, Alaska) and the Atlantic Highly Migratory Species division. Gaps in the data; current challenges with data collection and the use of existing models; and suggestions for improvement are noted for four different types of economic models. Due to time constraints, the workshop participants were not asked to come up with a set of priorities for future data collection and research during the workshop. Instead, NOAA Fisheries intends to hold followup meetings both internally and with stakeholders to identify priorities for recreational economic data collection and research based on the findings and suggestions of the 2011 workshop. NOAA Fisheries is committed to improvements in data quantity, quality and timeliness for economic data on recreational fisheries.