

# **The New Marine Recreational Fishery Statistics Survey Method for Estimating Charter Boat Fishing Effort**

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## **ABSTRACT**

From 1997 through 1999, state and federal agencies cooperated to conduct a pilot study of an alternative method for estimating charter boat angler fishing effort in the Gulf of Mexico. Cooperating agencies included the Gulf States Marine Fisheries Commission (GSMFC), the marine fishery agencies of Florida, Alabama, Mississippi, and Louisiana, and the National Marine Fisheries Service which funded the pilot study. The new method sought to improve effort estimates by collecting trip data via weekly telephone interviews of a 10% random sample from a directory of charter boat owners/operators. Respondents reported the number of charter boat trips, numbers of anglers who fished, and primary areas fished. The existing Marine Recreational Fishery Statistics Survey (MRFSS) methodology utilizes a random-digit-dialing (RDD) telephone survey

of coastal households, which requires a large correction factor due to a significant percentage of charter anglers not residing in coastal counties. We compared the two methodologies and found that charter directory estimates were considerably more precise than RDD estimates with more than a 50% reduction in standard error. Total annual effort estimates did not differ significantly; however, the new methodology produced geographic and temporal distributions of charter fishing effort which were considered much more credible by the Gulf for-hire industry. The new methodology indicates fewer trips in the Exclusive Economic Zone, more trips in inland areas, and no significant difference in the number of charter trips in State Territorial Seas. The primary implications of the new methodology include:

- i) More accurate fishing area data,
- ii) Relatively low respondent burden,
- iii) Increased cooperation and participation by the for-hire industry, and
- iv) More precise and accurate data making it easier to identify changing trends in the for-hire fishery.

This new methodology has been officially adopted by the National Marine Fisheries Service as the new MRFSS method for the Gulf of Mexico from West Florida through Louisiana beginning with 2000. Dependent on funding, we hope to implement the new methodology nationwide by 2001-2002.

**KEY WORDS:** Charter Boat Fishery, methods, surveys

## INTRODUCTION

Prior surveys of fishing effort and catch by the charter boat fishery have been inadequate for a variety of reasons. The National Marine Fisheries Service (NMFS) has conducted the Marine Recreational Fishery Statistics Survey (MRFSS) since 1979, which utilizes a random-digit-dialing (RDD) telephone survey of coastal residential households to estimate fishing effort and an access-point intercept survey to estimate catch-per-trip of finfish. The RDD survey is relatively efficient for estimating shore and private boat fishing effort, but it has been rather inefficient for estimating charter boat fishing effort. Charter boat fishing is relatively rare among residents of coastal residential households, and the coastal zone covered by the RDD survey includes only 20-30 % of the U.S. households with residents who fish on charter boats. Adjustment factors, which sometimes are large, are estimated from the MRFSS intercept survey to account for charter fishing trips by non-coastal residents. The low incidence of charter boat fishing trips in the MRFSS telephone survey sample and the relative instability of the large adjustment ratios have caused MRFSS estimates of charter boat fishing effort and catch to be very imprecise and highly sensitive to random measurement errors. A Voluntary Logbook Survey (VLS) conducted by the NMFS Panama City Lab in 1983-1996 was used to track general catch-rate trends in the charter boat fishery, but it's non-random method of sampling ruled

out its use for estimating total fishing effort or catch. Attempts to census charter boat fishing effort and catch through 100% mandatory logbook reporting (MLR) have traditionally encountered biases due to undercoverage and non-response. Furthermore, the respondent fatigue that can develop with MLR programs can lead to significant reporting and measurement errors (Pollock et al. 1994). Traditionally, logbook reporting programs for charter boats have not attempted to independently validate or measure reporting errors in the self-reported data they collect.

In 1997, the NMFS began a cooperative pilot study to test new methods of surveying fishing effort and catch by the charter boat fishery in the Gulf of Mexico. Participating agencies included the Gulf States Marine Fisheries Commission (GSMFC), the marine fishery agencies of Florida, Alabama, Mississippi, and Louisiana, and the National Marine Fisheries Service which funded the pilot study. The primary objective of the study was to test methods which would potentially be more efficient and more accurate in estimating effort and catch than the traditional methods used by the NMFS Marine Recreational Fishery Statistics Survey (MRFSS). Two sampling survey methods based on the development and use of a vessel directory as a sample frame were tested in comparison with the traditional MRFSS methods. Both a vessel-directory telephone survey and a vessel-directory logbook survey were tested as alternative methods for estimating the number of angler fishing trips on charter boats. Due to concerns over the potential inaccuracy of self-reported data, the pilot study also tested an independent validation survey as a means of estimating possible errors in the reporting of fishing effort by vessel operators. This report describes the new Vessel-Directory Telephone Survey (VDTS) methods and preliminary results, and compares them with the traditional MRFSS methods and estimates.

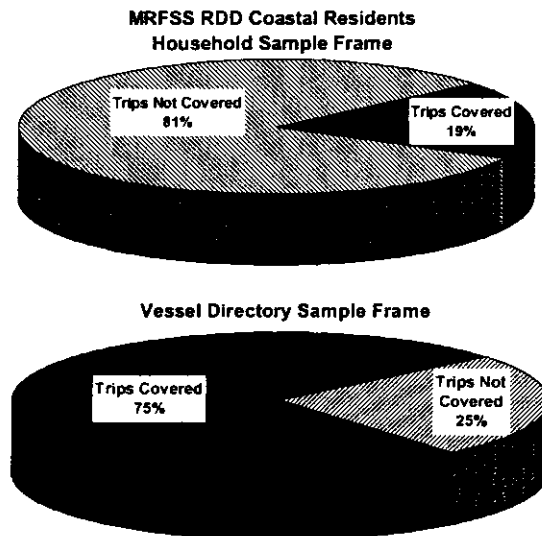
The MRFSS consists of two independent surveys which are stratified among geographic subregions, states, and two-month time periods (or 'waves'). The MRFSS telephone survey was designed to estimate the total number of marine recreational fishing trips made by permanent residents of coastal county households with telephones. The sample frame for this survey was the residential household telephone directory for a designated coastal zone in each coastal state. The survey used a technique called random-digit dialing (RDD) to select an approximately random sample of residential households with phones in each sampled county. The telephone survey dialing sample for each state was stratified by state, two-month wave, and county. Samples were proportionally allocated to each state and wave to match relative historical distributions of estimated fishing effort. The RDD method ensured that all residential phone numbers had an equal probability of being selected in the telephone survey sample for a given county. 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 at least one permanent resident of a contacted household participated in marine recreational fishing within the last two months, each recreational saltwater

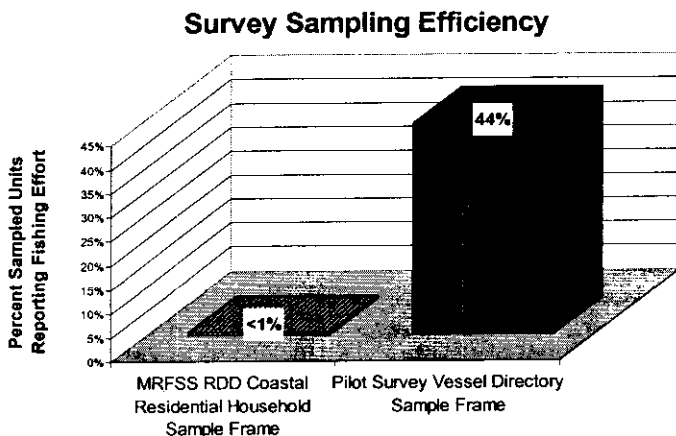
angler in that household who fished during that period was interviewed. The anglers were asked to provide the number of days, or day-trips, that he/she spent fishing in each of three different fishing modes – shore, private/rental boat, and charter boat. Next, the interviewer asked the respondent questions about each day-trip, starting with the most recent day of fishing and working back through the wave. For each trip, the angler was asked for the date of the trip, the state and county 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 RDD sample frame used by the MRFSS telephone survey has both overcoverage and undercoverage problems with respect to surveying charter boat fishing effort. Sample frame overcoverage refers to the inclusion of ineligible respondents in a survey sample frame, whereas sample frame undercoverage refers to the exclusion of eligible respondents from a survey sample frame.

The extreme overcoverage of the MRFSS RDD sample frame (Figure 1) with respect to charter boat fishing made it very difficult to obtain the effective sample sizes needed to make reasonably precise estimates of coastal resident fishing effort for each geographic region and two-month period. In addition, less than 0.5% of the residential households contacted by the telephone survey actually had residents who report that they took charter boat trips during the two-month sampling period (Figure 2). Effective sample sizes for estimating numbers of charter boat fishing trips by coastal residents were so small that “zero” effort estimates were common during low activity time periods and “non-zero” estimates were usually very imprecise even during relatively high activity periods.



**Figure 1.** Sample frame coverage of Charter Fishing Trips by the traditional MRFSS RDD telephone survey and the pilot VDTs charterboat study.



**Figure 2.** Sampling efficiency for Charter Fishing Trips by the traditional MRFSS RDD telephone survey and the pilot VDTs charterboat study.

The MRFSS telephone survey only covered about 20% of the anglers who fish from chartered boats. Most of the anglers who fish from chartered boats resided outside of the coastal zone covered by this survey. In order to correct for the approximate 80% undercoverage of the RDD sample frame, the MRFSS used angler residency data collected by the intercept survey to estimate an undercoverage correction ratio (UCR). The UCR varied greatly among geographic areas and time periods around a mean ratio of about 5:1. Correction ratios that high are very difficult to estimate precisely from intercept survey data, therefore the corrected total charter boat effort estimates were usually considerably more imprecise than the charter boat effort estimates for coastal residents.

MRFSS estimates of charter boat angler fishing effort were generally too imprecise to be useful in tracking temporal or geographic trends in the fishery. In order to get more precise estimates of charter boat fishing effort for a given geographic area or two-month sampling period, the MRFSS pools data collected during that time period with data collected in the four previous years for the same time period prior to calculating the estimates. Although pooling in this case increased the reliability of the estimates, it may have also introduced a bias if fishing effort was steadily declining or increasing over the five-year period. In addition, the estimates produced from the 5-year pooled data cannot be used to track year-to-year trends in the charter boat fishery.

The MRFSS obtained information about the distribution of trips by primary area of fishing (inland waters, state territorial seas, EEZ), state and county of residence, type of residence, and presence/absence of telephone in the household from the intercept survey. These data were used to post-stratify estimates of

total fishing effort into one of the three fishing areas, and to calculate adjustments for trips made by non-coastal county residents, those anglers not living in private households, and anglers living in households without a telephone. Data from the intercept survey was used for the area fish post-stratification because it was hard to get reliable data on the area of charter boat fishing trips directly from the telephone survey interviews of coastal household residents. Typically, charter anglers do not know specifically where they fished or may have trouble recalling the details of the trips taken up to two months prior to the interview. In addition, the large undercoverage of the MRFSS telephone survey suggested that its sample of trips was not likely to be fully representative of all trips. This post-stratification method relies heavily on the assumption that the area distribution of trips profiled by the intercept survey sample is truly representative of all charter fishing trips within the sample period and region.

#### METHODS

The pilot VDTS method tested in this study depended on the existence of a relatively complete list of boats used to take marine recreational anglers fishing for a fee. In order to use such a list as a sample frame for a telephone survey, a unique identifier for each vessel, as well as a telephone number and a designated representative for each vessel was required. Prior to the start of the pilot survey, additional information on each listed boat which could be used to facilitate successful survey contacts with boat representatives or to characterize the boat's fishing capacity and location was obtained. For each listed vessel, its name, its state or Coast Guard registration or license number, its length, and its principal county and port of operation was compiled. State personnel attempted to determine whether the boat was usually trailered and launched at public ramps or whether it was usually moored at a private dock, private marina, or public marina. They also obtained telephone numbers and mailing addresses for as many as three captains or owners of each boat. Through telephone contacts and mailings, state agency staff attempted to verify the vessel directory data. In addition, they asked vessel captains or owners to specify a particular person as the primary representative for reporting of the boat's fishing effort. Each boat was randomly assigned a survey identification number which could be used as an anonymous identifier of all data collected for that vessel in the pilot telephone survey databases.

In order to determine which of the listed boats should be considered for inclusion in the pilot survey, sample frames for each state and state subregion, the cooperating agencies used information reported by respondents to classify boats as either "active", "inactive", or "ineligible". "Active" boats were boats known to be taking fishing passengers for a fee. Unless otherwise indicated by a vessel representative, all listed boats were assumed to be active. "Inactive" boats were those reported to be temporarily out of operation as a guide, charter, or party boat. "Ineligible" boats were those reported to be used strictly for commercial or

private recreational fishing, as well as those known to be covered by the NMFS Southeast Headboat Survey, or some other non-fishing activity. Ineligible boats were not removed from the directory, but they were flagged so that they would not be used on the pilot survey sample frames. Boats for which representatives refused to supply data were identified in the directory as "not willing to participate" and were not included in pilot survey sample frames. Information on eligibility, activity status, and survey participation status was updated as new data were collected by interviewers conducting the MRFSS intercept survey or the pilot telephone survey.

Sampling for the pilot VDTS was stratified by state or state subregion (Louisiana, Mississippi, Alabama, and three subregions of Florida), MRFSS two-month wave, and week. The Gulf coast of Florida was divided into three distinct geographic strata. Boats with principal ports located in Escambia through Dixie Counties were assigned to the Panhandle Region; those located in Levy through Lee Counties were assigned to the Western Peninsula Region; and those located in Monroe County were assigned to the Keys Region. The sample frames used for the VDTS were developed from the vessel directories prepared for the three states and the three Florida subregions. Only boats in the directory that had at least one unique identifier (name, registration or license number), a valid telephone number, a county of operation, and a representative's name listed were chosen for each sample frame. Boats previously identified as ineligible and boats previously reported to be inactive for the entire sampling wave were not included in the frame. Also, boats whose representatives identified themselves as not willing to participate were not included. Inactive boats projected to become active at some time during the sample wave were included in that wave's sample frame. Sample frames were constructed and all sample draws were made for a given wave at least two weeks prior to the start of the wave. The same sample frame was used to draw telephone calling samples for all weeks of a given wave in each state or state subregion.

For each week, a 10% sample of boats was selected by stratified, systematic random sampling from each state or state subregion sample frame. Prior to selecting the sample, the program used randomly sorted the boats in the sample frame and then sorted the "shuffled" list of boats by county of principal port and boat length category. Boats for each county were separated into short (less than or equal to 28 feet in length) or long (greater than 28 feet in length) categories, with boats of unknown length comprising a third size category. We sorted in this manner to assure a consistent proportional representation of boats among weeks with respect to boat size and geographic area of port. We randomized the start point and set the sampling interval such that every 10th boat was selected on one pass through the entire list. Since we randomly sorted boats within the geographic/boat-size strata prior to each week's sample draw, we assumed simple random sampling of boats for each week.

Gulf States Marine Fisheries Commission (GSMFC) staff mailed pre-contact letters and optional data forms to representatives of the boats included in the

weekly telephone interviewing samples. The letter was mailed at least two weeks in advance of the telephone interviewing attempts, and an optional data form which explained the type of information sought was included in the mailing so that the captains or owners would know what to expect. In addition, it was provided so that the respondents could use it to record their fishing effort data for the week to be surveyed. Representatives of boats for which a correct mailing address had not been obtained obviously did not receive the mailings.

Calling for the VDTS was completed by state agency personnel during the week following each designated sampling week. Callings started on Monday and continued until representatives of all boats in the sample had either been successfully contacted or called without contact at least five times. Repeated calling attempts for particular boat representatives were made at different times of day and on different days to increase the likelihood of a successful contact. If a contact was made but the designated vessel representative was not available then more callbacks were attempted to contact the appropriate person. The outcomes of all calling attempts were recorded and the final result for each vessel was coded at the end of the week. The final results of calling attempts included "successful contact", "line busy", "no answer", "answering machine or service", "wrong number", "not available", "not in service", "refusal", "communication problem", and "fax/computer response". Once telephone contact was made with a given vessel representative, the respondent was asked to specify a preferred day and/or time of day for subsequent survey interviews. This information was entered into the vessel directory for later reference.

Respondents were interviewed about their boat's fishing activity during the prior full week. Initial screening questions verified that the person contacted was an eligible representative of the selected boat. The interviewer then asked the respondent to report the number of dock-to-dock trips taken by the selected boat during the prior week, as well as the number of those trips which were for the purpose of marine recreational fishing. For each recreational fishing trip, starting with the most recent, the interviewer asked the respondent to report the mode of the trip (charter, headboat, or private), the number of anglers who fished on the trip, the primary area fished (inland or ocean waters), and, if ocean, the distance from shore (< 3 miles or > 3 miles in AL, MS, and LA; < 10 miles or > 10 miles in Florida). In addition, they asked for the number of hours fished, the primary and secondary fishing methods used, the return time, and both the county and specific site of fishing access. For each boat fishing trip reported the interviewer also recorded both the date and day of the week on which it occurred. At the end of each interview, interviewers asked additional questions to update information listed for the boat in the vessel directory, if needed.

A random 10 % sample of the completed interviews were selected and a second call was made later in the week to allow the respondent to verify the data recorded from the interview. This "post-validation" procedure was implemented to build confidence in the quality of the data collected and minimize possible



recording errors made by the interviewers. Post-validated interviews were flagged in the final database.

An independent survey was conducted to determine whether or not respondents were accurately reporting their fishing effort data on the VDTS. Using the sample drawn for a given week, state personnel attempted to visit the principal port identified for each boat on at least one day during the sample week. The time of validation visits was chosen to coincide with the time of day when boat fishing activity could most readily be confirmed. Observers usually visited boat slips during the morning hours between 9:00AM and 1:00PM. If the boat was observed to be out of its slip, then the observer recorded the boat as "out". If the boat was observed to be in its slip, then the observer recorded that the boat was "in". For the first two waves of the VDTS (September - December 1997), boats that were "out" were assumed to be fishing that day. Starting in January of 1998, validation observers attempted to confirm the fishing status of boats. If a boat was observed to be out of its slip, then the observer recorded the boat as "out" and attempted to determine whether the boat was fishing by asking a marina operator or other knowledgeable people present at the site. If the boat was determined to be fishing, then the boat's status was recorded as "out, fishing confirmed". If the observer was unable to confirm that the boat was fishing that day, then he/she recorded the status as "out, fishing not confirmed". In order to estimate reporting errors, we matched validation observations with fishing effort data reported during the subsequent VDTS interview. This allowed direct comparisons of observed fishing effort with reported fishing effort for a given boat and day. The results of these comparisons were used to estimate reporting errors which were stratified by state, or state subregion, and wave.

## RESULTS

Estimates of Gulf charter boat fishing effort from September 1997 - December 1999 derived from the pilot VDTS followed a seasonal trend with peak activity in May/June of 1998 and 1999 (Figure 3). Adjustment estimates were relatively small each wave except for some unexpectedly large adjustments for unlisted boats in Nov/Dec 1998 and Mar - Jun 1999, and an unusually large adjustment for reporting errors in Nov/Dec 1998 (Figure 3). Relative to estimates derived from the traditional MRFSS RDD telephone survey the pilot VDTS estimates were more precise (smaller 95% confidence intervals) and demonstrated an expected seasonal trend of fishing activity in the Gulf of Mexico (Figure 4).

The relative precisions of the pilot VDTS wave estimates were greater than those of the traditional MRFSS estimates, were more consistent from wave to wave, and were independent of the magnitude of the estimates (Figure 5). The Gulf charter boat pilot VDTS effort estimated by fishing area was significantly lower in the EEZ and significantly higher in Inland waters than the estimates

derived by the traditional MRFSS RDD telephone survey for corresponding areas (Figure 6).

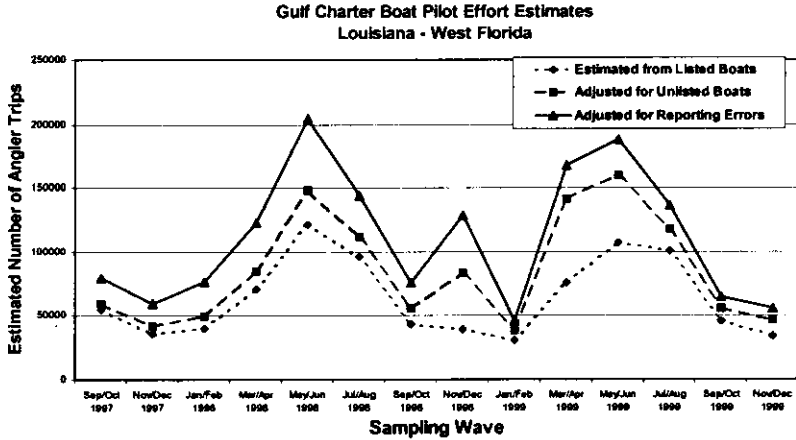


Figure 3. Gulf charter boat effort estimates and adjustments by wave from pilot VDTs study.

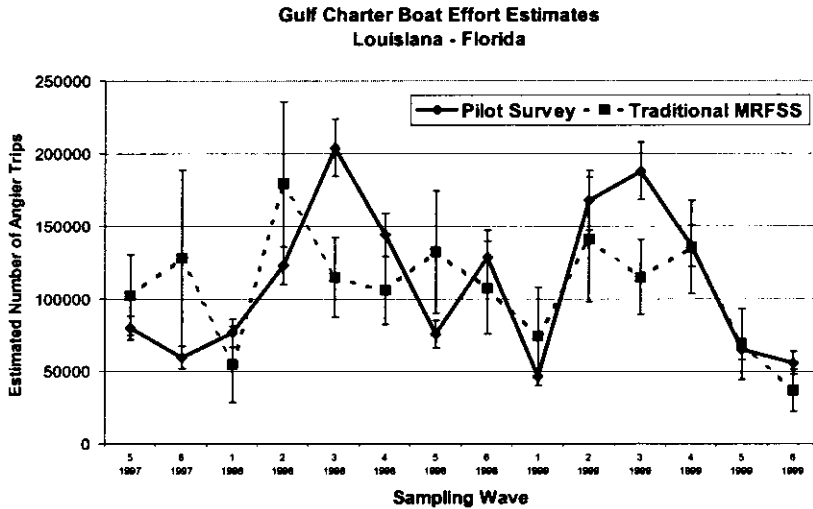
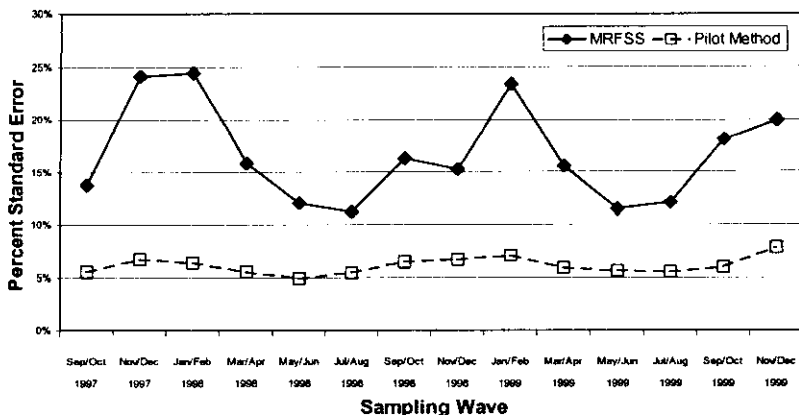
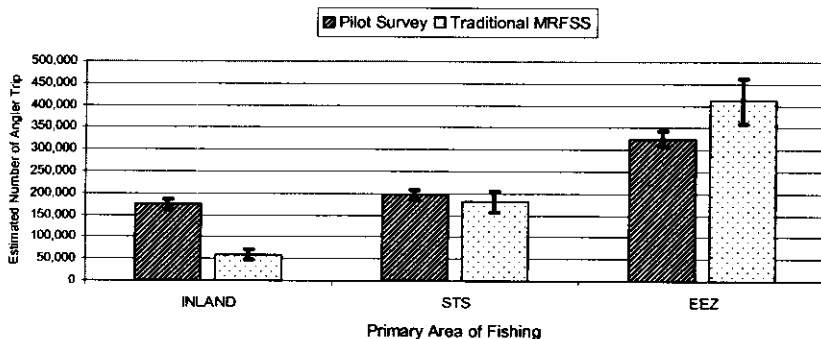


Figure 4. Gulf charter boat effort estimates and 95% confidence intervals by wave from pilot VDTs study and traditional MRFSS RDD telephone survey.



**Figure 5.** Precision of estimated angler effort (trips) by pilot VDTs and traditional MRFSS methods [PSE = (Std. Error of Estimate/Estimate) x 100].

**Average Annual Charter Boat Angler Trips by Area**  
Louisiana - Florida (Sept. 1997 - Dec. 1999)



**Figure 6.** Annual charter boat angler trips estimated by the pilot VDTs and the traditional MRFSS methods.

**DISCUSSION**

The pilot vessel directory telephone survey produced significantly more efficient, precise, and credible charter angler effort estimates than the traditional MRFSS method. This was primarily due to better coverage of Gulf charter angling activity, collecting the data from vessel representatives rather than their customers, and excellent cooperation rates from the charter fleet. Although there

was no significant difference in the annual Gulf of Mexico and state level effort estimates, the new methodology generally showed higher charter angler effort in inland waters and lower charter angler effort in the exclusive economic zone (EEZ). The pilot study also indicated a significantly different seasonal distribution of charter angler effort relative to the traditional MRFSS distribution, which the Gulf charter fleet considered more realistic.

Participating agencies were pleased by the preliminary findings. The NMFS adopted the pilot survey as the new MRFSS charter method in the Gulf of Mexico starting in 2000 and hopes to implement it nationwide in the near future.

#### LITERATURE CITED

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