

estimate that saltwater anglers spent an estimated \$5.8 billion on trip-based expenditures (e.g., ice, bait, and fuel) and another \$25.6 billion on fishing equipment and durable goods (e.g., fishing rods, fishing tackle, and boats) in 2006. We also show that as these angler expenditures filtered through the U.S. economy, they generated an estimated \$82.3 billion in total sales, \$39.1 billion in value-added (i.e., contribution to gross domestic product), \$24.0 billion in income, and supported nearly 534 thousand jobs.

The report begins with a description of the survey sampling design and the completion statistics. The methods used to estimate mean angler expenditures, total angler expenditures, and economic impacts are shown next and then the expenditure and impact results are presented in four separate regional sections: the Northeast, Southeast, Pacific Coast, and Hawaii. Results for the entire U.S. are shown in a separate section. A number of statistical tests were conducted to examine the potential effects of non-response bias and survey mode differences and these findings are also discussed. The last section places the study results in context relative to the expenditure and impact estimates previously collected by NMFS and to angler expenditure estimates produced by the U.S. Fish and Wildlife Service (USFWS) in 2006. The last section also provides some concluding remarks regarding model assumptions and limitations.

DATA COLLECTION INSTRUMENTS

Across the U.S. there currently is no complete and consistent frame of saltwater anglers as some coastal states do not require a saltwater license. Therefore, this survey effort utilized a number of sampling frames. The Marine Recreational Information Program (MRIP) conducts an intercept creel survey in the state of Hawaii and in all of the states on the East and Gulf Coasts, excluding Texas. The MRIP survey platform represents the best, most consistent sample frame for saltwater anglers in states covered by the MRIP. Within the MRIP coverage area, an add-on to the intercept survey was used to collect expenditures resulting from the intercepted trip and to gather a frame for mailing a follow-up survey regarding annual durable expenditures. However, there are coverage gaps in the MRIP for collecting national level data as the entire West Coast, Texas, and Alaska are not covered. In those states, license frames were utilized to contact anglers via a mail survey regarding both trip and durable good purchases.

The MRIP

The MRIP consists of two independent and complementary surveys. These two surveys are stratified to provide independent estimates of catch, effort, and participation across states, fishing modes, and two month waves through each year. The fishing modes used for this stratification are: shore mode, private or rental boat mode, and party or charter boat mode. This method of stratification has proven useful for developing estimates annually or seasonally and it allows individual regions to easily add sample within strata to increase the precision of the estimates.

The first survey is an intercept survey of marine anglers at fishing access sites. This survey attempts to obtain a random sample of all marine recreational fishing trips. The MRIP maintains a list of over 6,000 sites in a master site list, which is continuously updated. Each of these sites is

ranked by an index of relative fishing pressure by mode, month, and weekday or weekend designation. For a given date, interviewers are assigned to a specific site and to a specific mode of fishing. Interviewers are also given two adjacent, alternate sites if a minimum number of interviews cannot be obtained at the original site assignment. Sampling for private/rental and party/charter modes is conducted after the angler's fishing day has been completed. Sampling for the shore mode may be conducted when at least two-thirds of the fishing for the day has been completed and the angler then estimates total trip effort.

The intercept sampling implies a three-stage-sampling framework. In stage one, a given site/day is randomly selected with probability of assignment proportional to the fishing pressure index of the site for that specific day (Cochran 1977). The second stage involves the selection of angling parties, boatloads, groups, or individuals, at the assigned site. Finally, stage three involves possible sub-sampling among the angling parties selected in stage two. Selection of parties (stage 2) and sub-sampling among parties (stage 3) is assumed random with equal probabilities. This allows the use of self-weighting estimators to obtain mean catch-per-trip estimates for each species across all strata.

This intercept survey is a creel survey primarily used to estimate mean catch-per-trip by species. Data elements collected during the base part of the intercept survey include state, county, and zip code of residence, hours fished, primary area fished, target species, gear used, and days fished in the last two 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.

For a given stratum, estimates of mean catch-per-trip multiplied by an estimate of the total number of trips (effort) equals the total catch for that stratum. The effort estimates are obtained through the second part of this survey process; the telephone survey of coastal households. Residential households are sampled randomly using the random digit dialing technique as described by Groves et al. (1988). All anglers in the contacted household are identified, and each is asked about their fishing activity for the previous two-month period. Multiple attempts are made to contact identified anglers. This survey is used to estimate effort by coastal residents living in households with telephones. Ratios from the intercept survey are used to correct these effort estimates to account for non-coastal residents and coastal residents who do not have telephones, as those groups are not covered in the household sampling frame. Data elements collected for this survey include the number of trips in the last two months and the number of trips in the last 12 months. For trips in the last two months, trip dates, mode, time of return, and state of access are also collected.

In NMFS' previous angler expenditure data collection efforts an intercept add-on survey was used to collect a few basic demographic characteristics and a respondent telephone number. The telephone number was then used to contact the angler to collect trip and durable expenditure information via a telephone follow-up survey. To increase sample sizes for the trip expenditure data, the trip-level questions were moved to the intercept add-on survey. This change in methodology reduced standard errors, increasing the precision of the trip expenditure estimates.

The economic intercept survey (Appendix 1) obtained overnight trip information, from those on overnight trips, including number of days away from residence, number of days spent fishing, lodging expenses, and the purpose of the trip. All anglers were asked travel costs, days of fishing in last two months, fishing ability, boat ownership, and trip supply expenditures (bait, ice, refreshments, boat fees, etc.).

Interviewers attempted to collect trip expenditure data from every participant in the creel portion of the survey. In the states where the MRIP survey was conducted, a total of 110,719 economic add-ons were attempted and 99,755 contained at least a home zip code allowing the calculation of travel distance and private transportation expenditures (Table 1). Overall, 68,632 respondents (62.0%) completed the trip expenditure portion of the MRIP economic intercept survey and 20,679 of those respondents (30.1%) supplied a mailing address. Intercept survey participants supplying a mailing address were then sent a mail survey to obtain durable expenditure information.

Mail Survey

The MRIP mail follow-up survey was dedicated to the collection of durable expenditures, socioeconomic, and demographic data (Appendix 2). Expenditure data categories included semi-durable goods (tackle, rods, reels, line, etc.), durable goods (motor boats and accessories, non-motorized boats, boating electronics, mooring, boat storage, boat insurance and vehicles or homes) and angling accessories and multi-purpose items (magazines, club dues, saltwater angling specific clothing and camping gear). Also, the expenditure survey collected a set of socioeconomic and demographic variables.

The switch to a mail survey in 2006 eliminated a number of concerns associated with collecting durable expenditure data over the telephone, as was done in the first round of angler expenditure surveys conducted by NMFS. These concerns included recall of detailed durable expenditures during a short telephone survey, the growing prevalence of cell phone only households, and falling response rates for telephone surveys in general. To compare how this change in methodology may have affected the results, both mail and telephone surveys were administered in the state of Florida. Results of the side-by-side comparisons are reported below.

The mail survey followed a four contact methodology outlined in Dillman (2000) for MRIP intercepted anglers, Hawaii Commercial Marine License (CML) holders, and Texas saltwater license holders. The mailing sequence for these anglers included a pre-notification letter, a survey and cover letter, a reminder postcard, and a final survey and cover letter mailing. Hawaii CML holders were sampled because a CML can be purchased by recreational fishermen so that catch can be sold. Also, while the MRIP is conducted in Hawaii, the survey samples at lower sampling rates than on the mainland, and due to the nature of shore access on many of the islands, shore mode anglers can be difficult to contact. To augment the sample in Hawaii, the CML data base was utilized as well as voluntary angler sign-ups through tackle shops and various fishery events attended by NMFS personnel.

Mail survey questions in Hawaii were designed so that anglers holding permits that allow fish sales could be post stratified as commercial fishermen, expense fishermen, or recreational fishermen based on their survey responses. These questions included whether or not catch was ever sold or whether the fishermen chartered their boat for paying customers. A recreational fisherman was defined as a fisherman that had not sold any fish nor chartered their boat during the previous 12 months. Additional questions were asked regarding the percentage of income earned from the sale of fish or vessel charters and this data was used to separate commercial from expense fishermen. Generally, this post stratification followed Hamilton and Huffman's (1997) work with the Hawaiian small boat fleet. Only fishermen that did not sell fish nor conducted any charters in the previous year are included in the expenditure estimates.

A modification to Dillman's (2000) four contact methodology was required for saltwater license holders in California, Oregon, Washington, and Alaska. Anglers in these states purchase a combined saltwater/freshwater fishing license so a fifth contact was necessary to exclude anglers that only fished in fresh water. In California, names and addresses for the mailing were collected via the California's Recreational Fisheries Survey (CRFS) existing telephone survey of licensed anglers. Details of their surveying methodology are available on the Pacific States Marine Fisheries Commission web site (PSMFC 2008). In all license frame states, the sampling was conducted on a wave basis to correspond to the intercept survey and in an effort to capture seasonality in trip expenditures.

Additional sample augmentation was required in California as well. Saltwater anglers are exempt from licensure when fishing from a man made structure such as a pier or a jetty and a significant amount of fishing effort takes place on the state's jetties and piers. As such, they would never be contacted through the CRFS. Additionally, for-hire anglers are contacted infrequently during the CRFS telephone survey, prompting the CRFS to conduct intercept interviews in both the man-made shore and for-hire modes. As a result, the intercept portion of the CRFS was used to collect additional sample for the mail survey by collecting the names and addresses of participants intercepted in the shore and for-hire fishing modes.

In Oregon, Washington, and Alaska a brief telephone screening survey was conducted. State license files were used for the dialing. Phone numbers were validated and missing phone numbers found using a private phone number look-up service. A maximum of ten attempts were made to contact anglers. If license holders took a saltwater fishing trip in the previous 12 months in the state of licensure, the respondent was deemed eligible to participate in the mail survey and mailing address details were verified.

In California, the actual sampling protocol was controlled by the Pacific States Marine Fisheries Commission (PSMFC, 2008). In all other license frame states, sample was randomly drawn, stratified by resident status, every two months from the most recent version of the entire license database without replacement. These samples were drawn proportionally to effort occurring during the same period for the previous year or the latest year that effort was estimated for the state. The target sampling intensity was 10% of the licensed saltwater anglers, but because sampling targets were formulated using the previous year's license frame and because Oregon, Washington, and Alaska required a prescreening survey, actual sampling rates varied from that

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