target. Final wave sampling in all license frame states, besides California, was delayed until each state could provide their final and complete sample frame from 2006.

Survey versions were personalized based on the state of intercept or licensure, including framing of state specific questions and graphics. Otherwise, questions were identical for every intercept state. The license frame state versions were different from the intercept version only in that the trip expenditure questions were added to the mail survey in the license frame states (Appendix 3). In the license frame states, the trip expenditures were anchored to the most recent saltwater 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 referent trip.

In total, 41,669 mail surveys were sent to anglers across the U.S. (Table 1). Approximately 9.0% of the surveys (3,758) were returned undeliverable, but almost 40% were completed and returned (16,317 surveys). Response rates were fairly consistent across states and generally favorable. One notable exception was Texas. In Texas, all licenses that allowed saltwater fishing were sampled. This included a large number of combination license holders (31.2%) that buy licenses that allow saltwater fishing along with freshwater fishing and/or hunting. A recent survey by Texas Parks and Wildlife Department indicates that only 55.1% of Super Combo and 43.5% of Senior Super Combo license holders actually fish in saltwater (Leitz 2007). It is likely that any Texas combination license holder that did not fish in saltwater would not return the survey, explaining the low response rate in that state. To further explore potential non-response bias, a telephone survey of 10% of all non-respondents was conducted and the results are detailed below.

METHODS

Angler Expenditures

The surveys obtained information on total expenditures made during the trip that might involve multiple days and multiple participants. Therefore, information about party size and trip duration was collected so that trip expenditures could be estimated as per person, per day expenditures.

Data for all intercepted survey participants and all mail survey participants contained the home zip code of the participant. Round trip travel distance between the participant's home zip code and the actual latitude and longitude of the intercept site or the county of their most recent trip, in the case of license frame states, was calculated. The American Automobile Association's 2006 average variable cost of operating a vehicle ($0.145/mile) was used to convert distance to private transportation expenditures. While all surveys asked the respondent to supply private transportation costs, missing values in the data set were replaced with the calculated value.

Respondents to expenditure surveys conducted through the mail often leave questions unanswered if no spending occurred for the item(s) of interest. This makes it difficult to determine whether the actual response should have been zero or the respondent skipped-over that portion of the survey. To avoid making assumptions about a respondent's intentions, screening questions were added to the survey for every grouping of expenditure categories. If a respondent answered the screening question in the affirmative for a particular group of expenditure items (i.e., fishing tackle or gear), 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.

All expenditure groupings included an “other” category allowing an open-ended response for expenditure type and amount. These verbatim responses were then re-coded an added into the appropriate expenditure categories.

Because all durable goods can be used for multiple activities, each expenditure grouping, or in some cases individual categories, included a question about the percent of time the goods purchased in the grouping or category were used for saltwater fishing. The percentage given was used to reduce the expenditure amount used for estimation. In the first round of expenditure surveys that NMFS conducted, respondents were instructed to provide expenditures only for those categories in which the goods purchased were used primarily for saltwater fishing. In order to stay consistent with this notion of primacy, if a respondent said the item was used less than 50% of the time for saltwater fishing, the expenditure amount was re-coded as a zero.

Intercept surveys designed to collect a random sample of trips, as in the MRIP, generally incur an avidity bias as more avid anglers have a higher likelihood of being sampled. If this avidity bias is present in the data it would not effect the estimation of anglers’ daily trip expenditures since the intercept selection probability employed by the MRIP is uniform across fishing trips. However, the avidity bias could effect the fishing equipment and durable expenditure estimates to the extent they are correlated with avidity. The last round of expenditure studies conducted by NMFS (Steinback and Gentner 2001; Gentner et al 2001; Gentner et al 2001a) used the MRIP intercept survey approach to sample anglers and a positive relationship between avidity and expenditures was found and corrected for with a weight developed by Thomson (1991). For this study, we did not test for this bias, but assumed that it exists for the fishing equipment and durable good expenditures since our sample of anglers originated from the MRIP intercept survey. The same weight developed by Thomson (1991) was used to correct for the avidity bias.

In addition to the avidity bias weight, another weight was developed in both the MRIP and license frame states to account for differences between expected and actual fishing effort in 2006. In the MRIP states, intercept sampling is based on quotas developed using expected fishing effort during a two-month sampling period (i.e., wave). Expected fishing effort is simply the effort estimate for the same two-month wave in the previous year. To ensure that the trip-level expenditure estimates are based upon the actual effort distributions that occurred in 2006, each expenditure data point in a particular stratum (i.e., state, mode, wave, residency status) was weighted by the proportion of total estimated effort in 2006 occurring in that stratum. The next section provides a narrative of the effort and participation estimates used in this study.

In all license frame states, a similar weight was used because sampling levels were based on quotas developed using expected license sales during the sampling period. Expected license sales by sampling period were predicted from 2005 license sales rates. Since both trip and durable good expenditures were collected from mail surveys sent to license holders, all expenditure data points were weighted by the number of anglers sampled in a stratum divided by the total saltwater license sales that occurred in that stratum in 2006.

Outliers were removed from the data set by strata (resident status and state of intercept/licensure) by expenditure category. 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 2000) and any strata/category combination with a proportion of standard error (PSE) greater than 20% had the upper 1% of its distribution truncated.

Statistical tests were conducted to examine the potential effects of non-response bias and survey mode differences. Firstly, to examine potential differences between non-respondents and respondents, 10% of the mail survey non-respondents were re-contacted by telephone and asked about their demographic characteristics and their expenditures on fishing gear, fishing tackle, and fishing rods and reels. Secondly, the follow-up expenditure survey was conducted using a mail survey this time instead of a telephone survey, primarily to enhance the ability of the respondent to look up and provide an accounting of detailed annual expenditures. To test the impact of this decision, half of the anglers surveyed in Florida were mailed a follow-up expenditure survey and half were contacted by telephone using the same survey instrument. Results of these tests are shown below.

For policy purposes, only those expenditures that generate economic activity matter. Angler purchases of used goods from private parties do not generate any economic activity and are considered transfer payments from one household to another. Respondents were asked if expenditures on boats, vehicles, and second homes were made new or used, from dealers or private parties, or were financed. If a boat, vehicle, or home was purchased new the entire purchase price was used for estimation. If 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. To calculate the loan principal and the 2006 interest payment to the banking sector, microdata from the Consumer Expenditure Survey (CES) were used to calculate the average loan term, the average principal balance, and the average interest rate (CES 2006). Amortization equations were used to develop the additional categories for each respondent purchasing a financed vehicle, boat, or second home. Additionally, for second homes, the average U.S. property tax was obtained from the National Association of Homebuilders (NAHB 2007). Real estate commissions from home purchases were assumed to be 6%.

Effort and Participation

Total trip expenditures were developed by multiplying mean trip expenditures by category by total annual effort in each stratum (state, mode, two-month period, and residency status), and total durable expenditures were developed by multiplying mean durable good expenditures by category by total annual participation in each stratum (state, two-month period, and residency status). The MRIP generates effort and participation estimates at the stratum-level so those estimates were used in the calculations for all East Coast and Gulf Coast states, excluding Texas where the MRIP survey is not conducted (Table’s 2 and 3). For Texas, all three West Coast states, Hawaii, and Alaska, estimates of angler effort and participation are typically not produced at the stratum level so it was necessary to adjust the available data obtained from those states for this study. These adjustments are delineated below.

Effort

For Texas, survey data were used to estimate effort because the state of Texas does not produce annual effort estimates for all modes. The survey asked respondents to provide the number of trips taken in the last two months in each fishing mode and asked for the number of trips taken in the state of licensure in the previous year. The harmonic mean of 12-month avidity over the last year was calculated for Texas respondents by resident status. Harmonic means were expanded by the number of resident and non resident participants. Effort by mode in Texas was estimated by taking the weighted mean proportion of effort in each mode from the mail survey. The Texas effort estimates were vetted by the Texas Parks and Wildlife Department.

For the West Coast states, PSMFC estimates were used in this analysis (PSMFC 2008). However, the PSMFC estimates that were provided were not stratified by resident status so the data were adjusted so that we could distinguish between resident and non-resident effort. In California, the effort estimates were post-stratified by the weighted mean of avidity from residents and non-residents intercepted during the CRFS intercept survey. In Oregon and Washington, the resident/non-resident effort was post-stratified by the proportion of resident/non-resident license holders. This may be problematic as it assumes the trip taking profile of a resident is the same as that of a non-resident. However, no other data was available to make this stratification.

In Alaska, Alaska Department of Fish and Game effort estimates were used for this analysis (Jennings 2008). MRIP effort estimates were utilized for the private boat and shore modes in Hawaii, and the for-hire effort estimates were obtained from the NMFS Pacific Islands Regional Office (Harman 2007) since the MRIP does not provide estimates of effort for the for-hire mode in Hawaii.

Participation

Although the MRIP participation estimates were used when available, the MRIP non-resident participation estimates are not additive across states as it is impossible to know from MRIP data 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 participation was used to expand the means to the U.S. total expenditure estimate. This restriction likely results in an underestimate of U.S. participation and durable expenditures. For all license frames, participation estimates are considered lower bound estimates as each state has exemptions for various fishing types.

Texas has the following license exemptions: under 17 years of age; born before September 1, 1930; mentally disabled and participating in recreational fishing as part of a medically approved therapy supervised by hospital personnel; mentally retarded person under the direct supervision of a licensed angler; and veterans. Participation in Texas was estimated as the sum of saltwater licenses sold plus a proportion of combination licenses sold. Texas recently completed a survey of combination license holders and found that 55.1% of regular combo and 43.5% of senior combination license holders fished in saltwater. These proportions were used to reduce the number of saltwater participants across these categories. It was also assumed that these percentages also held for the resident and non-resident all-water and lifetime license holders.

Estimating participation in California was a real challenge. The only exemption in their license laws is for anglers fishing from man-made structures, but it is a large exemption. For licensed anglers in California, participation was simply estimated as the sum of resident and non-resident licenses sold. For unlicensed man-made mode anglers in California, participation was estimated by taking state total effort estimates in the man-made stratum and applying the harmonic mean of 12-month avidity in strata from the intercept survey. The actual field questionnaire asked each intercepted angler about 12-month avidity in the district of California where the angler was intercepted. Therefore this estimation strategy assumes that the intercepted angler fished only within the district where they were intercepted. This in district question was new to the 2006 man-made intercept form. In previous years, 12-month avidity was asked at the statewide level and a comparison of the harmonic mean showed that there was very little change in the mean avidity pre- and post questionnaire change. These participation estimates were vetted by the state of California (Ryan 2007).

Oregon’s license frame does not separate fresh and saltwater anglers and contains the following exemptions: 14 and younger; Oregon landowners fishing from their own property; and fishing within three miles of shore between Cape Falcon, Oregon and Leadbetter Point, Washington either an Oregon or Washington license is valid. As a result, the estimates of participation presented here are considered lower bound estimates. Participation was estimated by taking the proportion of residents and non-residents reporting saltwater fishing activity during the last 12 months during the screener survey conducted as described above. Averaged across all six two-month waves, 75.5% of Oregon license holders had participated in saltwater fishing in the previous 12 months, but only 5.8% of all license holders were willing to participate in the mail survey.

Washington’s license frame does not separate fresh and saltwater anglers and contains the following exemptions: 14 and younger; and fishing within three miles of shore between Cape Falcon, Oregon and Leadbetter Point, Washington either an Oregon or Washington license is valid. Therefore, the estimates of participation presented here are again considered lower bound estimates. Participation was estimated by taking the proportion of residents and non-residents reporting saltwater fishing activity during the last 12 months during the screener survey conducted as described above. Averaged across all six two-month waves 84.0% of Washington license holders had participated in saltwater fishing in the previous 12 months, but only 15.0% of all license holders were willing to participate in the mail survey.

Finally, Alaskan participation was provided by the Alaska Department of Fish and Game (Jennings 2007). While Alaska provided saltwater participation estimates, a screener was still necessary to contact saltwater anglers. Averaged across all six two-month waves 93.5% of Alaska license holders had participated in saltwater fishing in the previous 12 months, but only 2.42% of all license holders were willing to participate in the mail survey.

For the remainder of this report, U.S. total participation (15.5 million) includes only resident participants to avoid potential double counting of non-resident participants. As a result, the U.S. total used here likely underestimates total participation in 2006. The actual number of saltwater fishing participants in 2006 in the U.S. is estimated to range between 15.5 million anglers (the summation of all state resident participants) and 24.7 million anglers (the summation of all state resident and non-resident participates).

Economic Impacts

In addition to quantifying angler expenditures within each coastal state and the U.S. as a whole, the second exercise carried out for this study was a regional input-output assessment that examined how those expenditures circulated through each state's economy as well as the economy of the entire U.S. The economic contribution or impact of saltwater sportfishing extends well beyond simply measuring angler expenditures. Angler expenditures provide considerable income and employment in a wide range of manufacturing, transportation, and service sectors. 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 retail and service sectors purchase fishing 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 saltwater sportfishing expenditures to the overall regional economy. In this study, we provide total impact estimates for sales, value-added, income, employment, and taxes for each coastal state in the U.S. including aggregate estimates for the entire U.S.

Input-output modeling is an approach used to describe the structure and interactions of businesses in a regional economy. 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. For a comprehensive description of the strengths and weaknesses of the input-output modeling technique see Miller and Blair (1985).

In the analyses presented here, a ready-made regional input-output system called IMPLAN Pro (Minnesota IMPLAN Group, Inc. 1997) was employed to estimate the economic contribution of marine recreational fishing to each coastal state in the US. The IMPLAN Pro system is a widely used, nationally recognized tool, providing detailed purchasing information for 509 industrial sectors.

State-level multiplier effects attributed to anglers' expenditures were estimated by multiplying the total value of each of the individual expense items (see Table 4 for list of items) that is spent within a particular state by the corresponding IMPLAN-generated multiplier. The IMPLAN Pro multipliers measure the total state-level sales, income, value-added, and employment change in each economic sector caused by a $1 change in output in any particular sector. Therefore, the product of the expenditure values that are spent within a particular state with their matching IMPLAN-generated multiplier provides an estimate of the contribution of each particular expenditure item to the state economy.

Angler expenditures 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 demand in each sector in each state. While the survey asked for total grocery expenditures, the typical grocery or convenience store purchase includes a wide range of products. To allocate generic grocery expenditures to more accurately reflect the mix of products purchased, the Personal Consumption Expenditure (PCE) activity data base for grocery store purchases contained in IMPLAN was used. PCE activity data bases are created by the Bureau of Economic Analysis and represent national average expenditure patterns.

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. RPCs were applied to the retail expenditure estimates to insure that imported goods were not included in the impact estimates.

The resident status stratification is carried through to the impact analysis. Spending by residents on marine recreational fishing generally affects the amount of money available to be spent on other leisure-related activities within a state. A decrease in resident angler expenditures may shift disposable income to other leisure sectors resulting in little overall net change to sales, value-added, income, employment, and taxes within a state. However, even though the overall net change may approach zero, resident angling expenditures support jobs that might not otherwise exist. On the other hand, non-resident angling expenditures contribute to an overall net increase in economic impacts. To address these differences, separate input-output models were constructed for residents and non-residents. Multipliers in the non-resident model are estimated using the base state data in IMPLAN. To avoid double counting of resident expenditures, a separate model was constructed and the total value of resident expenditures was removed from the final demand in each state before the multipliers were generated.

State-level impacts were estimated for sales, value-added, income, employment, and taxes. Sales reflect total dollar sales generated from expenditures by anglers in each state. Value-added represents the contribution recreational angling makes to gross domestic product. Income represents wages, salaries, benefits, and proprietary income generated from angler expenditures. Employment includes both full-time and part-time workers and is expressed as total jobs. Finally, taxes denote the income received by federal and state/local governments.