

# **The Economic Contribution of Marine Angler Expenditures in the United States, 2011**

Sabrina J. Lovell, Scott Steinback, and James Hilger



U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-F/SPO-134  
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U.S. Department of Commerce  
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National Marine Fisheries Service  
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## **ABSTRACT**

Marine recreational fishing is a popular pastime across the United States that generates significant economic impacts to both local economies and to the nation. NOAA Fisheries estimates that over 70 million recreational fishing trips were taken by more than 11 million marine anglers in 2011. In this report, the level of fishing expenditures for these anglers was quantified within each coastal state and the U.S. as a whole. At the national level, it is estimated that marine anglers spent an estimated \$4.4 billion on trip-based expenditures (e.g., ice, bait, and fuel) and another \$19 billion on fishing equipment and durable goods (e.g., fishing rods, fishing tackle, and boats) in 2011. For this study, a regional input-output assessment was conducted to examine how those expenditures circulated through each state's economy as well as the economy of the entire U.S. It is shown that as angler expenditures filtered through the U.S. economy, they contributed an estimated \$56 billion in total output impacts, \$29 billion in value-added impacts (i.e., contribution to gross domestic product), \$18 billion in income impacts, and supported 364 thousand jobs in the United States.

## **I. INTRODUCTION**

In 2011, the National Marine Fisheries Service (NMFS) conducted the National Marine Recreational Fishing Expenditure Survey (hereafter referred to as "NES"). The survey collected information from anglers on expenditures related to marine recreational fishing. Marine recreational fishing was defined as fishing for finfish in the open ocean or any body of water that is marine or brackish for sport or pleasure. The survey is the second nationwide survey conducted by NMFS to gather marine recreational fishing expenditures across the United States. The first nationwide survey was in 2006. Prior to that year, three regional surveys were conducted starting in 1998 with the Northeast Region, the Southeast Region in 1999, and the Pacific Region in 2000 (Steinback and Gentner, 2001; Gentner, Price, and Steinback, 2001a; Gentner, Price, and Steinback, 2001b).

The primary objectives of the national expenditure surveys are to collect trip expenditures for an angler's most recent marine recreational fishing trip and to collect annual expenditures on durable goods used for marine recreational fishing. Additional objectives include obtaining a profile of the most recent marine recreational fishing trip and collecting demographic information on marine recreational anglers. As specified in the Magnuson-Stevenson Fishery Conservation and Management Act of 1996 (and reauthorized in 2007), NMFS is required to enumerate the economic impacts of the policies it implements on fishing participants and coastal communities. In order to routinely fulfill this mandate and in recognition of the economic importance of recreational fisheries, NOAA conducts nationwide angler expenditure surveys on marine recreational fishing approximately every 5 years. The survey data are then used to estimate the economic contributions of marine recreational fishing to a region's economy via a regional input-output model.

The input-output model used in this report generates four different metrics, referred to as impacts, for assessing the contributions to a region's economy from expenditures on marine recreational fishing. The different measures of impacts are:

- Output is the gross value of sales by businesses within the economic region affected by an activity. In the rest of the document, the terms “sales impacts” and “output impacts” are used interchangeably.
- Labor income includes personal income (wages and salaries) and proprietors’ income (income from self-employment).
- Value Added is the contribution made to the gross domestic product in a region from marine recreational fishing.
- Employment is specified on the basis of full-time and part-time jobs. There is significant part-time and seasonal employment in commercial and recreational fishing and many other industries.

The first three types of impacts are measured in terms of dollars, whereas employment impacts are measured in terms of number of jobs. Additionally, the four categories of impacts are not independent and it is important to note that adding them together would result in some double counting of impacts. Throughout this report, the results of the input-output analysis are referred to as either “economic contributions” or “economic impacts” with no implied distinction in the terms.

The estimates of expenditures and impacts from the 2006 NES have been widely used by NOAA Fisheries, other government agencies, academic institutions and fishing-related organizations. The 2011 angler expenditure and impact estimates in this report provide updated information on the economic importance of recreational fishing in each coastal state and in the U.S. as a whole. At the national level, it is estimated that marine anglers spent \$4.4 billion on trip-based expenditures (e.g., ice, bait, and fuel) and another \$19 billion on fishing equipment and durable goods (e.g., fishing rods, fishing tackle, and boats) in 2011. These expenditures generated an estimated \$56 billion in total output impacts, \$29 billion in value-added impacts (i.e., contribution to gross domestic product), \$18 billion in income impacts, and supported more than 364 thousand jobs across the United States.

Section 2 of this report gives a brief description of the survey methodology and sampling design. In section 3, the survey questionnaires, survey protocol and survey response rates are discussed. Section 4 presents the analytical methods used to estimate mean angler expenditures and total angler expenditures. Section 5 includes a discussion of the regional input-output model and the methods for estimating state level and U.S. level economic contributions from marine recreational fishing. Section 6 concludes with some remarks regarding model assumptions, limitations, and possible survey improvements for future years. Following Section 6, tables with the expenditure and impact results are listed for the entire U.S., for individual coastal states, and for Puerto Rico.

## **II. SAMPLE FRAMES**

The target population for the 2011 NES was marine recreational anglers, 16 years of age and older, who fished in all coastal states and in Puerto Rico during 2011. Puerto Rico was a new addition to the survey in 2011. Ideally, the sample frame for the NES would be a comprehensive database of marine anglers in each state. In 2006, no such frame existed because not all states required marine anglers to obtain state fishing licenses. Since 2010, anglers across the U.S. were either required to obtain a marine fishing license or enter a registry in the state where they fish or to register with NMFS’s National Marine Angler Registry. However, for consistency with the sample frame used for the 2006 NES, the 2011 NES utilized two sample frames: field intercepts with anglers and databases of licensed anglers. Additionally, due to differences in fishing license requirements and exemptions across states, use of an intercept sample frame was determined to be the best approach for some states in 2011.

The Marine Recreational Information Program (MRIP) is an integrated series of regional surveys coordinated by NMFS in order to provide reliable estimates of marine fishing effort, catch, and

participation. There are three primary surveys used to obtain these estimates. The first is the Coastal Household Telephone Survey (CHTS) which is a telephone survey of coastal households designed to measure total fishing effort by coastal residents in a given state or region. Effort is defined in terms of angler fishing trips where a trip is a day of fishing in one fishing mode (e.g., from shore, from a boat). The second survey is the For-Hire Telephone Survey (FHTS) designed to measure effort on charter and party boats. The third survey, the Access Point Angler Intercept Survey (APAIS), is used to estimate catch-per-unit effort in all modes and to estimate correction factors for non-coastal resident angler-trips. Appendix I provides a complete description of the MRIP survey procedures. In the APAIS, Florida is divided into East Florida, which is considered part of the NMFS' South Atlantic Region, and West Florida, which is considered part of the NMFS' Gulf of Mexico Region. This separation of the state is maintained throughout the expenditure and economic contribution analyses.

As was done in 2006, an add-on to the APAIS survey was designed to collect expenditures resulting from the intercepted trip and to gather a frame for mailing a follow-up survey regarding annual durable expenditures. In those states where the APAIS survey is not conducted (Texas, California, Oregon, Washington, and Alaska) license frames were utilized to contact anglers via a mail survey regarding both trip and durable good purchases. The same procedure was followed for the 2006 expenditure survey. For further information about the license frame sampling procedures see Appendix I.

### **III. SURVEY INSTRUMENTS AND PROCEDURES**

#### **Intercept Questionnaire**

As noted above, for the states where MRIP conducts the APAIS, a one-page economic add-on was added to the existing catch survey questionnaire. Information routinely collected from anglers during the APAIS include state and zip code of primary residence, number of hours fished on the interviewed trip, top two target species, type of fishing gear used, and the number of days fished in the last 2 and 12 months. The creel portion of the survey collects length and weight of all fish species retained by the angler and the species and disposition of all catch not retained by the angler. The economic questionnaire included questions on whether or not anglers were on an overnight trip, the number of nights spent away from the angler's primary residence, the total number of days spent fishing, and the primary purpose of the entire overnight trip (fishing, business, or personal). All anglers were asked to estimate their expenditures for their entire trip (not just for the days spent fishing). These included costs for auto fuel, auto rental, public transportation (airfare, bus, taxi, subway, ferry), lodging, food (from grocery stores and from restaurants), bait, ice, boat fuel, guide fees, tips to crew, fish processing, and gifts or souvenirs. Respondents were also asked to estimate the proportion of their total expenditure that was spent in the state of the fishing trip. At the end of the interview, respondents were asked for their postal and email addresses for a follow-up survey about their annual durable expenditures.

Every angler over 16 years of age who completed the APAIS base catch survey was eligible for the economic add-on questions. In the states where the MRIP survey was conducted, a total of 108,820 economic add-ons were attempted with anglers. 89,384 interviews were conducted with anglers who were 16 years old or older (Table 1). Overall, 78,780 eligible respondents (72.0%) agreed to the economic add-on survey and 18,921 of those (24%) supplied contact information for a follow-up survey on their durable expenses.

## Mail Survey and Questionnaire

The MRIP intercept frame sample and the license frame samples followed slightly different survey protocols. For the MRIP intercept frame, anglers who provided contact information were sent a follow-up survey either by mail or email that asked about their expenditures on marine fishing-related durable goods in the prior 12 months. For the license frame samples, anglers were sent a complete version of the survey by mail or email that included questions on their most recent marine fishing trip and questions on their purchases of durable goods. The trip-related questions on the mail survey gathered the same information that was obtained in the economic add-on to the APAIS. ICF Macro, Inc. conducted the NES mail data collection for all states except California, Oregon, and Washington, which was conducted by CIC Research, Inc. Copies of the questionnaires are available online.<sup>1</sup>

Questions related to the purchases of durable goods asked anglers for their expenditures in the prior 12 months and focused on expenditures in the state of the most recent trip. The survey asked about expenditures on semi-durable goods such as fishing tackle and gear (fishing line, hooks, lures, etc.), rods and reels, fishing licenses, special clothing, publications (books, magazines, newspapers, etc.), camping equipment, binoculars, dues and contributions to fishing clubs, and processing or taxidermy costs. Questions on durable goods were related to boats, vehicles, and second homes. Anglers were asked if they owned a boat that they used for recreational marine fishing in the prior 12 months. Additional questions were asked on the length and horsepower of the boat, and the percentage of time in the prior 12 months that they had used it for marine recreational fishing. Boat-related expenditures included purchases of motorboats and accessories, non-motorized boats, boating electronics, mooring and storage, boat insurance, boat and trailer license and registration, and boat and trailer maintenance and repairs.<sup>2</sup> Similar questions were asked about vehicles and second homes used for marine recreational fishing in the past 12 months (purchase, repair and maintenance, insurance, and license/registration for vehicles). As with boats, respondents were asked to estimate the percentage of time that the vehicle and second home were used for marine recreational fishing. The final section of the mail survey collected a set of socioeconomic and demographic variables, including gender, age, ethnicity, race, annual household income, education level, number of hours worked per week, and the years of marine fishing experience.

The sampling protocol followed a modified Dillman method. If an email address was available for a respondent, then the respondent was first sent an email invitation to access a web-based version of the survey using a unique user identification code and password. Respondents were asked to complete the web survey within 1 week of receiving the email. Three days later, they received a reminder email. Respondents with complete postal addresses and who did not complete the survey online within one week, were then routed into the postal mail group. Anglers were first sent a cover letter describing the purpose of the survey, a questionnaire booklet, and a business reply envelope. One week later, all anglers were sent a postcard that thanked the angler for participating in the survey and included a reminder to return the survey. Three weeks after the first mailing, anglers whose surveys had not yet been received were sent a modified cover letter and another copy of the questionnaire. The second cover letter offered the option of completing the survey online and provided the web address to access the survey as well as a unique user name and password. The provision of the web address in the second cover letter was based on studies that showed reduced overall response rates when an online option was given in the first contact versus providing that option in a subsequent contact (ICF Macro, Inc., 2012).

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<sup>1</sup> <http://www.st.nmfs.noaa.gov/economics/fisheries/recreational/angler-expenditures-economic-impacts/index>.

<sup>2</sup> Questions on fishing tackle expenses and boat mooring, storage, and repair expenses for a given trip were included as trip-related expenditures in 2006, and similar categories were also included in the durable good expenditures in 2006; in 2011 both categories were only included as durable goods to avoid any possible double counting.

Survey versions were personalized based on the state of intercept or licensure, including framing of state specific questions and graphics. In the license frame states, the trip expenditures were anchored to the most recent marine trip taken. All information collected through the MRIP intercept survey was collected in the license frame surveys in order to have similar data on the most recent trip. A few additional state-specific questions were added to the Alaska, California, and Hawaii license frame versions.

A total of 43,472 surveys were sent to anglers across the U.S. either via email or postal mail (Table 1). About 5.8% of the total surveys sent out were returned as being undeliverable by the postal service. Approximately (34%) of the surveys (14,782) were completed either online or returned in the mail. Response rates were fairly consistent across states. Alaska had the highest response rate (65%), followed by Washington and Oregon with 50% and 48%, respectively. States with the lowest response rates included Texas (18%) and New York (19%). A lower response rate was expected in Texas, however, given that licenses were not exclusive to marine fishing and were also sampled without pre-screening for trips taken in 2011. For the three West coast states, 62% of the potential respondents were initially mailed a questionnaire packet and the remaining 38% were initially emailed an invitation to complete the web version of the questionnaire. The number of surveys returned via the mail was 72% versus 28% via the online version. For all other states, 35% were sent the first survey via an email invitation to complete the web survey. For completed surveys, 30% were from the online version and 70% were from the mail version.

To address potential non-response bias, a telephone non-response survey was conducted two weeks after the second mailing. Ten percent of anglers who did not return the survey were selected for the non-response sample in each wave and state. Details on the non-response survey are provided in Appendix II.

## **IV. METHODS**

### **Trip Expenditures**

Survey data for different categories of trip expenditures were used to estimate mean trip expenditures by survey stratum (state, mode of fishing trip (for-hire, private boat, and shore), and resident status). Resident status was split into two categories, resident or non-resident. Anglers who were permanent residents of the state in which they were interviewed as part of the APAIS were considered residents. For the license frame states, anglers who were permanent residents of the state of licensure were considered residents. Mean trip expenditures were calculated for an angler-trip, defined as one day of fishing for one angler. On the survey, anglers were asked to estimate total expenditures for the entire trip away from their permanent residence if the trip involved an overnight stay. Data on the number of nights anglers spent away from their permanent residence and the number of days spent fishing was collected and used to calculate expenditures per angler-trip.

Anglers were asked to report what they personally spent on either themselves or others. They were asked not to include expenses that others paid on their behalf. If they did not have expenditures in a given category, they were asked to record zero rather than leaving the item blank. Missing values for trip expenditure categories were replaced with zero if an angler reported a non-zero dollar amount for at least one other trip expenditure category. The trip expenditure questions included an “other” category that allowed for an open-ended response for the expenditure type and the amount. These responses were re-coded into one of the other expenditure categories if applicable and separable into discrete amounts. The survey also asked anglers to estimate the percentage of trip expenditures that were spent in the state of the most recent fishing trip. These percentages were multiplied by each trip expenditure category to calculate the final expenditure per respondent spent in the state of the trip. If a percentage was left blank, it was

replaced with either 100% in the case of residents, or for non-residents, a statewide average percentage (based on non-resident records only).

Mean trip expenditures were estimated by accounting for both the survey design of the underlying sample and the appropriate sample weights. For the intercept-based sample, the sample weights were based on MRIP weights adjusted for anglers over 16 years of age and for non-response to the economic add-on survey (Foster, 2012). In the APAIS, sampling quotas for a given APAIS stratum (state, mode, wave) are developed according to expected fishing effort for that stratum. Expected fishing effort is based on historical effort estimates for that same stratum. The MRIP sample weights are designed so that each intercept in a particular stratum is weighted based on the estimated total effort in that stratum, and therefore, summing over the sample weights will equal total effort. For the license frame samples, sample weights were calculated based on the sampling strata and sampling design for each license frame state. These base survey weights, either from the intercept or license frame samples, were further adjusted in the process of estimating mean trip expenditures in order to account for item non-response to the set of trip expenditure questions.

Total annual trip expenditures were estimated by multiplying mean trip expenditure by the estimated annual number of adult trips in a given stratum (state/mode/resident). For the Atlantic and Gulf Coast states and Hawaii (shore and private boat modes), the annual number of adult trips by stratum was estimated by summing over the adjusted MRIP sample weights in a given stratum. Hawaii charter effort was based on estimates provided by the Pacific Islands Fisheries Science Center. For all three West Coast states, Texas, and Alaska, estimates of total angler effort were obtained from the Pacific States Marine Fisheries Commission, Texas Department of Parks and Wildlife, and the Alaska Department of Fish and Game, respectively. For these states, adult trips were calculated by multiplying the average percentage of adult trips by mode and resident status across all the MRIP states by the total number of angler trips for the same mode/resident stratum. Total U.S. trip expenditures by mode and resident status were obtained by summing across states. Table 2 provides the 2011 adult effort totals by state, mode, and resident status.

## **Durable Expenditures**

Mean durable expenditures were estimated by state and resident status for each durable expenditure category on the survey. Anglers were asked to estimate the percent of time that they used the items for marine fishing and the percentage spent in the survey state. The percentages were then multiplied by the expenditure amount in order to get the amount attributed to marine fishing spent in the survey state. As with the 2006 NES, only durable goods used primarily for fishing (50% or over) were included. For any items that anglers reported using less than 50% of the time for marine fishing, expenditures were recoded to zero.

Given the length and detail of the mail/internet portion of the survey, it was anticipated that respondents were likely to save time by leaving some questions blank if they did not have an expense. In order to correctly capture zero expenditures, the questionnaire instructed respondents to write zero if they spent nothing for an item. Additionally, screening questions were added to the survey for every grouping of expenditure categories. A set of coding rules was implemented to cover various combinations of answers to the screening questions and for filling in missing values to the subsequent expenditure questions. In general, if an angler indicated in the screening question that he/she had expenditures in a given category (i.e., fishing tackle or gear), then all subsequent missing responses for each of the individual expense items within that group were coded as zeros. For respondents that provided negative responses to the screening questions, all subsequent missing responses were coded as missing data. As with the trip expenditures, if at least one of the individual expense categories within a group was non-zero but others were left blank, these missing values were replaced by zeros. Missing values for either the percentage of usage for marine fishing or for

the percentage spent in the state were replaced with the appropriate average values (stratified by resident status).

An avidity bias related to durable expenditures may be present for the intercept-based portion of the sample. This bias could occur if more avid anglers have a higher likelihood of being sampled as part of the APAIS and if their durable expenditures are correlated with avidity. For the trip expenditures, any potential bias is likely to be small after incorporating the new MRIP sample weights and because expenditures are reported on a per trip basis rather than over multiple trips. Following the procedures used in estimating mean durable expenditures in the 2006 NES, the base sample weights were adjusted as in Thomson (1991) to correct for potential avidity bias.

For calculating economic impacts, only those expenditures that generate new economic activity matter. Angler purchases of used goods from private parties do not generate any new economic activity and are considered transfer payments from one household to another. Respondents were asked if purchases of boats, boat accessories, vehicles, and second homes were made new or used, from dealers or private parties, or were financed. If one of these items was purchased new within the survey state, then the purchase price was included in the estimation procedures. If, however, any of these items were purchased used from a private party and not financed, the expenditure was not included. If the purchase was financed, regardless of whether used or new, financed charges were assumed to be 2% of the loan principal. For used boats purchased through a dealer, used boat accessories, and used vehicles, the purchase price was multiplied by 19% to account for dealer revenues. This percentage was based on the reported retail margins associated with the industrial sector that sells boats and vehicles in IMPLAN Version 3 (MIG, 2008). To calculate the loan principal and the 2011 interest payment to the banking sector for boats, vehicles, and homes, microdata from the 2010 Consumer Expenditure Survey (CES) for each of these expenditure categories were used to calculate the average loan term, the average principal balance, and the average interest rate (CES 2010). Amortization equations were used to develop the additional categories for each respondent purchasing a financed boat, boat accessory, vehicle, or second home. Additionally, for second homes, the average U.S. property tax was obtained from the Tax Foundation (Tax Foundation, 2012). Real estate commissions from home purchases were assumed to be 6%.

Total annual durable expenditures were estimated by multiplying mean durable expenditures in each category by the estimated annual number of adult participants in a given state and resident stratum. For the Atlantic, Gulf Coast states, and Hawaii, the annual number of adult participants was calculated by multiplying the MRIP estimates of participation in a given stratum by the percentage of adults in that same stratum. The percentage of adults was calculated from the percentage of adult effort in the same stratum. Estimates of total participation for the West Coast license frame states were provided by the Southwest Fisheries Science Center (Thompson, 2012). Alaska participation was provided by the Alaska Department of Fish and Game (Jennings, 2012). Estimates of participation for Texas were based on numbers of licenses that included marine fishing in consultation with the Texas Department of Parks and Wildlife. Adult trips for the license frame states were calculated by multiplying the percentage of adult effort by resident status averaged across all the MRIP states by the total number of participants for the same resident stratum. Table 3 provides the 2011 adult participation totals by state, mode, and resident

Outliers within each expenditure category (either trip or durable) and survey strata (i.e., state/mode/resident for trip expenditures and state/resident for durables) were removed from the data set. The decision rule for outliers allowed strata with low variances to remain intact while strata with high variances had outliers removed. Initial weighted mean estimates for all expenditures categories were generated using the *Proc Surveymeans* procedure in SAS (SAS Version 9.3, 2011) and any strata/category combination with a proportion of standard error (PSE) greater than 20% had the upper 1% of its distribution truncated. For the purchase of new and used boats, new and used vehicles, and second homes, the wide variation in

expenditures required slight adjustments to the decision rule based on visual inspection of the data and best professional judgment.

In order to estimate durable expenditures at the U.S. level, mean durable resident expenditures for the U.S. were first calculated and then multiplied by total adult resident participants rather than simply summing over state level expenditures. This allowed for the purchase of boats, vehicles and second homes, regardless of whether or not they were purchased in the survey state, to be included in the estimation. Adult participation for the U.S. was calculated as the sum of state level adult participants. Issues arise, however, when trying to estimate total participation at the U.S. level because the non-resident estimates are not additive across states. Based on the MRIP methods for calculating participation in a given state, it is impossible to know if a non-resident participant in one coastal state is resident or non-resident participant in another coastal state. Because of the inability to assess double counting in non-resident participation in each state, only resident adult participation was used to expand the means to the U.S. total expenditure estimate. This restriction likely results in an underestimate of U.S. adult participation and durable expenditures. For the remainder of this report, U.S. total participation (9.8 million) includes only resident adult participants to avoid potential double counting of non-resident participants.

## **V. ECONOMIC CONTRIBUTION ANALYSIS**

An analysis of the economic contributions derived from marine angler expenditures was the second objective of the 2011 NES. The economic contributions of angler expenditures extend beyond the direct purchases anglers make on fishing trips or for fishing related goods. The effects of these expenditures can be classified as: (1) direct, (2) indirect, or (3) induced. Direct effects occur when anglers spend money at retail and service oriented fishing businesses. Indirect effects occur when recreational fishing retail and service sectors purchase business supplies from wholesale trade businesses and manufacturers, and pay operating expenditures. These secondary industries, in turn, purchase additional supplies and this cycle of industry to industry purchasing continues until all indirect effects are derived from outside the region of interest (Steinback, Gentner, and Castle 2004). Payments for goods and services produced outside of the study area (i.e., outside state lines) are excluded because these effects impact businesses located in other regions. Induced effects occur when employees in the direct and indirect sectors make purchases from retailers and service establishments in the normal course of household consumption. The summation of the direct, indirect, and induced multiplier effects represent the total economic contributions or impacts generated from marine sportfishing expenditures to the overall regional economy.

A regional input-output model was used to analyze how angler expenditures circulated through each state's and territory's economy, and throughout the entire U.S. Input-output models are based on the interrelationship between demand for final goods and services in a regional economy and the supply of intermediate goods and services needed to produce these final goods and services. Input-output models are capable of tracking quantities and purchasing locations of expenditures by anglers, support businesses, and employees in both direct and indirectly affected industries. In analyzing the 2011 angler expenditures, a commercially available regional input-output model called IMPLAN (Minnesota IMPLAN Group, Inc., 2010) was used to estimate the economic contributions of marine recreational fishing. The IMPLAN software is a widely used, nationally recognized tool. For this report, IMPLAN Version 3 software was used, which provides detailed purchasing information for 440 industrial and retail sectors. Previous NMFS analyses of economic impacts from recreational fishing, including the 2006 NES, used earlier versions of IMPLAN (Gentner and Steinback, 2006).

In order to accurately analyze the economic impacts from angler expenditures, it was necessary to match the type of expenditure with a corresponding industry or retail sector in IMPLAN. Angler expenditure categories from the 2011 NES were allocated to IMPLAN sectors based on the sectoring scheme shown in

Table 4. Expenditure categories that included more than one IMPLAN sector were not aggregated to avoid the biases associated with aggregating. Instead, the expenditure in the category was distributed to individual IMPLAN sectors based on the proportion of final household demand in each sector in each state. Because the typical grocery or convenience store purchase includes a wide range of products, expenditures at grocery and convenience stores were allocated across sectors based on IMPLAN's Personal Consumption Expenditure (PCE) activity database for grocery store purchases. PCE activity databases are created by the Bureau of Economic Analysis and represent national average expenditure patterns. Similarly, expenditures on boat and vehicle registrations and licenses, fishing licenses, property taxes, and parking /site access fees were allocated across sectors using IMPLAN's *State/Local Government NonEducation Institution Spending Pattern* database.

In IMPLAN, margins are used to convert the retail-level prices paid by anglers into appropriate producer values. Margins ensure that correct values are assigned to products as they move from producers, to wholesalers, through the transportation sectors, and finally on to retail establishments. Regional purchase coefficients (RPCs) reflect the proportion of a retail item that is manufactured within the state or region. IMPLANs default RPCs were applied to all the retail expenditure estimates to ensure that imported goods were not included in the impact estimates. The one exception was for bait purchased on a fishing trip. As virtually all bait is derived from local harvesters, all state-level RPC values for bait purchases were increased to 100%. Retail margins were also modified to account for this adjustment.

State-level impacts were estimated by fishing mode (for-hire, private boat, shore), by durable expenses, and for total expenses. The impacts are divided into output (i.e. sales), value-added, income, and employment impacts. Output impacts reflect total dollar sales generated from expenditures by anglers in each state. Value-added impacts represents the contribution recreational angling makes to the gross domestic product of a state or region. Income impacts represents wages, salaries, benefits, and proprietary income generated from angler expenditures. Employment impacts includes both full-time and part-time workers and is expressed as total jobs. For all expenditures combined, the tax impacts were also estimated. Taxes denote the income received by federal and state/local governments. The tax revenue estimates are based on data available in IMPLAN's social accounting matrix, which tracks monetary flows between industries and institutions such as households, government, investment, and trade. Note that impact estimates for a specific state measure only the impacts that occurred within that state due to marine recreational fishing expenditures in that state. Impacts that occur across states are captured in the aggregate U.S. model.

## **VI. RESULTS AND DISCUSSION**

Anglers' marine recreational fishing expenditures and the economic contributions of those expenditures are presented for each coastal state, for Puerto Rico, and for the U.S as a whole. Four tables of results are shown for each state, Puerto Rico, and the U.S. The first table summarizes the total economic impacts attributable to recreational fishing expenditures on output, value-added, income, and employment by trip mode, durable expenditures, and overall total. The second table for each state shows the estimated revenue received by federal and state/local governments from angler purchases. The third table shows mean trip and durable expenditures by type of expenditure and resident status. The fourth table provides total expenditures by type of expenditure and resident status. When interpreting the results, note that it is incorrect (and a frequent misunderstanding) to add the different types of impacts together because they are not mutually exclusive.

Overall, total U.S. expenditures in 2011 decreased 34% compared to the inflation-adjusted estimates shown in Gentner and Steinback (2008) for the U.S. in 2006.<sup>3</sup> Further comparisons show an inflation-adjusted

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<sup>3</sup> The 2006 expenditure estimates shown were adjusted to year 2011 dollars using the Bureau of Labor Statistics' Consumer Price Index.

decrease in total U.S. trip expenditures of 32% and a 34% decrease in total durable expenditures in 2011 compared to 2006. According to data from MRIP and the license frame states, angler effort in 2011 decreased 22% and participation decreased 30% compared to 2006 U.S. levels. This means that mean expenditures per trip also declined from 2006 levels because the magnitude of the decline was higher for trip expenditures than for effort. Similarly, total durable expenditures declined by 34%, while adult participation declined by 30%, suggesting that mean durable expenditures per participant in the U.S. actually decreased in 2011 compared to 2006.

The most recent data from the Bureau of Labor Statistic's Consumer Expenditure Survey (CES) shows similar declines in overall consumer spending in 2011 compared to 2006. Average annual expenditures by consumers on all goods and services declined by 11%, after adjusting for inflation (CES 2011). Average annual consumer spending on vehicles, which includes new and used cars, trucks, and boats, decreased 46% from 2006-2011, after adjusting for inflation. Also, the National Marine Manufacturer's Association (NMMA) estimated sales of the three most popular fishing boats (outboard boats, sterndrive boats, and inboard boats) to be \$19.1 billion in 2006 and \$11.7 billion in 2011 – a 39% decline after adjusting for inflation.

The U.S. Fish and Wildlife Service (USFWS) also collected expenditure data from marine anglers across the U.S. in 2011. Their data show that anglers across the U.S. spent a total of \$10.3 billion on marine fishing in 2011 (USFWS 2012), approximately 56% below our estimate of total marine angler expenditures in the U.S. (\$23.4 billion). Several reasons exist for the disparity. First, the durable expenditure estimates presented in this study are partly a function of MRIP participation estimates. For 2011, MRIP estimates of marine participation in the U.S. are about a million anglers higher than estimated by the USFWS. The disparity is also likely due to differences in sampling procedures. The USFWS estimates are based on a general household survey, rather than a survey based on licensed anglers or intercepted anglers. In contrast to the MRIP survey, which is specifically designed to target only marine anglers, the USFWS targets freshwater anglers, marine anglers, hunters, and other recreational activities as an add-on to the decennial census. Additionally, for many states, the sampling rates used for this study were considerably higher than used for the USFWS study. Differences also exist in how expenditures on durable goods are calculated. The USFWS uses the entire amount of the purchase in the survey year, if the angler indicated that the primary use was fishing. If the primary purpose was not fishing, it is not included in the expenditures. In the NES, anglers were asked the percentage of time that they used the durable good for saltwater fishing, and this percentage was used to calculate expenditures. Also, amortization equations were employed in the NES estimation procedures, but only when an angler indicated the purchase was financed. If a boat or vehicle was purchased new, and the purchase was not financed, the entire purchase price was used for estimation. Lastly, our study contains spending estimates for a greater number of expenditure categories than collected by the USFWS.<sup>4</sup>

At the U.S. level, it was difficult to estimate total angler participation. A resident participant from one state may also have fished in one or more other states or vice-versa. Summing resident and non-resident participation across all states would certainly have overstated participation at the U.S. level. Therefore, only resident participation summed across all of the coastal states was used to expand the durable good expenditure means to total durable expenditures in the U.S. As a result, the durable expenditure estimates shown in this report for the U.S. likely underestimates actual expenditures.

As total angler expenditures in the U.S. decreased in 2011 from 2006 levels, so did the economic activity generated from those expenditures. The total output impacts resulting from angler expenditures in the U.S.

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<sup>4</sup> Additional categories of expenditures collected during the 2011 NES include boat and vehicle registration fees, boat accessories, fishing vehicle maintenance, fishing vehicle insurance, second home purchase, second home property taxes, second home real estate commissions, second home maintenance, second home insurance, fishing club dues, fishing magazine purchases, and finance charges for purchases of boat, vehicles, and second homes.

decreased from \$92.2 billion in 2006<sup>5</sup> to \$56 billion in 2011. The total income impacts produced from angler expenditures, after adjusting for inflation, dropped from \$26.9 billion in 2006 to \$18 billion in 2011. Value-added impacts declined to \$29 billion from \$42.7 billion, and the total employment impacts supported by angler expenditures decreased from 533,813 to 363,932 across the U.S.

The majority of the changes in economic activity in 2011 compared to 2006 are simply due to lower overall angler expenditures in 2011. The remaining differences are the result of structural changes in a declining economy and because of adjustments in the products and services purchased by anglers. The impact estimates shown in Gentner and Steinback (2008) are based on 2006 IMPLAN data and since 2006 the linkages between businesses that support angler expenditures has changed. For this study we utilize 2008 IMPLAN data, so presumably any underlying structural changes in an economy, such as the mix of goods and services purchased by businesses that support angler expenditures, or in the proportions of goods and services purchased from local suppliers (i.e., RPCs), are reflected in the impact estimates shown here.

A comparison of Keynesian multipliers across the two studies provides an indication of the actual mathematical effect that structural changes in an economy and adjustments in the products and services purchased by anglers have had on the level of impacts generated from angler expenditures. Keynesian multipliers are defined as the ratio of total impacts to final expenditures and express the mathematical relationships between angler expenditures and the economic impacts generated from the expenditures (Archer 1984). While these multipliers are not reported in the tables, the reader may notice that at the U.S. level, the aggregate output multiplier decreased from 2006 (2.62) to 2011 (2.39). The income and value-added multipliers remained nearly constant in 2011 compared to 2006 (0.78 and 1.24, respectively), and the total number of jobs supported by angler expenditures declined from about 17 jobs per million dollars of angler spending in 2006 to 16 jobs in 2011. This means that because of structural changes in the U.S. economy and adjustments in the types of products and services purchased by anglers, an average dollar of angler expenditure in 2011 generated comparatively lower total output and employment, but about equal income and value-added when compared to 2006. The outcome of multiplier comparisons across states varies.

Keynesian multipliers can also be used to predict how changes in angler expenditures (increases or decreases) will affect output, income, value-added, and employment in a regional economy. To do this, one multiplies the appropriate Keynesian multiplier (total impact/total expenditure) by the change. For example, an increase of \$100,000 in overall angler expenditures in Alabama would yield a total increase in output within the state of approximately \$95,680 ( $\$100,000 \times (\$819 \text{ million}/\$856 \text{ million})$ ). Caution is advised, however, when using the expenditure and impact estimates shown in this report to make projections because the projections are based on a particular region's industrial structure in 2008 and if the outcome of an increase in angler expenditures is desired, it must be assumed that there is sufficient productive capacity (i.e., labor and capital) within the region to satisfy an increase in angler expenditures.

The reader should also be aware of additional caveats associated with the state-level impact estimates shown in this report. Separate models were constructed for each state. Therefore, the estimated impacts are limited to economic activity within a state or territory and may underestimate the state-level effects associated with marine recreational fishing. Impacts generated through the imports of goods and services from other neighboring coastal states are not part of each individual state assessment. For example, if a retail store in Florida sold fishing tackle that was manufactured in California, the impacts associated with the production of the fishing tackle are not included in either state's impact assessment. The associated wholesale, distribution, and retail mark-ups that occurred in Florida are included in Florida's impact assessment, but

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<sup>5</sup> The 2006 sales estimate shown in Gentner and Steinback (2008), \$82.3 billion, was converted to its 2011 equivalent using the Bureau of Labor Statistic's Consumer Price Index.

the portion attributable to tackle manufacturing is not included in the California assessment. These cross-state effects, however, are captured in the aggregate U.S. model.

The purpose of the input-output analysis was to estimate the total economic activity associated with marine angling expenditures in each coastal state and across the U.S. Therefore, expenditures by both residents and non-residents were included in the input-output analysis. In contrast to a true “economic impact” analysis that examines how changes in policies or other external factors affect the economic activity associated with changes in angler expenditures, the assessment shown here is generally described as a “contribution” analysis and simply shows the total economic contribution of marine angling expenditures to a regional economy under the conditions that existed during 2011. Often, in economic impact analysis as opposed to economic contribution analysis, spending by residents must be adjusted in the model because it is assumed that they would reallocate most of their expenditures to other sectors of the regional economy, thereby causing no net change in impacts.

Input-output modeling is the most common approach for describing the structure and interactions of regional economies, although it is prudent to be aware of its assumptions regarding linear production functions, constant relative prices, and homogenous sector output. These assumptions are of questionable validity, but are necessary in order to construct the technical coefficients used to determine the direct, indirect, and induced effects in an input-output model. In fact, Propst and Gavrilis (1987) considered these assumptions in their assessment of regional economic impact procedures and concluded that the input-output approach can satisfy the widest range of information needs at high precision levels if primary data are supplied for final demand estimates (i.e., collected directly from anglers as was done for this study).

Another caveat that deserves attention relates to the underlying purpose and use of input-output analysis. In particular, it is a positivistic model designed to identify patterns of transactions and the resource requirements and sector output requirements resulting from angler expenditures. The input-output approach should not be considered a substitute for normative approaches such as benefit-cost analysis. Benefit-cost analysis seeks to determine whether resources are being put to their best use by examining the difference between total economic value and total costs. In the context of recreational fishing, total net economic value is generally defined as willingness to pay in excess of actual expenditures. Alternatively, input-output assessments reveal how actual expenditures affect economic activity within each sector of an economy.

**Table 1. Intercept and Followup Survey Completion Statistics**

<b>State</b>	<b>MRIP Intercept Surveys</b>	<b>MRIP Economic Add-Ons Completed</b>	<b>Mail Surveys Sent</b>	<b>Mail Surveys Returned</b>
Alabama	2,778	1,726	243	80
Alaska			647	412
Connecticut	1,262	941	58	21
California			9,616	2,830
Delaware	3,359	2,623	858	302
Florida	39,208	27,090	4,565	1,931
Georgia	1,719	1,075	207	72
Hawaii	2,529	1,327	4,406	1,105
Louisiana	5,897	5,117	1,608	633
Maine	1,495	1,032	119	55
Maryland	3,815	3,365	1,241	440
Massachusetts	4,262	3,352	1,250	486
Mississippi	1,783	1,200	435	129
New Hampshire	2,341	1,498	621	229
New Jersey	4,296	3,599	1,277	529
New York	3,581	3,122	665	129
North Carolina	20,756	14,295	3,574	1,562
Oregon			2,365	1,221
Puerto Rico	2,290	1,950	252	50
Rhode Island	1,222	825	180	82
South Carolina	2,824	2,141	356	100
Texas			5,820	1,025
Virginia	3,403	2,502	591	243
Washington			2,518	1,115
<b>Total</b>	<b>108,820</b>	<b>78,780</b>	<b>43,472</b>	<b>14,781</b>

<sup>a</sup> The number of completed surveys shown in this Table includes those with some missing responses to individual questions.

<sup>b</sup> The number of surveys mailed in Hawaii exceeds the number of addresses collected via the MRIP intercept due to additional sample from the National Saltwater Angler Registry for Hawaii, additional charter intercepts conducted specifically for the 2011 NES, and a sample of anglers collected at tackle shops in Hawaii.

**Table 2. Angler Effort in Thousands of Trips, 2011**

State	Anglers 16 years and older		Total
	Resident	Non-Resident	
Alabama	1,692	559	2,250
Alaska	393	340	734
California	3,716	103	3,820
Connecticut	994	113	1,107
Delaware	558	306	863
East Florida	7,869	1,012	8,882
Georgia	793	79	872
Hawaii	1,376	48	1,425
Louisiana	3,944	372	4,316
Maine	298	149	447
Maryland	1,827	780	2,607
Massachusetts	2,060	495	2,555
Mississippi	1,316	88	1,404
New Hampshire	195	73	267
New Jersey	3,709	1,123	4,832
New York	3,483	104	3,587
North Carolina	3,289	1,227	4,517
Oregon	571	22	594
Puerto Rico	364	14	378
Rhode Island	511	500	1,011
South Carolina	1,249	430	1,679
Texas	2,016	140	2,156
Virginia	2,076	625	2,701
Washington	1,024	24	1,047
West Florida	9,353	2,772	12,125
United States	54,312	11,484	65,798

<sup>a</sup> United States totals do not include Puerto Rico.

**Table 3. Angler Participation in Thousands of Anglers, 2011**

State	Anglers 16 years and older		Total
	Resident	Non-Resident	
Alabama	425	349	774
Alaska	106	136	241
California	809	78	887
Connecticut	286	82	368
Delaware	114	155	270
East Florida	911	450	1,362
Georgia	242	60	302
Hawaii	83	4	87
Louisiana	707	174	882
Maine	73	89	162
Maryland	400	345	745
Massachusetts	526	243	769
Mississippi	165	54	219
New Hampshire	58	26	84
New Jersey	626	315	942
New York	428	39	467
North Carolina	674	645	1,319
Oregon	172	12	185
Puerto Rico	80	13	93
Rhode Island	88	156	244
South Carolina	197	228	425
Texas	685	66	751
Virginia	485	303	788
Washington	259	14	273
West Florida	1,322	1,313	2,634

**Table 4. Recreational Expenditure Sectoring Scheme for IMPLAN**

<b>Expenditure Category</b>		<b>IMPLAN 440 Sector(s)</b>	<b>Basis</b>	
<b>Trip</b>	Auto Fuel	3115	Retail	
	Auto Rental	362	Industry	
	Bait	3017	Retail	
	Boat Fuel	3115	Retail	
	Boat Rental	363	Industry	
	Charter Crew Tips	338	Industry	
	Charter Fees	338	Industry	
	Fish Processing	61	Industry	
	Food – Grocery Stores	338	Household PCE Vector	
	Food – Restaurants	413	Industry	
	Gifts and Souvenirs	330	Industry/Margins	
	Ice	3070	Retail	
	Lodging	411, 412	Industry	
	Parking and Site Access Fees		State/Local Govt NISP	
	Public Transportation	336, 332	Industry	
	Tournament Fees	410	Industry	
	<b>Tackle</b>	Rods & Reels	3311	Retail
		Tackle & Gear	3311	Retail
Spearfishing Gear		3312	Retail	
<b>Equipment</b>	Camping Equipment	3311, 3084	Retail	
	Binoculars	3211	Retail	
	Fishing Clothing	3087, 3088, 3089, 3093,3311	Retail	
	Club Dues	410	Industry	
	Processing/Taxidermy	405	Industry	
	Subscriptions	3342, 3341 3343,3345	Retail	
	Fishing License Fees		State/Local Govt NISP	

**Table 4. Recreational Expenditure Sectoring Scheme for IMPLAN (continued)**

Expenditure Category		IMPLAN 440 Sector(s)	Basis
<b>Boats</b>	New Power Boat	3291	Retail
	New Canoes/Non-motor Boat	3291	Retail
	Electronics/Accessories	3249, 3238, 3085	Retail
	Boat Maintenance	418, 320	Industry/Margins
	Boat Insurance	357	Industry
	Boat License/Registration		State/Local Govt NISP
	Boat Storage	410	Industry
<b>Houses</b>	New Vacation Home	37, 38	Industry
	Property Taxes for Homes		State/Local Govt NISP
	Second Home Maintenance	40	Retail
	Second Home Insurance	357	Industry
<b>Vehicles</b>	Fishing Vehicle	3276, 3277, 3281, 3282,3294	Retail
	Vehicle Maintenance	414, 320	Industry/Margins
	Vehicle Insurance	357	Industry
	Vehicle License/Registration		State/Local Govt NISP
<b>Interest Payments</b>	Boats	355	Industry
	Homes	355	Industry
	Vehicles	355	Industry
<b>Used Purchases</b>	Power Boats	320	Industry/Margins
	Canoes/Non-motor Boat	320	Industry/Margins
	Vehicles	320	Industry/Margins
	Boat Electronics	322	Industry/Margins
	Real Estate Commission	360	Industry

