

Re-Initiation of the Marine Recreational Fishery Statistics Survey in the U.S. Caribbean in 2000

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ABSTRACT

The Marine Recreational Fishery Statistics Survey (MRFSS) was begun by the National Marine Fisheries Service (NMFS) in 1979 to provide nationwide statistically valid and consistent estimates of saltwater recreational fishing catch, effort, and participation. The MRFSS was based on research conducted in the 1970's and consists of two complementary surveys: a telephone survey for effort and an intercept survey for catch. The MRFSS was conducted in the U.S. Caribbean territories in 1979 and in 1981; however, in 1982 insufficient funding caused that sampling to be discontinued. In 1999, the NMFS began planning to re-initiate the MRFSS in the U.S. Caribbean for calendar year 2000. Planning was conducted in a cooperative manner with the territorial fisheries resource agencies of Puerto Rico (PR) and the U.S. Virgin Islands (USVI). The Caribbean Fisheries Management Council (CFMC) and NMFS Southeastern Regional staff were also consulted to ensure federal management needs unique to the U.S. Caribbean were considered. Telephone sampling began December 1999 in both territories while intercept sampling began January 2000 in PR and March 2000 in the USVI. Sampling results and preliminary estimates are provided and lessons learned from the re-initiation of the MRFSS are discussed. The MRFSS staff expects that the survey will continue into 2001, which will allow continued improvement and adaptation to local conditions.

KEY WORDS: Recreational fishery, Fishery-dependant surveys, U.S. Caribbean

INTRODUCTION

Detailed information on marine recreational fishing is required to support a variety of fishery management and development purposes and is mandated by the Sustainable Fisheries Act, Public Law 94-265. In 1979, NMFS began the comprehensive Marine Recreational Fishery Statistical Survey (MRFSS) to provide such information on a national basis. Although the recreational harvest is only about six percent of the total U.S. harvest of finfish for the contiguous 48 states (O'Bannon 1999), it is important to managers because the fishing activities of millions of marine anglers are directed at relatively few species. Data collected through the MRFSS show that recreational fisheries have tremendous impacts on many recreationally important species and for some species recreational landings surpass commercial landings.

The MRFSS consists of an intercept survey of anglers in the field and a telephone survey of coastal county households. Numerous NMFS methodological studies indicated that a national survey should be structured around this data collection approach (Brown 1977, Brown et al. 1977, Chandler 1977, Chandler and Brown 1978, Hiatt and Ghosh 1977, Hiatt and Worrall 1977, Metze 1977). The studies showed that a telephone survey could be used to collect reliable data on recreational fishing effort. Data on fishing trips became less reliable beyond a two month period due to recall problems. Information on the actual catch such as species identity, number, and size of fish caught could not be reliably collected by telephone. Catch data are obtained from anglers intercepted by trained interviewers stationed at fishing access sites. The MRFSS surveys are stratified among geographic subregions, states, and two-month time periods ('waves'), and the intercept survey is also stratified by fishing mode (shore, private/rental boat, and charter/head boat).

From calendar years 1979 to 1981 the MRFSS was conducted in the U.S. Western Pacific and Caribbean territories and in all coastal states except Alaska, although the Caribbean was not surveyed in 1980. Due to insufficient funding throughout the 1980s and early 1990s, MRFSS coverage was dropped from Hawaii and the U.S. Territories in 1982, and from the Pacific coast (Washington through California) from 1990 to 1992. Sampling coverage during winter months was also curtailed on the Atlantic and Gulf coasts during various years, including the present. Coverage was dropped in relation to the relative magnitudes of the recreational fisheries, with smaller fisheries dropped first. Funding has gradually improved since 1992, allowing re-establishment of the MRFSS on the Pacific coast in 1993, the U.S. Caribbean in 2000, and Hawaii in 2001.

Planning for re-establishment of the survey in the Caribbean began the summer of 1999 and was done in cooperation with the PR Department of Natural and Environmental Resources and the USVI Division of Fish and Wildlife. The territorial agencies provided critical input on local fishing conditions, management information needs, preliminary listings of fishing access sites and estimated fishing pressures, numbers of charter boats, sources for census data needed for expansion of the estimates, review of Spanish-language questionnaires, and recommendations of interviewer hiring sources. PR also proposed using their own staff to increase intercept sample sizes above the base level that NMFS could afford. The Caribbean Fisheries Management Council (CFMC) and NMFS Southeastern Regional Office were also consulted to ensure federal management needs unique to the U.S. Caribbean were considered. Input from the SERO resulted in the use of the flexible questions option on the telephone survey to collect recreational shell-fishing data for lobster, whelk, and conch.

Telephone sampling began December 1999 in both PR and the USVI, while intercept sampling began in January 2000 in PR and in March 2000 in the USVI. Sampling has been completed through wave 5 (September-October) of the 2000

survey and some preliminary results through wave 4 (July-August) are now available. Telephone sampling was conducted by the current MRFSS telephone and intercept contractor, ORC Macro (Macro), one of the ten largest survey research companies in the world. Intercept sampling was conducted by Macro in the USVI and by a combination of Macro and PR staff in PR.

METHODS

The telephone survey collects data on the number of marine fishing trips. For the 1979-1981 Western Pacific and Caribbean surveys, personal interviews at individual homes were conducted instead of a telephone survey of households, due to the low percentage of telephone ownership. Although the contact method was slightly different for this survey component, other survey details and estimation procedures were similar to the routine MRFSS. For the 2000 survey, it was determined that telephone ownership rates (land-lines, not cell-phones) had increased enough to use the routine telephone survey, which is more affordable and logistically simpler, and allows larger sample sizes.

The MRFSS telephone survey estimates the total number of marine recreational fishing trips made by permanent residents of coastal county households with telephones. The sample frame for this survey is the residential household telephone directory for a designated coastal zone in each coastal state. For PR and the USVI the coastal zone includes all of the islands. The survey uses random-digit dialing (RDD) to select an approximately random sample of residential households with phones in each sampled county. The RDD method ensures that all residential phone numbers have an equal probability of being selected in the telephone survey sample for a given county. The sample allocation among counties in a state are based on the square root of the population, which helps ensure that rural counties with small populations are represented in at least some of the sample. For PR and the VI, there are municipalities and islands, respectively, instead of counties; however there is no census data available for these divisions, nor are there distinct telephone exchanges by municipality (PR) or island (USVI), therefore the telephone survey is a simple random sample within each territory.

Over 250,000 telephone households are contacted each year on the Atlantic, Gulf, and Pacific coasts. Samples typically are proportionally allocated to each state and wave based on relative historical distributions of estimated fishing effort. The 1979 and 1981 MRFSS Caribbean estimates were examined to determine their applicability to allocations but were extremely variable. Prevalence rates in the 1979 - 1981 surveys showed that 3 - 4% (PR) and 7 - 8% (USVI) of all households engaged in marine recreational fishing in the last two months, therefore sample sizes for each territory were set at 2,000 (PR) and 900 (USVI) households per wave. This is equivalent to state levels in the southeast U.S. which are the highest in the nation. Dialing for each wave's telephone survey was completed by contractor personnel during the two-week period which included the last week of the wave and the first week of the next wave.

If any of the permanent residents of a contacted household participated in marine recreational fishing within the last two months, all recreational saltwater fishermen in that household who fished during that period are interviewed. Fishermen are asked to provide the number of days, or day-trips, spent fishing in each fishing modes in the past two months. Next, the interviewer asks the respondent about each day-trip, starting with the most recent day of fishing and working back two months. For each trip, the fisherman is asked for the date of the trip, the state and county (municipality for PR and island for USVI) from which it was taken, the mode of fishing, the primary water body fished (ocean or inland waters), the type of access used (private or public), and the time of return.

The intercept survey gathers catch and demographic data from marine recreational anglers who have just completed fishing from shore, private/rental boats, or charter/head boats. In PR and USVI there are no head boats, so that mode is charter boat only. Over 80,000 fishermen interviews are conducted in coastal states on the mainland each year. Intercept sampling is stratified by state, mode, and wave with a minimum of 30 intercepts in each stratum. Beyond this minimum, samples are allocated in proportion to relative historical distributions of estimated fishing effort from the three previous survey years. The 1979 and 1981 MRFSS Caribbean data were too variable to provide practical guidance, therefore sample sizes were set equivalent to state levels in the Southeast U.S., but modified by preliminary estimates of the numbers of charter boats, and the numbers, distributions, and expected pressures by mode of fishing access sites. The 1979 and 1981 data showed high variability on seasonality between the two survey years, therefore sampling allocations were set equal for all waves for 2000 (Table 1).

Lists of access sites for marine recreational fishing were provided to MRFSS staff by PR and USVI in 1999 and modified by ORC Macro to include all MRFSS variables. These lists are updated prior to each wave's sample selection. Sites are chosen for interviewing assignments by randomly selecting from among the listed sites but weighting by estimates of expected fishing activity. The intent of the weighting is to sample so that each angler trip has an equal probability of inclusion in the sample, except that low pressure sites are down-weighted relative to medium and high-pressure sites to increase efficiency. Sampling historically has been distributed among weekdays and weekends (including holidays) based on a 60/40 split. Based on advice from PR, that was modified to a 50/50 split for that territory.

Anglers are intercepted, screened, and interviewed at assigned access sites upon completion of their fishing trips. Each interview consists of an introduction to the survey and information on the Privacy Act of 1974, an oral interview concerning the fishing trip just completed, collection of phone ownership and residence location, thorough examination of the respondent's catch, and measurement of lengths and weights from all of (or if necessary, a random sample) the fish of each species in the respondent's catch.

Table 1. Sample target goals for the Marine Recreational Fisheries Statistics Survey intercept interviews of fishermen by mode and territory for 2000.

Territory Sample Goals	Fishing Mode		
	Private Boat	Charter Boat	Shore
Puerto Rico			
MRFSS Base Target	200	90	130
PR Add-on Target	292	61	227
U.S. Virgin Islands			
MRFSS Base Target	150	80	100

Catch is divided into three categories – fish that were caught and landed whole or in such manner that they are available for identification, enumeration, weighing and measuring by trained MRFSS field personnel (type A); fish that are reported by the angler because they were filleted, released dead, given away, or disposed of in some way that interviewers can not verify the species, sizes, or numbers reported (type B1); and fish that were reported as released alive (type B2).

Effort estimates generated directly from the RDD telephone survey are the number of individual fishing trips taken by individual fishermen from households with phones in coastal counties. Trips are estimated for each state, wave and mode at the county level and then summed to state (territorial) level. For PR and the USVI the estimate is made for each territory as a whole, since county-type data for expansion are unavailable. The number of trips per all contacted household for each fishing mode during each wave is multiplied by the number of permanent, full-time occupied households in the coastal county (Bill Communications, Inc., 1999) to estimate total number of fishing trips in each mode by coastal county residents. Population estimates were obtained for PR from the Center for Income Registration or CRIM (1998 estimates were 1,225,400 households). Telephone ownership (78%) for PR was obtained from the PR Departamento de Comunicaciones. Population and telephone ownership estimates were obtained for the USVI from the Virgin Islands Population and Housing Survey, Eastern Caribbean center, University of the Virgin Islands (1995 estimates were 36,400 households with 90% telephone ownership). The variance associated with the average number of fishing trips per household is calculated using the model for a stratified simple random sample. The estimate of coastal resident trips is adjusted to cover trips not included in the sampling frame. For the U.S. Caribbean, it is adjusted by ratios obtained from the intercept survey for trips taken by out-of-state residents and for trips made by people who live in households without telephones. The total number of trips is then post-stratified into primary fishing area (inland, state territorial sea, and EEZ) by the distribution of intercept trips.

The catch of each finfish species is estimated for each subregion, state, wave, fishing mode, primary fishing area, wave, and catch type. The total number of fish for each stratum is estimated from the estimated number of fishing trips taken in that stratum, and the mean number of fish caught per trip in that stratum.

Estimation of the variances associated with the average catch and weight of catch estimates obtained from the intercept survey is based on the assumptions that the primary sampling unit was a fishing trip by an individual angler and that there is no clustering effect due to the collection of groups of interviews at each visited site. These assumptions were empirically verified in pilot surveys. Therefore, the variance is estimated using the standard variance equation for a stratified random sample. Combination estimates of total fishing effort, the numbers of fish caught, the weight harvested, and others are all produced by multiplying together the appropriate basic estimates, therefore the basic formula for the variance of a product of two random variables is used for those calculations (Goodman 1960). The total catch estimates are not necessarily normally distributed; however, simulation experiments indicated that a normal approximation is satisfactory for construction of 95 percent confidence intervals around the estimated total catch. More detailed information on the methodology and estimation procedures and access to the data are available on the Fisheries Statistics and Economics web page (www.st.nmfs.gov/st1).

RESULTS

Telephone quotas were met in all waves. Prevalence rates (the percent of coastal households with phones with 2-month marine recreational fishing activity were lower than historical rates (Table 2).

Table 2. Marine Recreational Fisheries Statistics Survey telephone sample sizes, percent of marine recreational fishing households, and number of marine recreational fishing households by wave and territory for sampling waves 1 - 4, 2000, in the U.S. Caribbean.

Territory	Sampling Wave			
	1	2	3	4
Puerto Rico				
Sample Size (households) % Saltwater	2,011	2,001	2,004	2,010
Fished	1.5	2.0	2.1	2.83
Saltwater Fishing Households	30	41	42	57
U.S. Virgin Islands				
Sample Size (households) % Saltwater	908	903	907	909
Fished	5.2	4.8	5.7	5.6
Saltwater Fishing Households	47	43	52	51

Based on historical rates, the sample sizes were expected to provide approximately 60 active fishing household interviews per wave and territory. Instead, prevalence rates ranged from 1.5 to 2.8 percent for PR and 4.8 to 5.7 percent for USVI, providing approximately 40-50 households with fishing activity per wave in each territory.

Intercept sample sizes have generally improved since the beginning of the survey in Puerto Rico but have been zero to minimal in the USVI (Table 3). For PR the sample sizes were lower than the MRFSS base target level for private/rental boats in waves 1-3, but exceeded the base in wave 4. For PR charter boat and shore fishing, the sample sizes were higher than the base target for all waves except wave 2 and wave 1, respectively. For the Virgin Islands, no intercept samples were obtained for waves 1 and 4, and for waves 2-3 were minimal.

Effort estimates for PR for waves 1-4, 2000, exceeded the total estimates for the 1979 and 1981 MRFSS, while USVI effort estimates were lower than the 1979 estimate and much higher than the 1981 estimates (Table 4). PSE's were similar to 1979-1981 for PR but better for the USVI. Shore fishing effort for PR was similar in all years, while private/rental boat effort has increased slightly (Figure 1). Charter boat effort was low relative to the other modes in all years. Effort by mode for the USVI was extremely variable between the 1979 and 1981 surveys (Figure 2). In 2000, effort was almost evenly split between the private/rental boat and shore fishing with only a trace of charter boat fishing. All effort estimates are preliminary and may be subject to change.

Table 3. Actual intercept interviews of fishermen obtained by the Marine Recreational Fisheries Statistics Survey by fishing mode and territory for 2000.

Territory	Waves 1-4, 2000		Waves 1-6, 1979 & 1980	
	Angler Trips	PSE	Angler Trips	PSE
Puerto Rico	807,100	13.8	1979-639,200 1981-592,900	@16
U.S. Virgin Islands	104,633	35.7	1979-163,800 1981- 26,100	@62

Table 4. Marine Recreational Fisheries Statistics Survey effort estimates and their proportional standard errors (PSE) for the U.S. Caribbean for waves 1-6 of 1979 and 1981, and waves 1- 4 of 2000.

Territory	Waves 1 - 4, 2000		Waves 1 - 6, 1979 and 1980	
	Angler Trips	PSE	Angler Trips	PSE
Puerto Rico	807,100	13.8	1979-639,200 1981-592,900	@16
U.S. Virgin Islands	104,633	35.7	1979-163,800 1981- 26,100	@62

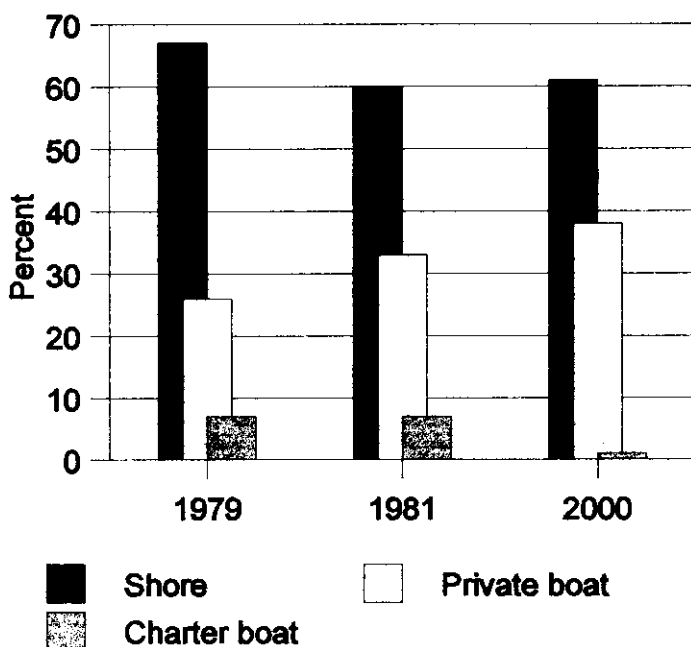


Figure 1. Marine Recreational Fisheries Statistics Survey effort estimates by mode for Puerto Rico for 1979, 1981 and 2000.

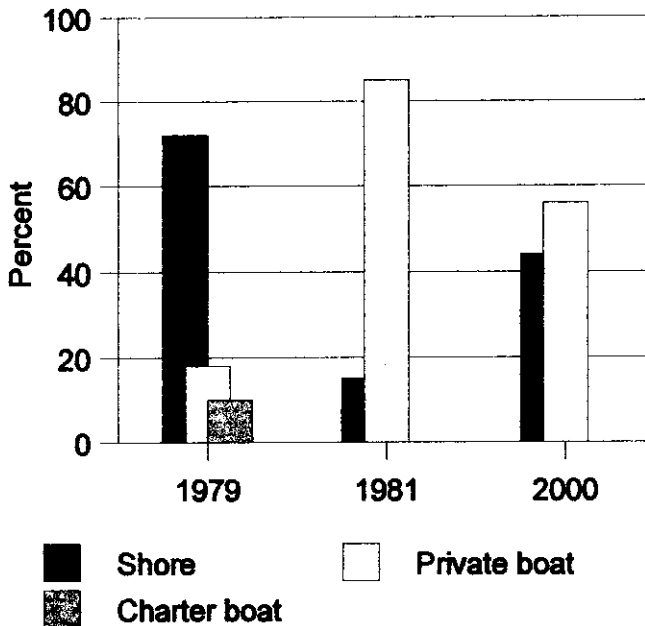


Figure 2. Marine Recreational Fisheries Statistics Survey effort estimates by mode for the U.S. Virgin Islands for 1979, 1981 and 2000.

Preliminary catch estimates are available for PR but not for the USVI due to the inadequate numbers of intercept samples obtained. Preliminary estimates for total catch (A+B1+B2) for PR are lower than the estimates from 1979 and 1981 but may reach the 1979 levels when the year is completed (Table 5). The percent of fish released is only seven percent. The top ten species groups of finfish harvested, in order, are herrings, snappers, dolphins, sea basses, mullets, jacks, tunas/mackerels, grunts, drums, and triggerfishes/filefishes. All catch estimates are preliminary and may be subject to change.

DISCUSSION

While two-month marine recreational fishing prevalence rates were lower than expected for the telephone survey, the large sample sizes ensured adequate numbers of active surveys, as shown by the PSE of 14 for Puerto Rico effort estimates. The PSE for the USVI effort estimates were negatively affected by the inability to obtain adequate intercept samples for the adjustments for out-of-state households.

Table 5. Marine Recreational Fisheries Statistics Survey harvest and released alive estimates of the numbers of fish and their proportional standard errors (PSE) for the U.S. Caribbean for waves 1-6 of 1979 and 1981, and waves 1-4 of 2000.

Type of Catch	Numbers of Fish	PSE	% of Total Catch
Harvest (A+B1)	1,842,000	23	93
Released Alive (B2)	142,000	21	7
Total Catch	1,984,000	22	100
Historical Total Catch		1979-2,664,000 1981-4,261,000	

The contractor has had difficulty in recruiting, hiring and retaining intercept samplers in the U.S. Caribbean, especially in the USVI. In PR, finding and hiring qualified interviewers was more difficult and took longer than expected prior to and during wave 1 of the survey. Without PR Department of Natural and Environmental Resources staff it is doubtful that sample sizes would have approached target levels in the earlier waves. The situation there has improved through the persistent efforts of the contractor and we expect sample sizes to continue to grow as the contractor-hired staff begin to obtain the base levels and the PR staff-collected interviews become true add-ons. Recruiting, hiring, and retaining staff in the USVI remains a problem, although the contractor successfully hired three new interviewers in October and they should be able to begin obtaining the target levels of interviews in wave 5. The interviewer problems is not a result of inactivity on the contractor's part, rather there just doesn't seem to be much interest by the populace in this type of part-time work. For example, a recent hiring effort resulted in 25 positive responses by phone, yet only three people actually show up for the testing and training sessions. In another case, a female interviewer was hired and sent a packet of assignments and forms, but her husband did not want her working so he hid the packet, and she missed the entire sampling period. We will continue to work with the contractor to explore remedies to these types of problems.

There have been other difficulties in attaining target levels of intercepts, including interviewer tardiness. The contractor has had difficulties in getting hired and trained interviewers to report back in a timely fashion and then to send in completed data forms. Without timely reporting of quotas, the contractor can not reschedule missed assignments or make additional assignments to make up for lower productivity levels. With-holding payment for completed assignments until completed packets are received doesn't seem to have much affect.

Lower productivity levels than expected has also resulted in not reaching target sampling goals. Productivity is affected by a variety of factors. Many of the fishing access sites have very low pressure, and there are relatively few very busy sites, which makes it more difficult and expensive to obtain samples. Subsistence fishing also seems to be affecting productivity as fishermen are excluding themselves due to the wording of our screening questions. These fishermen are using recreational methods, and many may be taking the fish home for the table so the catch is not being captured through monitoring of commercial fishing, yet these trips are not being captured by the MRFSS. We are considering changes to the screener for 2001 to allow categorization of the fishermen, while disposition of the catch questions will let us parse out fish that will enter commercial channels. Another factor causing low productivity is simply inexperience. The site registers and sample draws are working much better now that experienced interviewers have been in the field long enough to make better judgements on the expected pressures at access sites. More experienced interviewers also become more efficient and better at getting people to agree to be interviewed.

The survey estimation procedures are working well, although they could be improved if more recent information on household populations and phone ownership were available. Sampling could also be made more efficient if there were data on household populations by municipality in PR and by island in the USVI.

We currently expect that our budget will allow continued sampling in the U.S. Caribbean at least through 2001. This will allow us to continue to improve the survey and adapt to local conditions. Data and experience gathered through the 2000 survey will be used to fine tune sampling operations and we hope to provide full effort and catch estimates for the United States Virgin Islands as well as Puerto Rico for calendar year 2001.

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