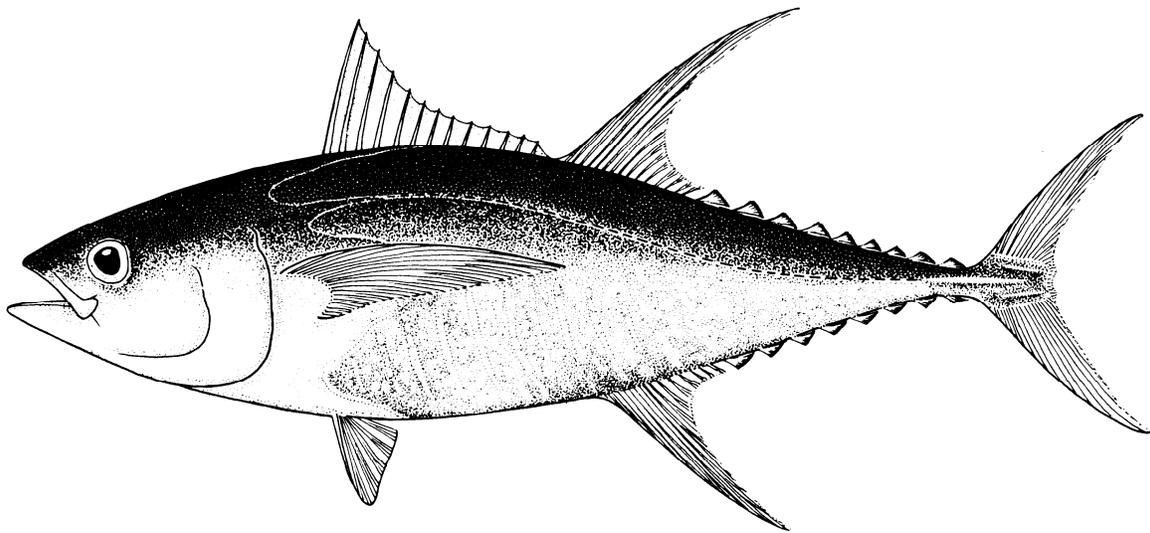


# **Characterization of Rod and Reel Highly Migratory Species Fisheries in the U.S. South Atlantic and Gulf of Mexico**



Prepared by:

MRIP Highly Migratory Species Work Group

September, 2009



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Acknowledgements: The project team would like to thank the following HMS fishing industry members for assisting with the design of the telephone questionnaire: Sharon Miller (Texas), John Price (Texas), Brent McCullough (Georgia), Devlin Roussel (Louisiana), and Anna and George Beckwith (North Carolina). Rob Andrews, Lauren Dolinger-Few, John Foster (NMFS Fisheries Statistics Division) and Dave McGowan (Florida Fish and Wildlife Conservation Commission) assisted with various project phases including survey design, data cleaning, and review of draft report. The characterization telephone survey was implemented by Strategic Research Group (SRG) out of Columbus, Ohio under contract to NOAA Fisheries. SRG provided Table 1, Figure 1, and Appendix C for this report. The project team would also like to thank members of the MRIP HMS Work Group (listed below) for providing project guidance and reviewing this report.

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## **Executive Summary**

Recreational fisheries targeting highly migratory pelagics such as tunas, billfish, and sharks make up a relatively small proportion of all recreational saltwater fishing effort. Trips directed at highly migratory species (HMS) can differ from more typical near shore fishing trips in many attributes including fishing locations, access sites, return times, tournament participation, and perhaps most importantly species composition and catch rates. Such differences, combined with the “rare event” nature of HMS fishing trips can often present unique sampling challenges. Generalized saltwater angler surveys aimed at estimating catch and effort for all species often do not produce very precise or accurate estimates for many highly migratory species. The purpose of this project was to characterize the HMS fisheries in the Gulf of Mexico and South Atlantic as an initial step towards evaluating the need for alternative data collection methods to improve on the accuracy and precision of HMS data in these sub-regions. The survey population included all HMS Angling (6,239) and Atlantic Tunas General (867) category permit holders whose principal port state was in North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, or Texas. HMS Charter/headboat category (185) permit holders in Texas were also surveyed. A contractor was hired to implement a telephone survey of all permit holders on these lists (i.e., attempted census). The telephone questionnaire focused on basic characterization questions such as how often, where (access sites) and when (times, seasons) do anglers fish for HMS, what species do they target, and do they participate in tournaments. The questionnaire was pre-tested by five HMS permit holders in the study area. A pre-notification letter was sent to each permit holder several days before dialing began. The CATI telephone survey was conducted during a three week period in September 2008. A total of 5,098 completed interviews were conducted out of 7,291 permit holders attempted for a 70% completion rate.

Private boat (Angling and General categories) permit holders reported taking, on average, about 6 HMS trips per year in the Gulf of Mexico and South Atlantic. Recreational HMS fishing occurs year-round from North Carolina through Texas. Peak months are July/August in the Gulf of Mexico and May/June in the South Atlantic. Yellowfin tuna is the most frequently targeted and caught HMS managed species throughout the region. Although not managed by NMFS, blackfin tuna are also highly pursued, particularly in the Gulf. Sailfish, blue marlin, and white marlin are all important target species for billfish anglers in the Gulf and South Atlantic. Although caught and released in large numbers, the majority of blacktip sharks are caught incidentally by anglers targeting other (non-shark) species. About 1 out of every 10 HMS Angling category vessel trips in the region is associated with a fishing tournament. Results suggest that a lot of these HMS tournaments are not complying with the federal registration requirement.

The potential for bias associated with under-coverage of restricted access site HMS trips is relatively high and should be addressed in the design of future recreational HMS surveys in this region. One out of every four permit holders indicated using a personal dock as their primary access site for HMS fishing. Prevalence of private dock usage varied greatly by state (e.g., Alabama nearly 40% versus Louisiana only 13%). Both species targeted and HMS catch rates varied considerably by primary access site type. Billfish were far more likely to be targeted on trips returning to personal docks than on trips returning to public boat ramps. The opposite was

true for trips targeting sharks. Angling category vessels returning to personal docks reported catching fewer sharks but more billfish per trip than vessels returning to public boat ramps. Differences between personal dock trips and marina trips were also found for particular state/species combinations, although these differences were generally smaller and less consistent than comparisons between personal docks and public boat ramps. Considering the differences found between personal dock and public boat ramp HMS trip catch rates, the potential for bias associated with under-coverage of private access HMS trips should be positively correlated with both the relative prevalence of inaccessible personal dock trips, and the proportion of all intercepted HMS trip interviews conducted at public boat ramps.

Regional differences were found between the South Atlantic and Gulf in potential bias associated with under-coverage of trips returning during off-peak sampling times. Overnight fishing trips are an extremely important component of the Gulf of Mexico HMS fishery but considerably less common in the South Atlantic. Potential bias associated with under-coverage of trips returning during off-peak times (i.e., late night and early morning) is a bigger concern in the Gulf. Comparisons between MRFSS assignment end times and reported HMS trip return times also revealed a large mis-match in the Gulf of Mexico. Seventy percent of Gulf Angling category permit holders indicated their most common HMS trip return time was between 5:00 pm and 10:00 pm. By contrast, 94% of all MRFSS Gulf assignments (across the same cells as the characterization survey) ended at or before 5:00 pm. MRFSS data on interview assignment end times suggests that for the South Atlantic the “peak” return time window for HMS trips is more adequately being covered by the survey.

Characterization survey results suggest that, in addition to lacking the desired level of precision, MRFSS intercept survey catch rates are biased low for some of the most frequently targeted and caught HMS species in the Gulf of Mexico and South Atlantic. Biased MRFSS catch rates for highly migratory species may be due to a combination of under-coverage of overnight HMS trips, trips returning to private access sites, and trips associated with tournaments, as well as other factors. If the management and assessment of these species rely upon precise and accurate total catch and landings estimates for the recreational sector, NMFS should consider implementing alternative data collection approaches in the region. Characterization results from this study can be used to either implement a new data collection pilot for HMS in the Gulf of Mexico and South Atlantic or to assist in the redesign of the MRFSS to more adequately cover “rare event” highly migratory species.

In addition to yellowfin and blackfin tuna landings, other commonly reported caught (although mostly released rather than landed) HMS in this region include skipjack tuna, bull shark, sand tiger shark, blue marlin, white marlin, and sailfish. Prospective survey design changes associated with the replacement of MRFSS with MRIP will likely improve the quality of catch estimates for these species in both sub-regions. However, more significant survey design changes and sample size enhancements will likely be needed in the Gulf of Mexico to attain the same level of accuracy and precision. Therefore, a specialized survey focused on HMS fishing may be a more efficient and cost effective way to improve the accuracy and precision of catch estimates for these species in the Gulf of Mexico. For both sub-regions the relative advantages and disadvantages of modifying a generalized survey, such as the MRFSS, to accurately and precisely estimate rare event HMS catches must be weighed against those of implementing a

specialized data collection program focused specifically on HMS. This decision should be based on several factors including: 1) the specific management or stock assessment need for a specified level of data quality and timeliness for particular species or species groups, 2) what changes to the MRFSS are actually implemented in the coming years under MRIP, and if this re-design will accommodate the need for improved data on “rare event” species in general, and 3) the relative cost associated with each approach.

For species that are infrequently landed (e.g., billfish, swordfish, and most shark species), even on directed HMS trips, accurate and precise landings estimates will not be attainable through modifications of a generalized survey such as the MRFSS, and may not even be feasible or cost effective through a specialized survey approach. An attempted census of all landings that is widely publicized, requires mandatory reporting, has adequate enforcement, and can be independently validated may be the only way to achieve the desired level of data quality for these species. Results from this study could also inform decisions regarding where and for what species a catch card census type programs might work, and what special provisions would need to be put in place to increase motivation to comply. For example, characterization survey results suggest that a catch card program may be more effective in Louisiana, where personal dock use is relatively small (13%), than in Alabama where 39% of HMS permit holders use personal docks. Boats returning from HMS fishing “after hours” when landings tags and catch cards are not available is more of a problem in the Gulf than South Atlantic. A catch card program implemented in the Gulf would need to accommodate HMS trips returning “after hours” (i.e., after marina operated reporting stations have closed). Characterization survey results indicate that nearly one of every three HMS trips in North Carolina returns to a private dock and another 25% return to a public boat ramp. Follow-up validation studies are needed to determine whether HMS landings from trips returning to North Carolina sites that are not official catch card reporting stations are being reported.

### ***Summary of Data Collection and Management Recommendations***

- If important for HMS management and assessment, improvements in the accuracy and precision of recreational yellowfin tuna landings estimates and skipjack tuna, bull shark, sand tiger shark, blue marlin, white marlin, and sailfish release estimates could likely be achieved either through 1) an MRIP redesign of MRFSS that accommodates “rare event” HMS, or 2) implementation of a new data collection approach focused specifically on offshore fishing for large pelagics in the Gulf and South Atlantic.
  - Results suggest that more substantial changes may be needed to attain the desired level of accuracy and precision on HMS catch in Gulf of Mexico compared to the South Atlantic. A specialized data collection focused on large pelagics may be a more efficient and effective way to improve HMS estimates in this region.
- If implemented, an MRIP redesign of MRFSS to improve HMS data should 1) address potential under-coverage biases (private access, return times, tournaments), 2) increase sample sizes in cells with HMS catches, and 3) utilize a list frame (e.g., saltwater license, angler registry, HMS permit list, or some combination) approach for estimating effort.

- Private access trips are a significant component of the HMS recreational fishery in the South Atlantic and Gulf of Mexico. Differences in catch success and target species likely exist between private access and public access trips for particular survey strata. Future HMS data collection programs should make every effort to address under-coverage of private access trips and include them in catch rate calculations. More emphasis should be placed on sampling boats at fuel docks and a question should be added to intercept interviews to determine where these boats are returning to.
- Overnight trips are a significant component of the HMS recreational fishery in the Gulf of Mexico. Potential bias associated with under-coverage of HMS trips returning during off-peak times should be addressed. Further studies are needed to compare HMS catch rates and target species across different return time blocks. Future surveys should address under-coverage due to return times by attempting to match sampling coverage times with the actual distribution of trip return times. Since return times for HMS trips are likely different from non-HMS trip return times this may require a unique HMS stratum for sampling or a specialized survey focused only on HMS.
- NMFS should explore the feasibility of implementing either HMS catch card or landings tag programs throughout the South Atlantic and Gulf to improve landings estimates of billfish and swordfish. Landings of certain shark species and rarely landed tunas in these regions (bluefin, bigeye, albacore, and skipjack) could also potentially be improved through an enforceable catch card or landings tag program.
- Results suggest there is either a considerable amount of confusion or blatant disregard concerning the differences between HMS rod and reel permit categories, and the rules and restrictions associated with each. NMFS should develop an outreach message aimed at informing and educating HMS captains about the different types of permits available, what each permit allows and doesn't allow, and the consequences of violating those rules.
- Results suggest that a large number of HMS tournaments are not complying with the mandatory registration requirement in the South Atlantic and Gulf. An educational outreach effort may also be needed to better inform HMS tournament directors and participants of the federal requirement to register their tournament and, for billfish tournaments, to report their catch and effort.
  - An attempt should be made to contact organizers of HMS tournaments mentioned by permit holders during the characterization interview that could not be matched to the registration list. Routine internet searches should be conducted to find HMS tournaments that have not registered.

## **Introduction**

Offshore fishing trips targeting highly migratory species (HMS) typically make up a relatively small proportion of all recreational fishing trips. As a result of the “rare event” nature of these trips, generalized angler surveys aimed at estimating catch and effort for all species do not produce very precise estimates for many highly migratory species. In addition to low precision, catch estimates for HMS derived from generalized survey approaches may suffer from biases associated with sampling under-coverage. For example, under-coverage of private access, night fishing and tournament trips in the Marine Recreational Fisheries Statistics Survey (MRFSS) dockside intercept survey may contribute to the inaccuracy of HMS catch and harvest estimates.

In such cases specialized surveys or other data collection approaches (e.g., catch card programs) are often needed to achieve the desired level of statistical precision. For example, the NOAA Fisheries Large Pelagic Survey (LPS) was specifically designed to collect information on recreational fishing directed at highly migratory species (e.g., tunas, billfishes, swordfish, and sharks). This specialization has allowed higher levels of sampling needed to provide more precise estimates of pelagic fishing effort and catches of highly migratory species. However, at present the LPS is only conducted from Maine through Virginia. Inadequate coverage of highly migratory species (HMS) in the South Atlantic and Gulf of Mexico regions was identified by fishery managers and constituents as a data gap at a NOAA sponsored Recreational Fisheries Statistics Requirements Workshop in 2007. Expansion of HMS data collection programs to meet management needs was also identified by the Marine Recreational Information Program’s (MRIP) Operations Team as a high priority recommendation both on a national level and specifically in the Gulf of Mexico.

The MRIP HMS Work Group has recognized the need to first characterize HMS fisheries before either geographically expanding data collection programs (i.e., such as LPS or catch cards) or implementing new methodologies in these regions. Characterization studies and pilot surveys are an important initial step in the development and implementation of full-scale catch and effort data collection programs. Information obtained from such studies is often essential in selecting the appropriate methodology and in defining the scope of new data collection programs. The purpose of this project was to characterize the HMS private boat rod and reel fisheries in the Gulf of Mexico and South Atlantic (excluding Florida), and the HMS charter boat fishery off Texas. The anticipated long-term benefit of this project is improved accuracy, precision and reliability of highly migratory recreational fisheries data in these regions. Fishery characterization information obtained from the telephone survey will also help assess the magnitude and impact of potential biases associated with under-coverage of private access and night-time fishing trips during dockside intercept surveys. Evaluation of these potential biases is a National Research Council recommendation and has been identified as a high priority by the MRIP Operations Team.

## Methods

### *Sampling*

This project set out to characterize HMS recreational fisheries in the South Atlantic and Gulf of Mexico as an initial step towards evaluating the need for alternative data collection methods to improve on the accuracy and precision of HMS data in these sub-regions. The approach taken here was an attempted census of all HMS Angling and Atlantic Tunas General (and HMS Charter/headboat category in Texas) category permit holders who indicated their principal port state was in the study range (i.e., NC-TX, excluding FL). While there are other types of HMS and Atlantic Tunas permits (e.g., Harpoon, Purse Seine), rod and reel fishing for highly migratory species is limited to these three. The large majority of vessels permitted to fish for HMS with rod and reel in the South Atlantic and Gulf of Mexico are in the Angling category. The three permit categories are defined by NOAA Fisheries as follows:

- 1) HMS Angling - owners/operators of vessels fishing recreationally for HMS in the Atlantic, Gulf of Mexico and Caribbean Sea must obtain this permit. This permit is for recreational fishing only, no sale of catch is permitted.
- 2) Atlantic Tunas General - owners/operators of vessels fishing commercially (in Federal or State waters) in the Atlantic, Gulf of Mexico and Caribbean Sea for Atlantic bluefin, bigeye, yellowfin, albacore, or skipjack tunas using a combination of rod and reel, harpoon, and/or handlines must obtain this permit. Sale of tuna catch is permitted with this permit.
- 3) HMS Charter/headboat - owners/operators of charter/headboat vessels fishing for and/or retaining regulated HMS (in Federal or State waters) in the Atlantic, Gulf of Mexico and Caribbean Sea, must obtain this permit. This permit allows a vessel to fish both commercially for tunas and recreationally for HMS, although not on the same day.

A telephone survey was used to collect characterization data from HMS permit holders in three permit categories. Strategic Research Group (SRG), a private survey research firm, was hired to implement the telephone survey with oversight from the MRIP HMS work group. SRG attempted to contact all permit holders in the HMS Angling and Atlantic Tunas General categories who indicated their principle port state was in North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana or Texas. Florida permit holders were not included in this study since a separate MRIP pilot study, conducted by Florida's Fish & Wildlife Conservation Commission in 2008-2009, characterized HMS fisheries in that state. SRG also attempted to contact all HMS Charter/headboat permit holders in Texas as there was an identified need to characterize this fishery.

Although they participate in the HMS recreational fisheries in the South Atlantic and Gulf of Mexico the following vessel groups were not included in this study:

- 1) Non-permitted recreational vessels that target and/or catch HMS. This includes both vessels fishing illegally for HMS without a proper permit and vessels fishing for a species of HMS not requiring a permit (e.g., blackfin tuna, Atlantic bonito)
- 2) Vessels whose principle port state is outside the study area but fish for HMS within the study area.

Thus, the results presented here do not represent all recreational HMS fishery participants but rather the subset of those that are permitted and have a vessel principally ported within the study area. Although one would expect this subset to account for the large majority of HMS catch and effort within the study area, additional surveys are needed to verify this.

The first step in the survey process was to check the lists of the HMS Angling, Atlantic Tunas General, and HMS Charter/Headboat permit holders in the database provided by the NOAA Fisheries. The sample database was checked for vessel duplication. All vessel and contact information was updated from call sheets, and missing information was researched further. Research associates first used on-line NOAA databases to look up vessel information. When information on addresses or telephone numbers was incorrect, incomplete, or missing, on-line White pages and other information sources were utilized in an attempt to collect accurate information. Research associates also looked up and contacted businesses as a further attempt to locate missing contact information in the sample database. After removing duplicates, a total of 7,291 HMS permit holders were selected to participate in the survey (6,239 Angling, 867 General, and 185 Charter/headboat; Table 1). Nearly 90% of these were considered “*valid*” meaning they contained the minimum contact information to be contacted for an interview.

A pre-notification letter was sent to each permit holder several days before the survey went into the field (Appendix A). The pre-notification letter served the following purposes: 1) inform each vessel representative that he/she has been selected for participation in the HMS characterization survey, 2) provide a brief description of the project and the purpose or objectives of the survey, 3) inform each vessel representative of the date when the Contractor will begin to call for an interview, 4) provide respondents with a toll-free number and instructions for scheduling an interview, and 5) provide respondents with contact information for a NOAA Fisheries representative to contact with additional questions about the project. A total of 142 letters were returned as undeliverable.

### ***Survey Instrument***

The primary focus of this pilot study was to answer fundamental questions such as how often, where (access sites) and when (times, seasons) do anglers fish for HMS, what species do they target, and do they participate in tournaments. Most of the survey questionnaire focused on answering these general effort related questions. A 12-month recall period was used in order to maximize the amount of information collected and effectively cover a full fishing year using a relatively short (3-week) dialing period. Despite recognized difficulties and caveats associated with collecting catch data over the phone using a long recall period, questions about HMS catch were included on the questionnaire to obtain a general idea or “ballpark” estimate of approximately how many fish are caught and landed by species.

Table 1. HMS Permit Holders by Principal Port State, Permit Type, and the Number Contacted for an Interview.

			<i>PERMIT TYPE</i>			<i>TOTAL</i>
			<b>HMS Angling</b>	<b>Atlantic Tunas General</b>	<b>HMS Charter/ Headboat</b>	
<i>PRINCIPAL PORT STATE</i>	<b>Alabama (AL)</b>	<b>Total Valid<sup>1</sup></b>	533	24	0	557
		<b>Valid</b>	466	22	0	488
		<b>% Valid</b>	87.43	91.67	0	87.61
	<b>Georgia (GA)</b>	<b>Total Valid</b>	126	11	0	137
		<b>Valid</b>	110	9	0	119
		<b>% Valid</b>	87.30	81.82	0	86.86
	<b>Louisiana (LA)</b>	<b>Total Valid</b>	796	49	0	845
		<b>Valid</b>	693	41	0	734
		<b>% Valid</b>	87.06	83.67	0	86.86
	<b>Mississippi (MS)</b>	<b>Total Valid</b>	224	10	0	234
		<b>Valid</b>	202	10	0	212
		<b>% Valid</b>	90.18	100.00	0	90.60
	<b>North Carolina (NC)</b>	<b>Total Valid</b>	2490	672	0	3162
		<b>Valid</b>	2247	603	0	2850
<b>% Valid</b>		90.24	89.73	0	90.13	
<b>South Carolina (SC)</b>	<b>Total Valid</b>	1215	83	0	1298	
	<b>Valid</b>	1065	76	0	1141	
	<b>% Valid</b>	87.65	91.57	0	87.90	
<b>Texas (TX)</b>	<b>Total Valid</b>	855	18	185	1058	
	<b>Valid</b>	785	16	173	974	
	<b>% Valid</b>	91.81	88.89	93.51	92.06	
<b><i>TOTAL</i></b>		<b>Total Valid</b>	6239	867	185	7291
		<b>Valid</b>	5568	777	173	6518
		<b>% Valid</b>	89.25	89.62	93.51	89.40

<sup>1</sup> *Valid* refers to the number of HMS permit holders with the minimum contact information to be contacted for an interview including those individuals that were contacted six or more times without resulting in an interview

The MRIP project team developed a rough draft characterization questionnaire at the project kick-off meeting. SRG and NOAA Fisheries reviewed the questionnaires for content, format, question-flow, and CATI adaptability, and provided recommended modifications to the project team. SRG programmed the questionnaire into the CATI system along with drop-down lists (provided by NOAA Fisheries) for looking up fishing access sites and HMS tournament names. SRG worked with the project team to pre-test the questionnaire and CATI program with representative anglers and captains. The questionnaire was pre-tested by phone with four permit holders: two from Texas and one each from Georgia and Louisiana. A fifth permit holder from North Carolina preferred to review an emailed copy of the questionnaire and provided us with

written feedback. Pre-test phone interviews were monitored by project team members and all were recorded for future listening. Following the interview pre-test respondents were asked a series of follow-up questions pertaining to the relevance and clarity of the questions, the length of the interview, and the overall flow of the interview. The pre-test resulted in some important modifications to the order and exact wording of specific questions. The final version of the questionnaire is included as Appendix B.

### ***Interviewer Training, Supervision, and Monitoring***

All SRG telephone interviewers receive general training in the following areas:

- Sampling procedures and identifying factors that can cause interviewer and respondent bias.
- How to introduce themselves and the project to potential respondents.
- How to make appointments and schedule call backs.
- Correct interviewing and probing techniques with emphasis placed on reading questions exactly as worded and recording open-ended responses verbatim.
- How to fill out call sheets and enter correct call disposition codes.
- How to use the computer-assisted telephone interviewing (CATI) system.

Trainers personally reviewed the Interviewer Training Manual with new Interviewers so that they had a comprehensive overview of SRG's interviewing procedures. The Interviewer Training Manual included scripts that the interviewer learned to help him or her respond to respondents' potential questions and concerns. All interviewers and other project staff were asked to read the NOAA Administrative Order 216-100 (Protection of Confidential Fisheries Statistics) and sign a statement of non-disclosure.

In addition to this general training, all interviewers participated in a training session customized to the HMS Characterization Survey project. The survey instrument was carefully reviewed and role-played with interviewers and any potential problems or issues that may have arisen were fully discussed. A project-specific interviewing manual was prepared by SRG with input from a North Carolina Sea Grant Extension Program fisheries specialist and NOAA Fisheries biologists. The manual included the goals and objectives of the project, specific fishery terms that the interviewer needed to know, information regarding the sample, responses to FAQs, and pictures and descriptions of the fish and fishing equipment to assist interviewers to fully understand respondents' answers. A document that included scripted responses for respondent questions was located at each survey station for quick reference.

A 1:5 supervisor/interviewer ratio was maintained throughout the survey effort. Supervisors were always on the floor with the interviewers listening to the interviews. Corrective feedback was provided to interviewers promptly, and supervisors were always available to handle questions or problems throughout all phases of interviewing. All interviewers were also regularly monitored via a silent monitoring station and feedback was provided to interviewers as required.

### *Dialing procedures*

The CATI telephone survey to characterize HMS in the South Atlantic and Gulf of Mexico was conducted from September 2 through September 23, 2008 with call-in interviews accepted until September 28. The vast majority of permit holders were called on day one of dialing. If multiple telephone numbers were provided, interviewers called the appropriate number identified for either daytime or evening calling. Interviewers made a minimum of six call attempts to each vessel owner or representative, with at least one call in the daytime and three in the evenings (with one in the early evening, one middle evening, and the other late evening). Permit holders were also called on Saturday during the day and Sunday evening. Once a respondent was reached the interviewer provided a brief introduction to the survey, verified who they were speaking with, and verified that the respondent had knowledge of the permitted vessel's fishing activity.

In an effort to reduce survey non-response, a two-phase message procedure was utilized to encourage participation. Interviewers left messages aimed at encouraging the respondent to call back when they were available, or at least pick up the telephone when called. The first message was left after reaching an answering machine two or three times, and the final message was left two or three days before the end of the calling window. Although respondent call-ins were not tracked, after leaving the first and second message there appeared to be a large increase in the number of call-ins. Another type of non-response occurs when a respondent is contacted but refuses to participate in the survey. Respondents who refused to be interviewed were called back on a different day/time in the hope of finding them more receptive. Interviewers were trained to respond to common complaints/concerns, and refusal conversion techniques through customized refusal avoidance scripts based on documentation of initial contacts. Supervisors were also on hand to talk to respondents when more assurance was needed. If a respondent asked to be "taken off the list" they were promptly removed from further contacts.

### *Data Quality Control*

SRG programmed data quality checks into a CATI software application called CASES in order to identify inconsistencies in the data, which could be corrected while the interview was in progress. Because only preprogrammed codes were allowed as responses, interviewers could not enter invalid responses. This procedure limited the possibility of an Interviewer mistyping a response as well as for the respondent to give an out-of-bounds response. About one-half of the interviews were recorded and archived so that supervisors could go back and listen to interviews at a later time to check open-ended responses or check the accuracy of a respondent's responses. Some interviews could not be recorded due to technical difficulties SRG experienced resulting from hurricane activity. Interviews initiated by respondents dialing in to SRG were also not recorded. Following a completed interview, a Supervisor reviewed the data for omissions, errors, and whether open-ended text responses were complete and understandable. If a case was determined to have questionable responses, the interviewer called the respondent again in an effort to obtain clarification.

Additionally, all data were reviewed by a senior analyst who looked for data entry errors, missing data issues, outliers, and inconsistencies in response patterns. When inconsistencies or outlying cases were found, the first action taken was to review the call sheet logs and notes and to listen to the actual recorded interview, if available, in an effort to determine if data incorrectly interpreted or entered by the Interviewer. While the survey was still in the field, callbacks were attempted for cases that could not be reconciled through a review of the logs or recordings. Once the survey interval ended, these cases were flagged in a dataset but not changed.

Additional data cleaning was conducted using SAS error-check programs. Error-check routines were run to check for and flag out-of-range values, outliers, improper skip patterns, illogical response patterns, and other potential errors. Attempts were made to reconcile errors (or potential errors) by listening to recorded interviews, when available. In some instances errors could not be resolved and values had to be converted to missing.

Review of the data uncovered two specific problems associated with the master site list NOAA provided to the contractor to code access sites:

1. In North Carolina there are two sites with the same name (Anchorage Marina). These two sites each have a unique site code but interviewers were not instructed to probe to determine which one to select from the CATI drop-down menu.
2. In both North Carolina and South Carolina there are some sites within the same state that have the same site number (they differ by county number). In these cases it was not possible to tell from the site number variable which site was selected by the interviewer. In North Carolina there were ten site numbers that were used for two or more sites, and in South Carolina there were five.

These problems were resolved by first listening to the recorded interview (if available) to determine which site the respondent was referring to. If this did not resolve the problem the next step was to use the field 'principle port city' from the permit file to try to make a determination regarding access site used. Only obvious cases where the principle port city matched the city for one of the sites and the other sites in question were geographically distant, were changed based on this information. In cases where ambiguity remained regarding the correct site to record the variable was converted to missing. A total of 73 records were resolved through either listening to recorded interviews or using the principle port city information. For another 28 records one of the access site variables could not be resolved and were converted to missing. In all, these errors in the site lists affected less than 2% of the total number of interviews conducted. The only variables impacted by these errors were site name (primary and others) and fuel site names, none of which were used in the analyses presented below.

## *Data Analyses*

Basic descriptive statistics were used to characterize the HMS fishery based on results of the attempted permit holder census. Most analyses included only the subset of respondents who indicated taking at least one trip targeting a highly migratory species in the past 12 months. This group made up about 72%, 57%, and 67% of all completed interviews in the Angling, General and Charter/headboat categories respectively. Respondents who indicated they didn't fish for HMS in the past 12 months were not asked all the detailed effort and catch questions the analyses were based on. The three permit categories were analyzed individually: Angling, General and Charter/headboat (Texas only). Within permit category data were analyzed by sub-region (Gulf of Mexico and South Atlantic), state, and for some analyses by primary access site type (i.e., marina, public boat ramp, and personal dock).

All data analyses were performed using SAS (V9.1). Basic summary statistics were produced using SAS *FREQ*, *SUMMARY*, and *MEANS* procedures. Differences in means between categories were analyzed using *PROC ANOVA* and Tukeys comparison of means test with alpha of 0.10.

## Results

### *Dialing Results*

Out of the 7,291 unique permit holders provided by NOAA Fisheries, a total of 5,098 vessel owners or representatives completed the interview. Figure 1 displays the summarized breakdown of final call dispositions by principle port state for the Angling and General categories. The four categories of final call dispositions are:

- 1) non-contacts which includes partial completes, those too ill to complete the survey, non-English speakers, those with no knowledge of the boat's activities, those who were deceased or institutionalized, cases where six or more call attempts were made but no interview was conducted or the phone was never answered, and commercial vessels,
- 2) bad or wrong numbers which includes cases with too little or no contact information, cases with wrong contact information including businesses, disconnects, and wrong numbers, and cases where the contact person no longer owns the boat and cannot provide contact information for the new owner,
- 3) refusals, including both 'hard' and 'soft refusals, and
- 4) completed interviews

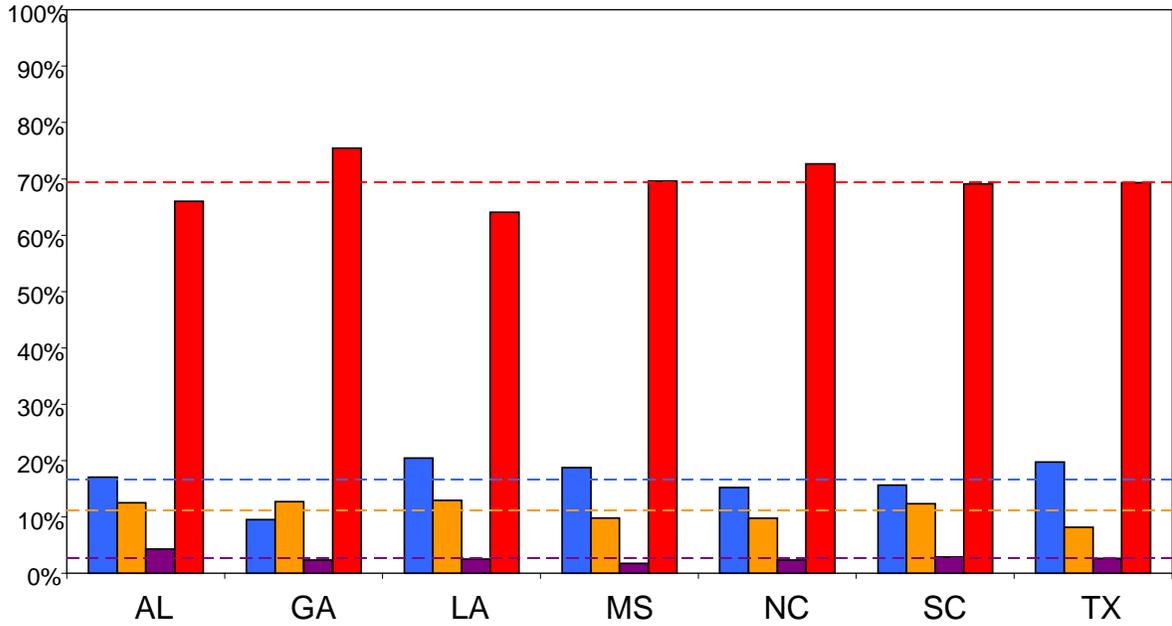
(Note: See Appendix C. for tables showing more complete detailed accounting of final call dispositions for the Angling and General categories.)

For HMS Angling permit holders, the average percentage of completed interviews was 69.8%, with all states averaging above 64% of completed interviews. The average refusal rate was quite low at 2.7%, with all states below 5%. Texas and Louisiana had the highest percentages of non-contacts (19.8% and 20.5% respectively), which may have been partially due to the hurricane activity in the area during the study period.

For the Atlantic Tunas General Permit holders, the average percentage of completed interviews was 72.4%, with only Georgia falling below 66% of completed interviews. Georgia also had by far the highest percentage of bad or wrong numbers (18.2% compared to the average of 10.4%). The percentage of refusals was very low, with Texas having the highest refusal rate at 5.6%.

Out of 185 HMS Charter/headboat permit holders in Texas, 115 (62.2%) resulted in a completed interview and only 7 (3.8%) refused to participate. Nearly 28% resulted in non-contacts which, as mentioned above, may have been weather related.

### HMS Angling Category



### Atlantic Tunas General Category

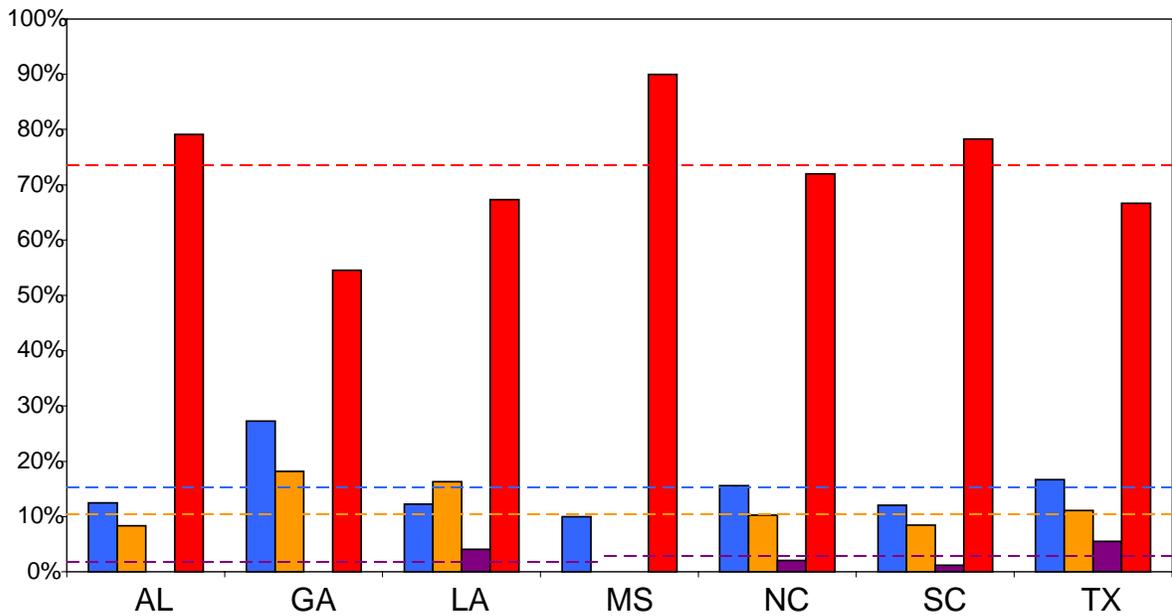


Figure 1. Percent of non-contacts, bad/wrong numbers, refusals, and completed interviews by permit category and state. Dashed lines indicate the average percent across all states.

## *Survey Results*

### HMS Angling Category

A total of 4,355 completed interviews were conducted with HMS Angling Category permit holders or vessel representatives. Respondents indicated having, on average, nearly 25 years of saltwater fishing experience for any species, and about 12 years of experience fishing for HMS, defined for this study as any tuna, shark (excluding Atlantic sharpnose or bonnethead), billfish or swordfish (Table 2). Angling Category permitted vessels in the Gulf of Mexico were used for an average of 5.9 HMS trips per year. Angling Category permitted vessels in the South Atlantic were used for an average of 6.5 HMS trips per year. The mean number of HMS trips taken in the past 12 months by respondents with principle ports in South Carolina (7.3) was significantly greater ( $\alpha=0.10$ ) than the mean for North Carolina (6.0), Louisiana (5.8), Alabama (5.4), and Mississippi (4.6). No other statistically significant differences were found between states in terms of 12-month HMS avidity.

About 72% of respondents indicated that their permitted vessel was used for at least one recreational fishing trip targeting an HMS in the previous 12 months. Proportion of permitted vessels used for at least one HMS trip was consistently between 70-76% for all states except Mississippi (64%). Mean HMS 12-month trip avidity for vessels with at least one HMS trip ranged from 7.0 trips per vessel in Alabama to 10.0 trips per vessel in South Carolina. Since detailed effort and catch data was only collected for vessels reporting at least one HMS trip, most analyses that follow were conducted using only this subset of vessels. HMS 12-month avidity was significantly positively correlated ( $p < 0.0001$ ) with number of years fished for HMS (Figure 2; excludes records with zero HMS trips in past 12 months). Angling category permit holders who indicated they had fished for HMS for over 20 years took, on average, about twice as many trips as those who indicated they had fished for HMS less than 3 years.

Differences were found among states in the distribution of primary access site types used by Angling category vessels (Figure 3). For example, in Alabama nearly 40% of HMS vessels were kept at a personal dock compared to only 13% in Louisiana. The proportion of Angling category vessels that use public boat ramps as a primary access site for HMS fishing is much greater in South Carolina (39%) and North Carolina (30%) than Louisiana (12%). In Louisiana nearly 2/3rds of HMS vessels were kept at unlocked marinas (either public or private) compared to only about 1/3rd in Alabama, South Carolina, and North Carolina.

About one out of five (20%) Angling category vessels that fished for HMS in the past 12 months used more than one access site (Table 3). Only about 4% of Angling category vessels that fished for HMS in the past 12 months used more than two access sites. The use of multiple access sites for HMS fishing was more prevalent in Mississippi compared to other states. The primary access site accounted for between 90-99% of reported HMS trips in all states except Mississippi (82%). A few differences were found in 12-month HMS trip avidity across primary access type within a given state. In Texas, vessels with primary access from a private dock took significantly more HMS trips on average than vessels with primary access from a marina or public boat ramp

(Figure 4; only includes vessels with at least one HMS trip). By contrast, in Alabama vessels with primary access from a marina took significantly more HMS trip on average than vessels with primary access from a private dock. In South Carolina and North Carolina vessels with primary access from a marina took significantly more HMS trips on average than vessels with primary access from a public boat ramp. Other differences were not statistically significant at the alpha 0.10 level.

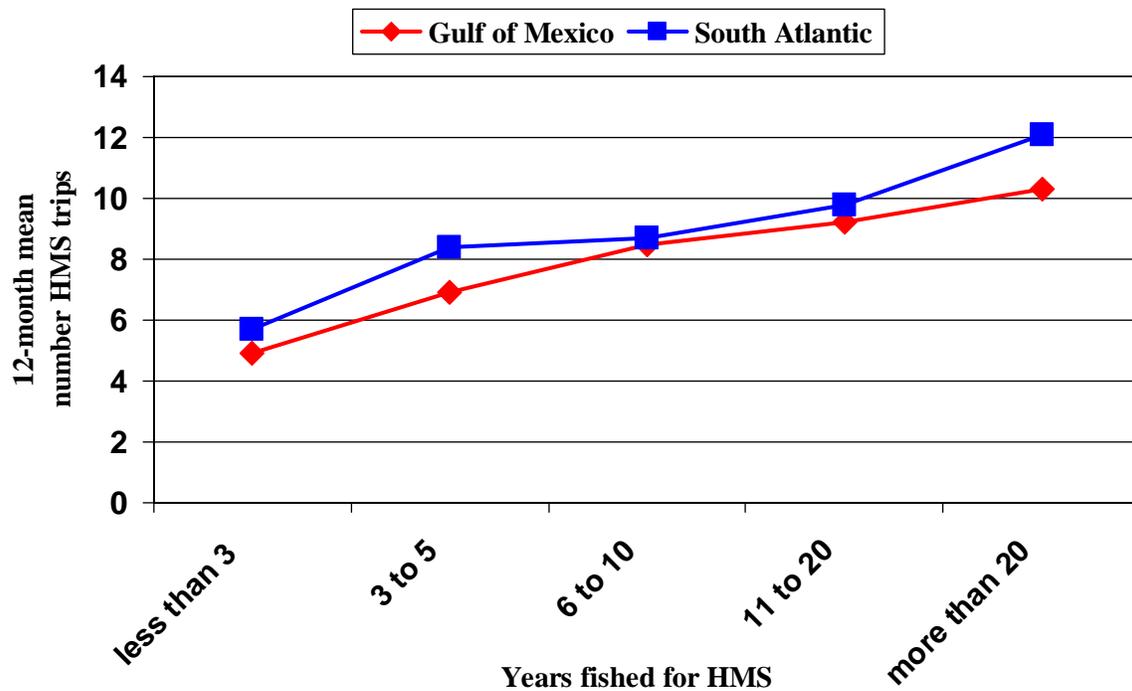


Figure 2. Mean number of Angling category HMS trips taken in the past 12 months by HMS years fished grouping. Only includes vessels that indicated taking at least one HMS trip.

As shown in Figure 3, a fairly large proportion of Angling category vessels in the South Atlantic and Gulf of Mexico use either personal docks or private locked marinas as their primary access site for HMS fishing. These restricted access site types are extremely difficult (if not impossible) to sample using dockside intercepts. In four states (North Carolina, Georgia, Alabama, and Texas) the proportion of Angling category vessels kept at restricted access sites exceeded 35%. Respondents who indicated using a personal dock or private locked marina as their primary

Table 2. Angling category completed interviews, mean years fished, and HMS 12-month trip avidity by principle port state.

Principle Port State	Total HMS Angling Permits	Total completed interviews	Mean Years Fished Saltwater	Mean Yrs. Fished HMS	Percent HMS Fishing past 12 months	Mean HMS 12-month Trips	Mean HMS 12-month Trips (excluding zeros)
TX	855	593	28.1	13.1	73%	6.7	9.2
LA	796	510	25.6	10.9	75%	5.8	7.8
MS	224	156	22.8	9.3	64%	4.6	7.2
AL	533	352	24.9	12.6	76%	5.4	7.0
All GOM	2,408	1,611	26.1	11.9	73%	5.9	8.1
GA	126	95	25.4	12.1	76%	7.0	9.2
SC	1,215	840	22.1	12.4	73%	7.3	10.0
NC	2,490	1,809	25.3	12.1	70%	6.0	8.7
All S. Atl.	3,831	2,744	24.3	12.2	71%	6.5	9.1

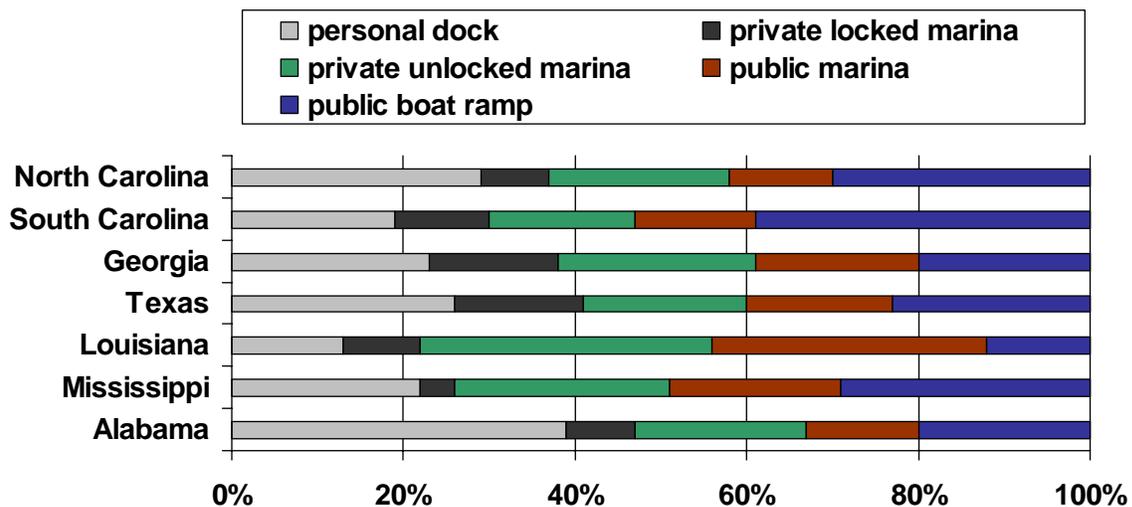


Figure 3. Type of access site primarily used by Angling category vessels to fish for HMS in past 12-months, by principle port state (note: only includes vessels with at least one HMS trip).

access site were asked whether they stop at a marina or fuel dock when returning from HMS fishing trips. This question was asked to determine if these vessels kept at restricted access sites could possibly be intercepted at another, less restricted, site that they stop at (for fuel, ice, tackle) on their way in. The majority of respondents with vessels kept at restricted access sites (either a private dock or locked marina) indicated that they stopped at a marina or fuel dock at least some of the time, when returning from HMS fishing trips (Figure 5). About one-half of respondents

with vessels kept at a private locked marina in North Carolina, South Carolina, Louisiana, and Texas indicated they “always” stop at a marina or fuel dock upon return from an HMS fishing trip. In no state did more than 1/3<sup>rd</sup> of respondents with vessels kept at a private locked marina indicate that they “never” stop at a marina or fuel dock upon return from an HMS fishing trip. Vessels kept at private docks were less likely to stop at a marina or fuel dock on their way in. In all states except Louisiana, less than 38% of respondents with vessels kept at a private dock indicated they “always” stop at a marina or fuel dock upon return from an HMS fishing trip.

Table 3. Percent of Angling category vessels that used a secondary or tertiary access site for HMS fishing, and percent of HMS trips taken from the primary access site in the past 12 months.

Principle Port State	Number Fished HMS past 12-months	Percent with secondary access site	Percent with tertiary access site	Percent of HMS trips from primary access site
TX	432	18.1%	3.5%	94.2%
LA	380	25.3%	6.1%	90.9%
MS	100	41.0%	12.0%	82.0%
AL	268	14.9%	3.0%	90.0%
All GOM	1,180	21.6%	4.9%	91.4%
GA	72	25.0%	4.2%	99.0%
SC	612	19.3%	1.6%	93.5%
NC	1,256	19.5%	3.3%	93.8%
All S. Atl.	1,940	19.6%	3.3%	93.9%

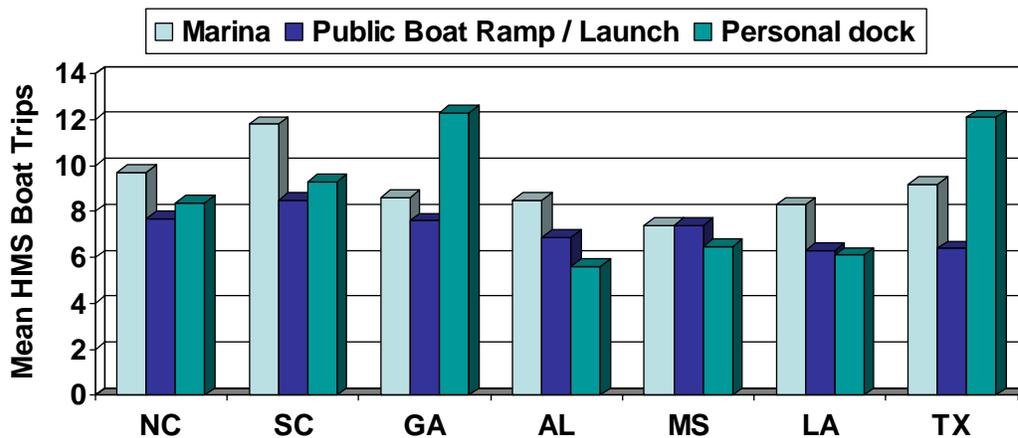


Figure 4. Average number of Angling category HMS boat trips in past 12-months by state and primary access type (note: only includes vessels with at least one HMS trip in past 12 months).

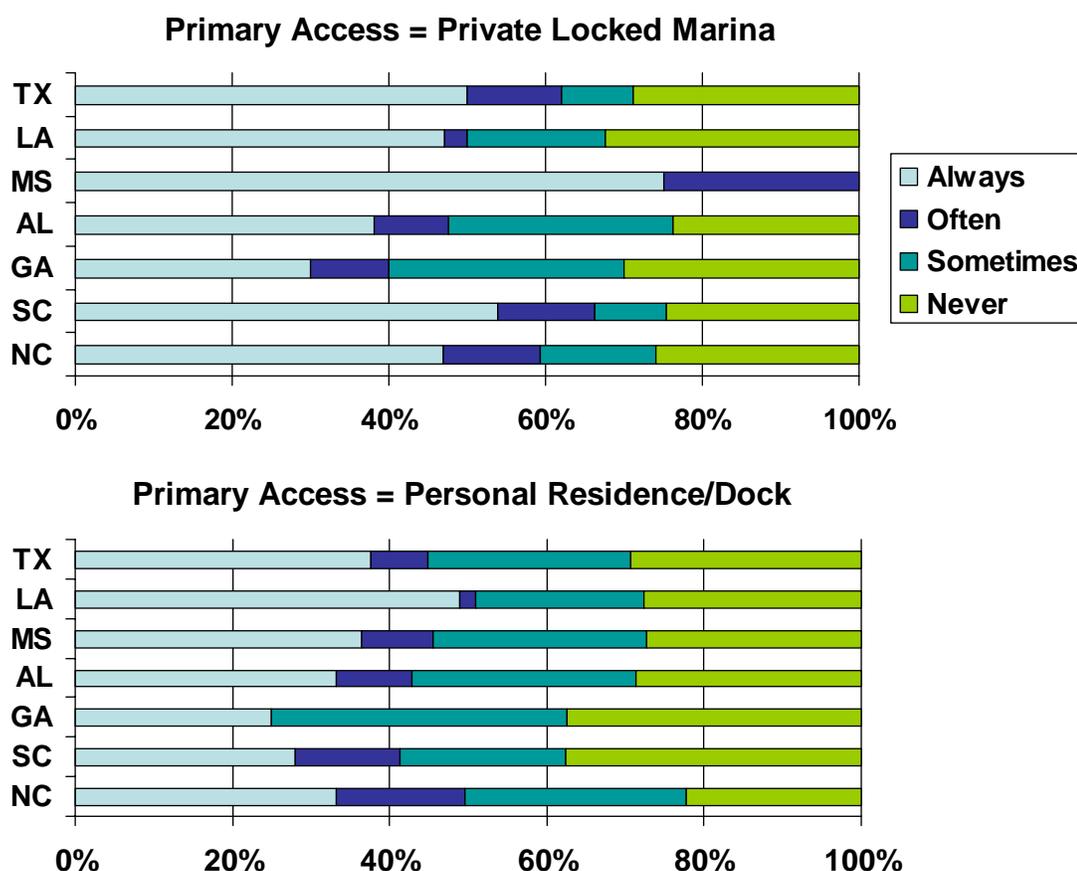


Figure 5. Response to Angling category question: *Does vessel stop at a marina or fuel dock when returning from HMS fishing?* (note: only includes vessels with at least one HMS trip in past 12 months).

Nearly 38% of respondents in Georgia and South Carolina with vessels kept at a private dock indicated they “never” stop at a marina or fuel dock upon return from an HMS fishing trip.

Angling category permit holders were also asked to report the number of HMS trips taken in the past twelve months that were overnight trips consisting of more than one day of fishing. Overnight fishing for HMS was far more prevalent in the Gulf of Mexico than in the South Atlantic. In the Gulf of Mexico nearly 2 out of every 3 Angling category vessels (64.5%) used for HMS fishing in the past 12 months took at least one overnight trip (Table 4). Nearly 37% of HMS Angling category trips reported by Gulf of Mexico respondents were overnight trips. By comparison, only 13% of Angling category vessels used for HMS fishing in South Atlantic states in the past 12 months took an overnight trip. Overnight trips accounted for less than 4% of all HMS trips taken by Angling category vessels in the South Atlantic.

Table 4. Percent of Angling category vessels that took at least one overnight HMS fishing trip, percent of HMS trips taken that were overnight, and mean number of overnight HMS trips per vessel in the past 12 months (note: overnight trip defined as a trip consisting of more than one day of fishing).

Principle Port State	Percent who took overnight HMS trips (of those who fished HMS)	Percent of HMS trips that were overnight	Mean number of HMS overnight trips past 12-months (of those who fished HMS)
TX	59.0%	28.4%	2.6
LA	62.6%	39.2%	3.1
MS	76.0%	41.7%	3.0
AL	67.4%	47.9%	3.4
All GOM	63.5%	36.6%	3.0
GA	23.6%	6.2%	0.6
SC	10.3%	4.1%	0.4
NC	17.2%	3.2%	0.3
All S. Atl.	12.9%	3.6%	0.3

Respondents were asked to indicate the approximate time their Angling category vessel left the dock for HMS fishing trips. Four 6-hour time intervals were used: 3:00 am – 9:00 am, 9:00 am – 3:00 pm, 3:00 pm – 9:00 pm, and 9:00 pm – 3:00 am. Differences in reported HMS trip start times were found between the South Atlantic and the Gulf of Mexico. In South Carolina and North Carolina over 95% of HMS trips left the dock between 3:00 am – 9:00 am, compared to only about 54% in Alabama, 63% in Mississippi, and 69% in Louisiana (Figure 6). Over 10% of HMS trips by vessels in Georgia and Alabama left the dock between 9:00 pm and 3:00 am, compared to 3% or less in all other states.

Differences between sub-regions were also found in times returned from HMS trips. In general, a greater proportion of HMS trips in the Gulf of Mexico returned to the dock outside of the traditional 3:00 pm to 9:00 pm time interval compared to HMS trips in the South Atlantic (Figure 7). In Alabama, Louisiana, and Mississippi over 20% of HMS trips did not return to the dock between 3:00 pm and 9:00 pm, compared to less than 5% in North Carolina. Return times were not found to vary much between access sites types (i.e., marina, boat ramp, and personal dock) within a given state.

To more narrowly define time returned, respondents were also asked to indicate the “most common time to the nearest hour” their vessel returns to the dock from an HMS fishing trip. Responses to this question indicated a wider range of return times for HMS fishing in the Gulf of Mexico compared to the South Atlantic (Figure 8). Nearly 80% of South Atlantic respondents indicated their most common return time as being either 4:00 pm, 5:00 pm, or 6:00 pm. In the Gulf of Mexico the three most frequently cited return times (5:00 pm, 6:00 pm, and 7:00 pm) made up only 56% of responses.

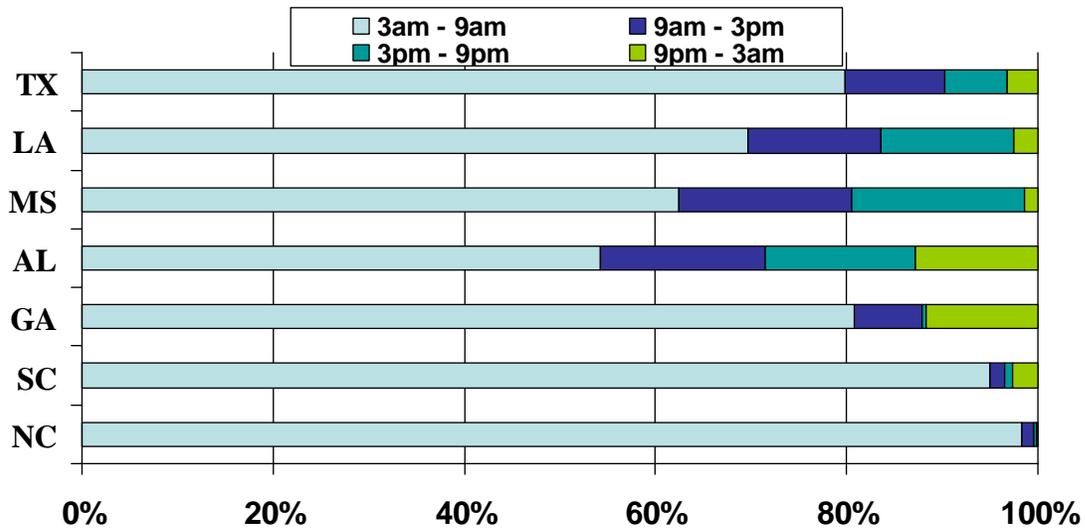


Figure 6. Distribution of time interval Angling category vessel **left the dock** on HMS trips taken in the past 12 months, by principle port state.

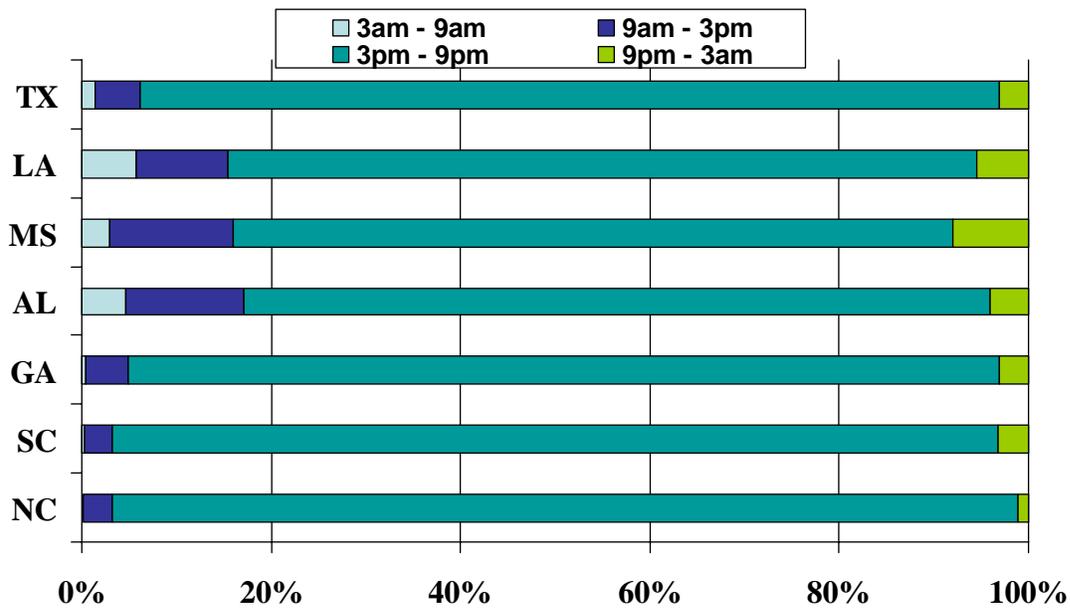


Figure 7. Distribution of time interval Angling category vessel **returned to the dock** on HMS trips taken in the past 12 months, by principle port state.

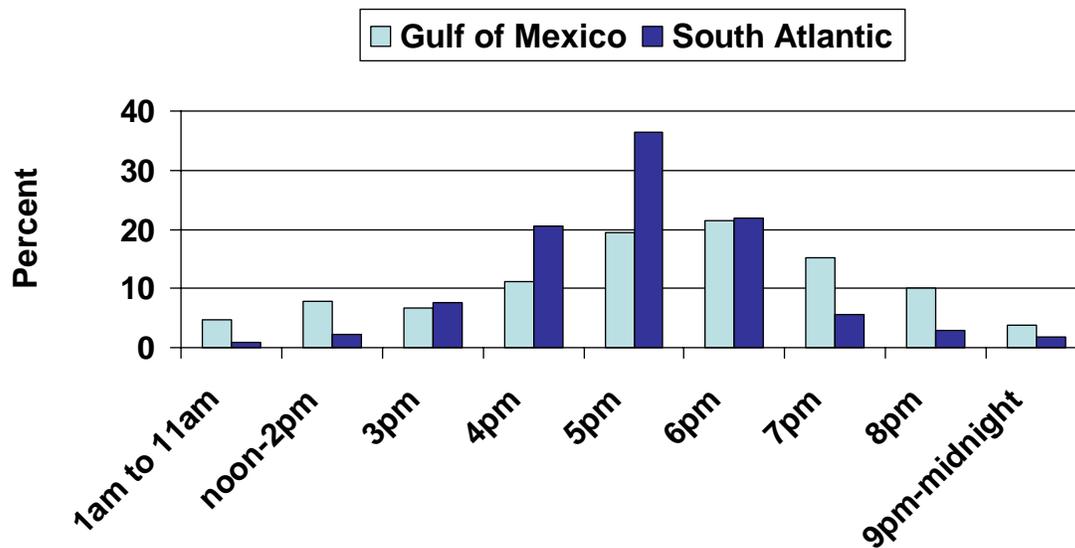


Figure 8. Distribution of most common time (to the nearest hour) Angling category vessel returned to the dock on HMS trips taken in the past 12 months, by principle port state.

Respondents were asked to recall which months their Angling category permitted vessel was used for HMS fishing in the past year. The number of HMS trips taken was recorded for six 2-month waves beginning with September-October 2007 and ending with July-August 2008. Figure 9 shows the seasonal trend in mean number of HMS trips per vessel over this time period (note: vessels that took zero HMS trips in the past 12-months were not included in calculation of means). While recreational HMS directed trips occur year-round in the Gulf of Mexico, the fishery is significantly more active in the summer and early fall. Seasonal trends in HMS trip distribution were very similar across Gulf of Mexico states. The HMS fishery in the South Atlantic also occurs year-round but peak activity starts a few months earlier than in the Gulf of Mexico (spring through early summer). In North Carolina the two most active HMS fishing seasons appear to be late spring (May-June) and early fall (September-October).

Respondents were asked to report on the number of trips taken on their Angling category permitted vessel that targeted the following HMS species or species group: tunas, sharks, billfish, and swordfish. In general, tunas appeared to be the most targeted HMS group, followed by billfish. Sharks and swordfish were targeted far less frequently by Angling category permit holders. Nearly 83% of respondents (of those that fished for HMS) indicated targeting tuna, while 54% indicated targeting billfish aboard their permitted vessel in the past 12 months. Less than 8% indicated targeting sharks and about 11% indicated targeting swordfish. Tunas, billfish and sharks were targeted at nearly identical rates by Angling category vessels in both the Gulf of Mexico and South Atlantic. A greater proportion of Gulf of Mexico vessels targeted swordfish as compared to South Atlantic vessels (18.2% versus 6.6%).

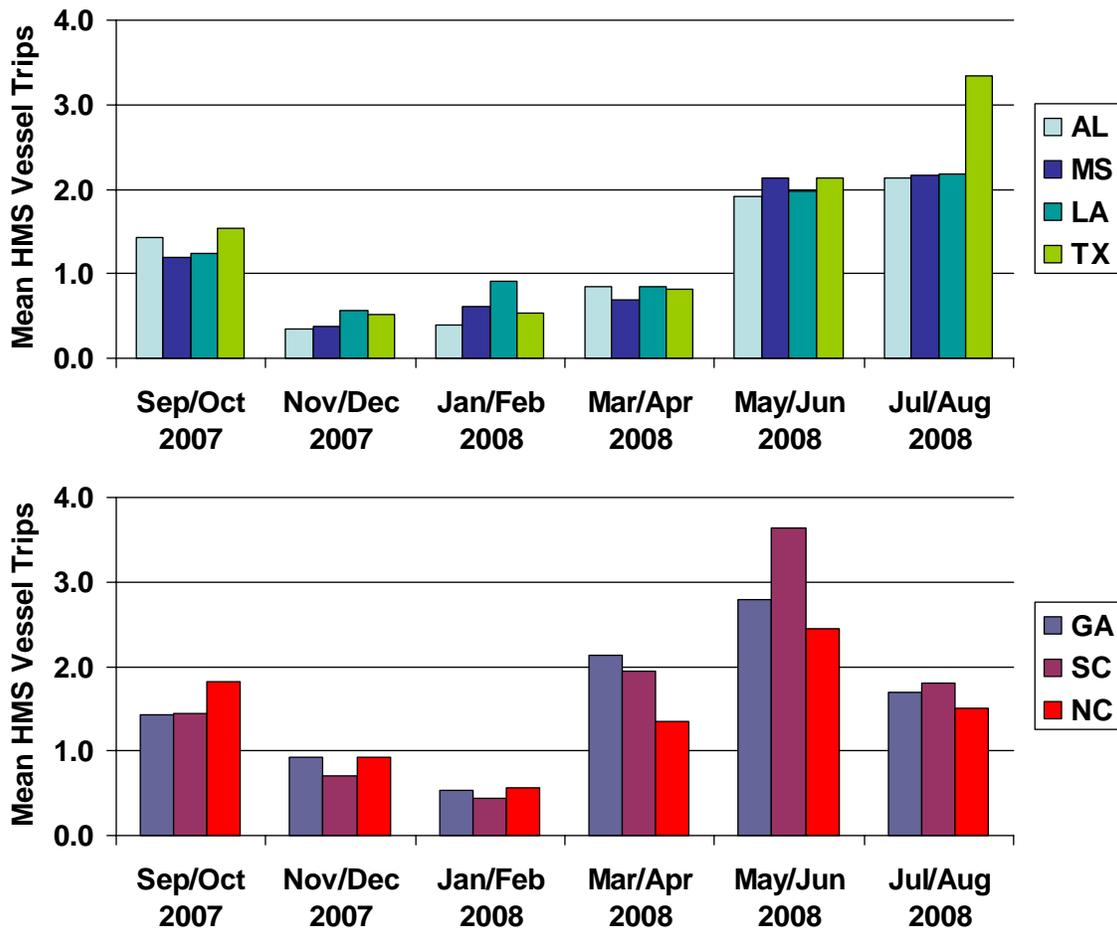


Figure 9. Mean number of Angling category HMS vessel trips in the past 12 months by state and two-month wave (note: means only include vessels that took at least one HMS trip in the past 12 months).

Table 5 shows the proportion of vessels that targeted a particular species or species group by principle port state and primary access site type (marina, boat ramp, and personal dock). Tuna were consistently targeted by a large majority of vessels across different states and primary access site types. Angling category vessels whose primary access site type was a marina or personal dock were far more likely to have targeted billfish than were vessels whose primary access site type was a boat launch. The opposite was true for sharks. The percent of vessels kept at a marina or personal dock that were used to target sharks was less than 15% for all states. By comparison, the percent of boat ramp vessels that were used to target sharks exceeded 15% in Mississippi (31.0%), Texas (24.2%), Georgia (21.4%), and South Carolina (16.9%). Sharks did not appear to be a heavily target species, regardless of site type used, among Angling category permit holders in North Carolina, Alabama or Louisiana. The proportion of Angling category vessels targeting swordfish was greatest in Alabama, exceeding 25% for all three access types.

Table 5. Percent of Angling category vessels targeting each species group on at least one trip in past 12 months by state and primary access site.

State	Primary Access Site	% Targeting Tuna	% Targeting Shark	% Targeting Billfish	% Targeting Swordfish
Alabama	Marina	84.4	2.8	70.6	37.6
	Public boat ramp	92.5	5.7	39.6	26.4
	Personal dock	81.0	4.8	68.6	30.5
Louisiana	Marina	89.9	2.8	37.3	12.0
	Public boat ramp	93.2	4.6	15.9	18.2
	Personal dock	89.4	0.0	57.5	12.8
Mississippi	Marina	98.0	6.1	63.3	8.2
	Public boat ramp	93.1	31.0	31.0	3.5
	Personal dock	86.4	4.6	59.1	27.3
Texas	Marina	75.9	10.0	69.6	16.4
	Public boat ramp	69.7	24.2	43.4	13.1
	Personal dock	68.8	9.2	75.2	16.5
Georgia	Marina	71.8	2.6	59.0	5.1
	Public boat ramp	71.4	21.4	28.6	21.4
	Personal dock	81.3	12.5	75.0	18.8
North Carolina	Marina	86.6	4.9	55.6	4.1
	Public boat ramp	87.4	8.7	36.9	3.3
	Personal dock	85.9	2.8	51.7	3.6
South Carolina	Marina	77.8	8.3	67.5	15.5
	Public boat ramp	71.7	16.9	52.7	7.6
	Personal dock	71.9	8.8	66.7	13.2

The proportion of HMS trips targeting each species group in the past 12 months was also analyzed. About 60% of HMS trips taken by Angling category vessels targeted tuna and 49% targeted billfish. Only 5% of HMS trips targeted sharks and 5% targeted swordfish. The proportion of trips targeting a species group varied considerably by state and primary access site type (Table 6; note: percentages do not add to 100% across rows since more than one species group could be targeted on the same trip.) Differences in HMS targets between site types within a state were primarily found comparing marina and personal dock trips with boat ramp trips. For example, in Georgia more than half (55%) of HMS trips from public boat ramps targeted sharks while only 6% of HMS trips taken from marinas and personal docks targeted shark. Similarly, in Mississippi more than 1/4<sup>th</sup> (26%) of HMS trips from public boat ramps targeted sharks while less than 1% of HMS trips taken from personal docks targeted shark. Some interesting differences were also found between trips leaving from personal docks and trips leaving from marinas in terms of billfish target rates. In Louisiana more than half (55%) of HMS trips from personal docks targeted billfish while less than 1/3<sup>rd</sup> (32%) of HMS trips taken from marinas targeted billfish. By contrast, in Mississippi less than half (44%) of HMS trips from personal docks targeted billfish while 2/3<sup>rd</sup>s of HMS trips taken from marinas targeted billfish.

Table 6. Percent of HMS trips by Angling category vessels in the past 12 months targeting each species group by state and primary access site.

State	Primary Access Site	% Targeting Tuna	% Targeting Shark	% Targeting Billfish	% Targeting Swordfish
Alabama	Marina	77.9	1.5	66.7	18.2
	Public boat ramp	66.8	5.7	36.0	9.5
	Personal dock	67.9	2.4	66.2	25.9
Louisiana	Marina	82.2	1.3	31.6	6.0
	Public boat ramp	88.4	7.6	17.0	7.9
	Personal dock	87.2	0.0	55.4	7.6
Mississippi	Marina	87.2	4.4	66.5	7.8
	Public boat ramp	64.4	26.4	31.5	0.5
	Personal dock	63.4	0.7	43.7	12.0
Texas	Marina	52.9	7.0	61.6	4.7
	Public boat ramp	50.5	18.1	46.7	6.8
	Personal dock	43.6	3.3	60.0	4.8
Georgia	Marina	63.8	6.0	62.0	1.2
	Public boat ramp	35.5	55.1	9.3	6.5
	Personal dock	57.7	5.6	55.6	8.7
North Carolina	Marina	57.9	1.5	51.2	1.4
	Public boat ramp	61.2	8.6	31.1	2.5
	Personal dock	58.6	1.5	42.5	2.2
South Carolina	Marina	51.3	7.1	65.4	8.2
	Public boat ramp	50.7	11.5	38.9	2.5
	Personal dock	56.2	7.4	58.4	4.9

The species most often targeted on directed tuna trips is yellowfin tuna. Of those anglers who indicated they target tuna, nearly 2/3rds said they targeted yellowfin tuna on all tuna trips (65% South Atlantic, 73% Gulf) while less than 5% said they never fish for yellowfin (Figure 10). Blackfin tuna was also a popular target choice in the Gulf of Mexico where over one-half of respondents (of those who targeted tuna) indicated they “always” fish for this species. Based on the results it would appear that in the Gulf of Mexico yellowfin and blackfin are frequently targeted together on the same trips. The majority of South Atlantic respondents indicated targeting blackfin tuna at least some of the time, although only 26% said they “always” fish for blackfin when targeting tuna. Other tuna species (skipjack, albacore, bigeye, and bluefin) are only targeted by a small percentage of tuna anglers in the Gulf as over 80% indicated they never fish for these species. Albacore, bigeye, and bluefin tuna were all relatively more important as a target species to South Atlantic anglers compared to Gulf anglers. However, even in the South Atlantic the large majority of Angling category tuna anglers indicated they “never” target these species (81% albacore, 72% bigeye, 59% bluefin). In North Carolina, which has an established recreational winter bluefin tuna fishery (typically November through March), 53% of Angling category respondents said they “never” target bluefin tuna. These results highlight the importance of yellowfin tuna (and blackfin tuna in the Gulf) to the HMS recreational fishery in these regions.

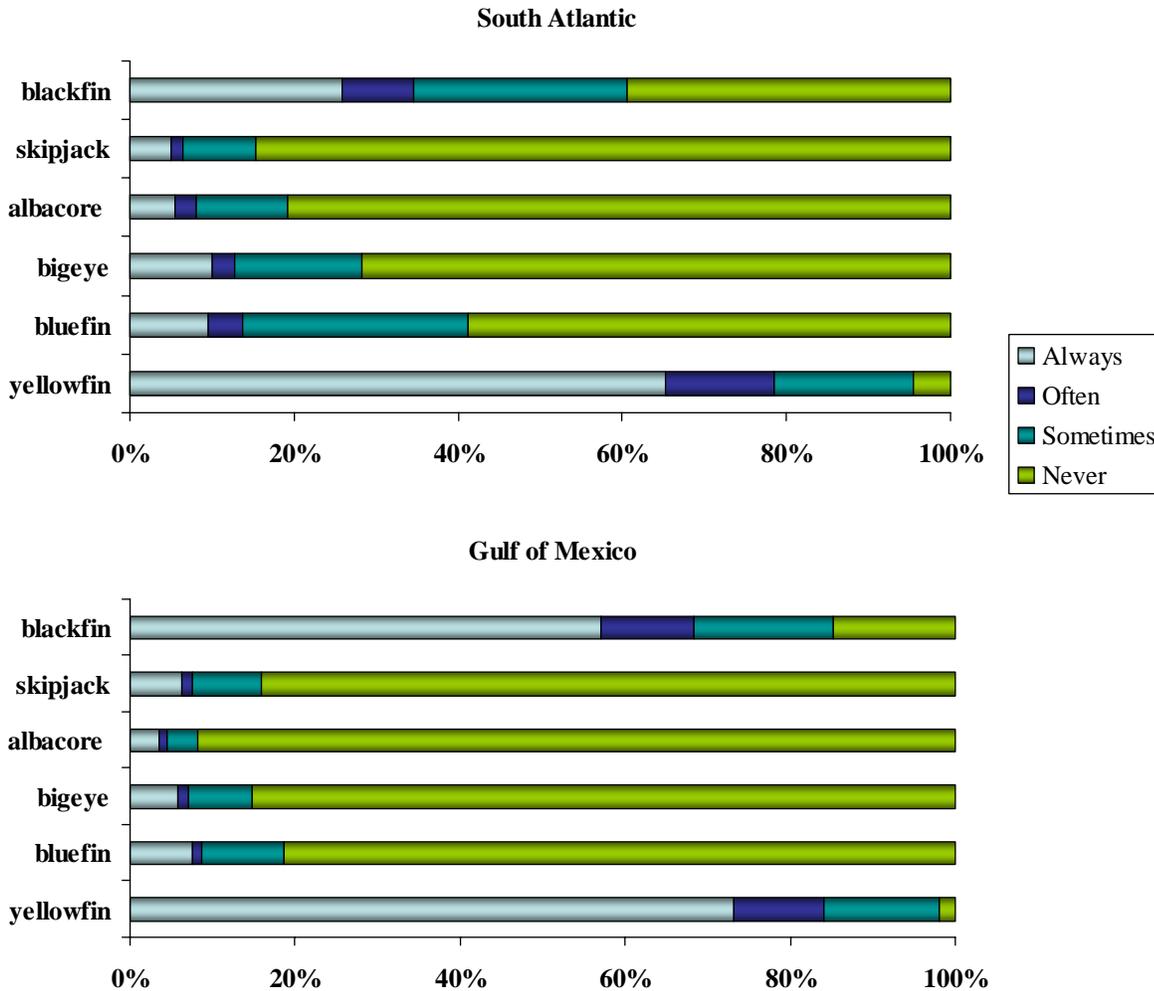


Figure 10. HMS Angling category permit holder responses to the question: *When targeting tuna how often do you target each of the following species?*

As shown above (Table 5) only a small percent of HMS Angling category vessel owners targeted sharks in the previous 12 month period. Among this small subset of respondents, blacktip shark was the most frequently targeted species (Figure 11). Over 60% of shark anglers in both the South Atlantic and Gulf of Mexico indicated they fish for blacktip sharks (either “always”, “often”, or “sometimes”). It should be noted that some recreational anglers tend to use “blacktip” to describe a wide range of shark species they may target, not necessarily limited to *Carcharhinus limbatus*. The next two most targeted shark species were bull shark and shortfin mako. Other species targeted by 10 or more shark anglers were hammerhead, tiger, blacknose, sand tiger, and spinner.

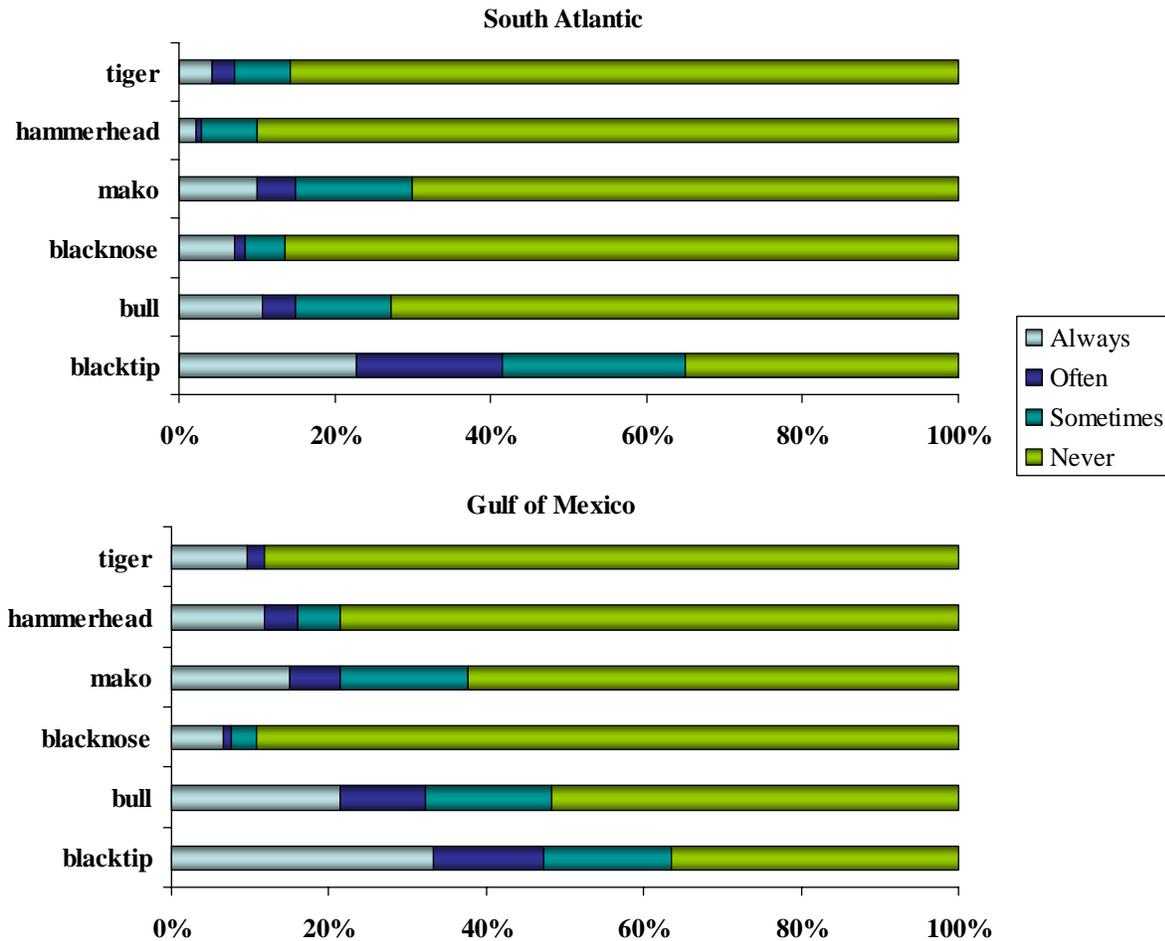


Figure 11. Angling category permit holder responses to the question: *When targeting shark how often do you target each of the following species?*

Three primary species of billfish were targeted by HMS Angling category permit holders in the Gulf of Mexico and South Atlantic: sailfish, blue marlin, and white marlin. Over 70% of billfish anglers in the Gulf indicated they “always” fish for blue marlin, while over 50% said they “always” fish for white marlin and sailfish on trips targeting billfish. These results indicate that two or more of these species are targeted simultaneously on the majority of billfish trips in the Gulf. In the South Atlantic the proportion of respondents who said they “always” fish for blue marlin (42%) and white marlin (36%) when targeting billfish was noticeably lower than in the Gulf. This suggests that South Atlantic billfish anglers are more likely to target a single species of marlin on a given trip compared to Gulf billfish anglers who are more likely to target both blue and white marlin.

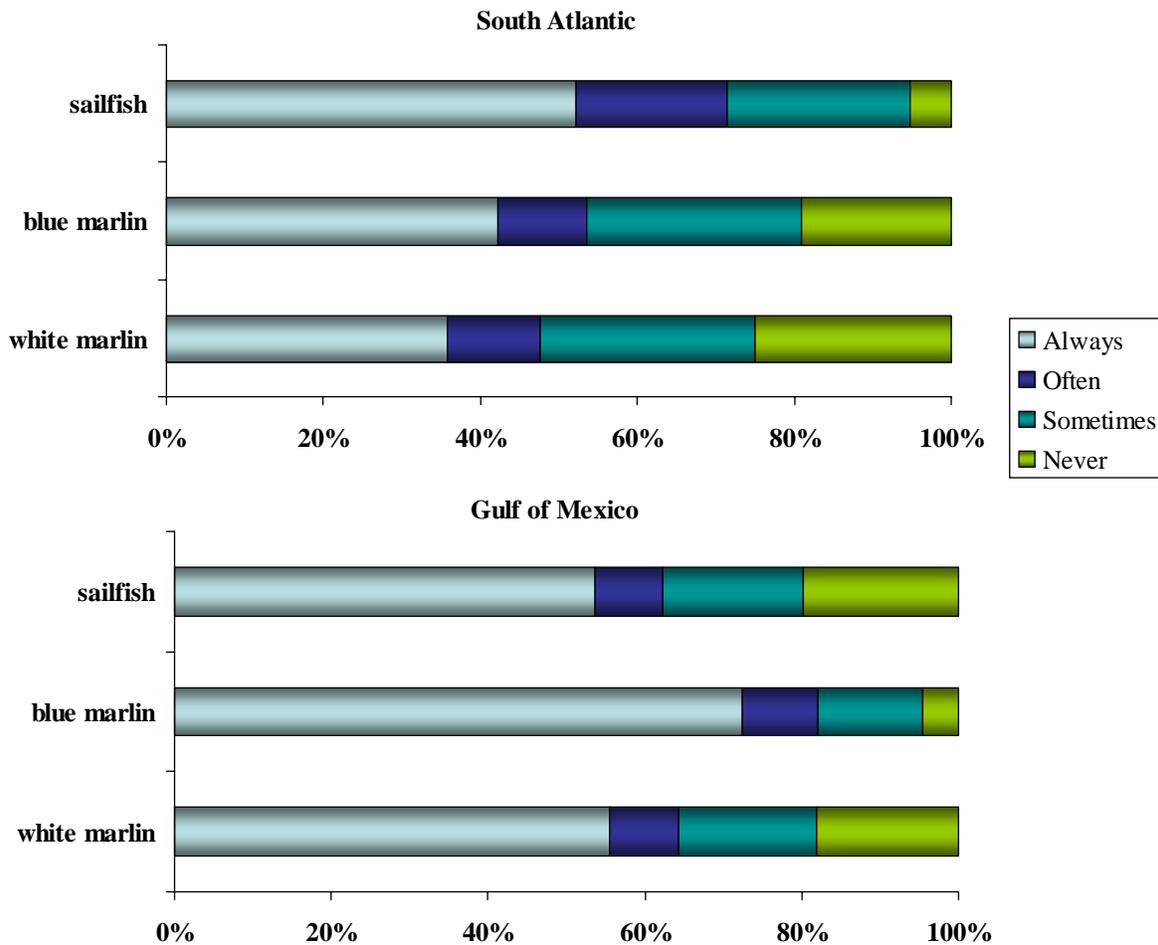


Figure 12. Angling category permit holder responses to the question: *When targeting billfish how often do you target each of the following species?*

Organized tournaments are often an important component of directed recreational fisheries for highly migratory species. NOAA Fisheries defines “HMS tournament” as follows:

“any fishing competition involving Atlantic HMS (i.e., billfish, tunas, sharks or swordfish) in which participants must register or otherwise enter, or in which a prize or award is offered for catching or landings such fish.”

All HMS tournaments in the Atlantic, Gulf of Mexico and Caribbean are required to register with NOAA Fisheries. In 2008 there were 96 registered HMS tournaments from North Carolina through Texas (excluding Florida). Respondents indicated fishing in 88 of these tournaments. Respondents also participated in 18 registered HMS tournaments in Florida. Over 225 responses for tournament name could not be matched to a registered tournament from our list.

Results showed that overall tournament participation rates were higher for Angling category vessels in the Gulf as compared to the South Atlantic. Of the Gulf of Mexico Angling category vessels that fished for HMS in the previous 12 months, about 40% participated in at least one HMS tournament. By comparison, only about 20% of South Atlantic vessels indicated fishing in an HMS tournament in the previous 12 months. Tournament participation also varied by primary access site type. In every state, respondents who indicated using a public boat ramp as their primary access site were less likely to have participated in an HMS tournament compared to respondents who kept their vessel either at a marina or personal dock (Figure 13). There also appears to be a positive relationship between HMS tournament participation and the number of years anglers had fished for HMS (Figure 14).

The proportion of reported HMS trips associated with tournaments followed the same general trends as participation rates. The overall proportion of HMS trips associated with tournaments was greater in the Gulf of Mexico (16%) than in the South Atlantic (8%), and greater for Angling category vessels kept at marinas and personal docks compared to those using public boat ramps (Figure 15).

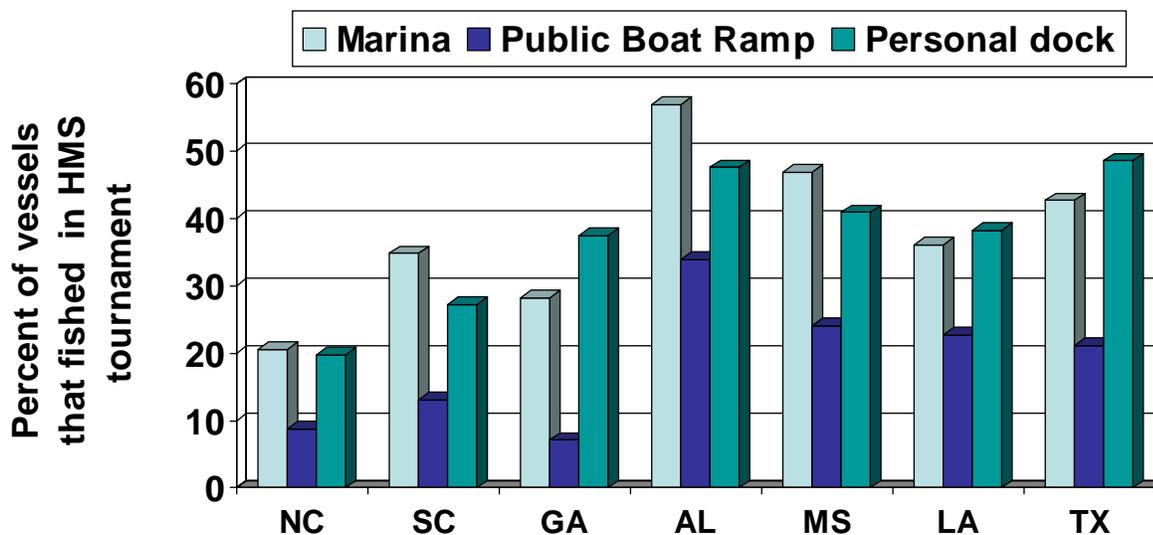


Figure 13. Percent of Angling category vessels participating in at least one HMS tournament in the past 12 months by state and primary access type (note: only includes vessels that took at least one HMS trip).

Respondents were asked to recall how many HMS they kept (i.e., landed) and released (by species) in the past 12 months aboard their Angling category vessel. Table 7 shows the number of tuna reported kept and released by Angling category vessels by species and principle port state. In the Gulf of Mexico more blackfin were reported as landed (18,438) than any other tuna species, followed by yellowfin (8,553). In the South Atlantic yellowfin was reported as landed most often (5,649), followed by blackfin (3,083).

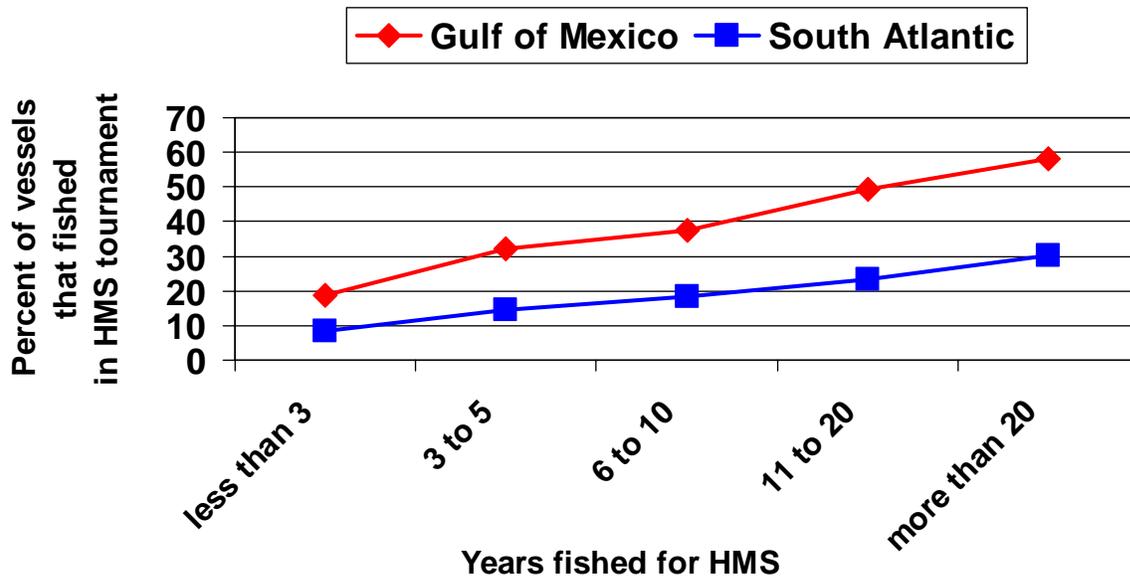


Figure 14. Angling category percent of vessels participating in at least one HMS tournament in the past 12 months versus avidity grouping in years fished for HMS (note: only includes vessels that took at least one HMS trip in past 12 months).

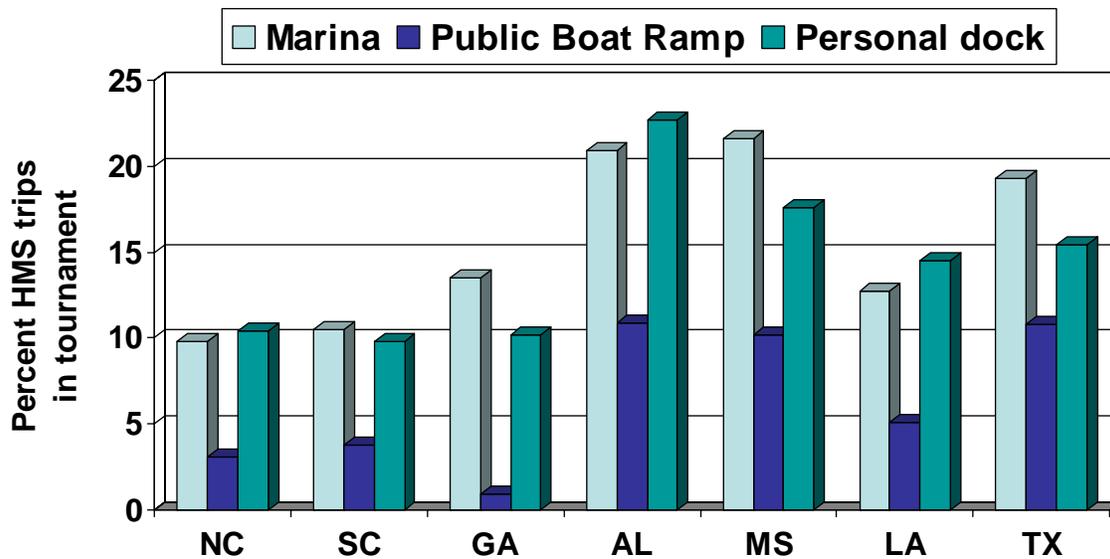


Figure 15. Percent of Angling category HMS trips taken in the past 12 months that were associated a fishing tournament by state and primary access type.

More blacktip sharks were reported caught by Angling category permit holders than any other species of shark in both sub-regions (Gulf 5,531; S. Atlantic 4,286; Table 8). A greater proportion of blacktips caught in the Gulf (10%) were kept compared to the South Atlantic (1.6%) For all sharks species reported the large majority caught are released alive. For

example, only 30 bull sharks were reported as kept (all states combined) while 1,724 were reported as released alive; 8 hammerheads were reported as kept while 522 were reported as released alive. Small numbers of prohibited species such as sand tiger (28), sandbar (1), and dusky (2) were reported as kept. However, the relative accuracy of species identification, particularly for sharks, and proper use of common names remains unknown and is an identified drawback of collecting catch data over the phone.

Most recreationally caught sharks by Angling category vessels in the Gulf and South Atlantic are not caught on directed trips but rather incidentally on trips targeting other species (Figure 16). Over 75% of blacktip, bull, mako and sand tiger sharks caught in Texas, Louisiana, Alabama, and North Carolina were by vessels that indicated they did not target sharks in the past 12 months. Exceptions to this were for blacktip sharks in Mississippi, Georgia, and South Carolina where less than half of the total catch was by Angling category vessels indicating they didn't target sharks.

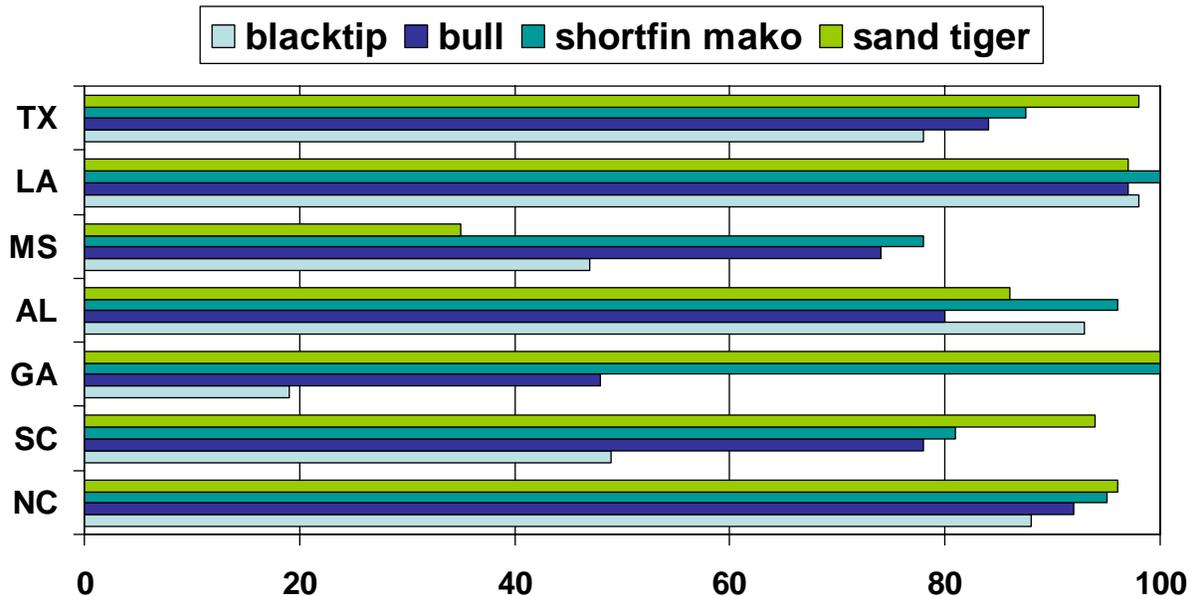


Figure 16. HMS Angling category percent of shark total catch reported by vessels that indicated they did not target shark in the past 12 months.

Similar to sharks the large majority of billfish reported as caught were released alive (Table 9). In the Gulf of Mexico Angling category permit holders reported releasing 1,110 blue marlin, 595 white marlin, and 815 sailfish. Over one-half of the sailfish and blue marlin caught in the Gulf were reported by Texas anglers. Over 3,000 sailfish were reported for the South Atlantic with the catch split about evenly between North Carolina and South Carolina vessels. For swordfish the ratio of landings to total catch was much higher compared to billfish but still only 170 swordfish were reported as landed for all permit holders surveyed.

Figures 17 and 18 display the distribution of Angling category reported landings of select species by primary access site type. Since catch data was collected for a 12 month period and not at the trip level, we do not have data on the reported number of fish landed at each access site type. Rather these figures represent the distribution of fish reported as landed by the vessel's *primary access site type* which may be different from the actual access site of landing for vessels that used more than one site for HMS fishing. However, Figures 17 and 18 are likely a good approximation of the distribution of reported landings by access site type since (as shown above in Table 3) over 90% of reported HMS trips were taken from the vessel's identified primary access site. In the Gulf of Mexico 50% or more of reported HMS landings were from respondents who used a marina as their primary access site. This held for all major HMS species landed except albacore tuna for which only 74 fish were reported landed. In the South Atlantic relatively more landings were reported by respondents who used public boat ramps as their primary access site compared to the Gulf of Mexico. Public boat ramp vessels accounted for 30% of yellowfin landings reported in the South Atlantic compared to only 14% in the Gulf. In the South Atlantic more bluefin tuna and skipjack tuna landings were reported by respondents who used public boat ramps as their primary access compared to respondents who used marinas as their primary access.

The effect of access site type on HMS catch rates was also explored to determine if differences exist between trips returning to private access, public boat ramp, and marinas. A subset of observations (2,480) where respondents indicated the vessel only had one access site was used for this analysis. Vessels with more than one access site were eliminated since it was not possible to attribute their catch to a particular access site type. Catch rates were calculated at the state, site type, and species level as the total number of fish kept (or released) divided by the total number of HMS trips reported. Results varied depending on the particular state/species combination: in some cases large differences in catch rates were found between site types and in others differences were small or insignificant. For example, in Louisiana vessels returning to personal docks reported landing more yellowfin tuna per HMS trip (2.6) than vessels returning to either marinas (1.2) or boat ramps (1.3). In North Carolina the number of yellowfin tuna reported landed per trip was more similar across access site types, with personal dock trips actually yielding slightly fewer fish per trip (0.40 versus 0.50 for marinas and 0.56 for boat ramps). The number of blacktip sharks reported caught per HMS trip was greater for trips returning to public boat ramps than those returning to personal docks in all seven states. By sub-region, in the Gulf of Mexico 0.76 blacktips were caught per HMS trip returning to a boat ramp versus 0.31 and 0.56 for trips returning to personal docks and marinas, respectively; in the South Atlantic 0.45 blacktips were caught per HMS trip returning to a boat ramp versus 0.16 and 0.22 for trips returning to personal docks and marinas, respectively. In general, billfish released per trip rates were higher for trips returning to personal docks or marinas than to public boat ramps. For example, Texas vessels returning to personal docks and marinas reported more blue marlin released per HMS trip (0.16 and 0.17) than vessels returning to public boat ramps (0.06). Similarly, South Carolina vessels returning to personal docks and marinas reported more sailfish released per HMS trip (0.35 and 0.22) than vessels returning to public boat ramps (0.15).

Considering the long recall period and length of the telephone survey, quantitative data on HMS directed (or target) trips were collected at the species group level (tuna trips, shark trips, billfish trips, and swordfish) rather than the individual species level. As a result, directed catch rates

Table 7. Angling category total number of tuna reported kept and released alive in past 12 months by state and species.

	<b>Yellowfin</b>		<b>Bluefin</b>		<b>Bigeye</b>		<b>Albacore</b>		<b>Skipjack</b>		<b>Blackfin</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>AL</b>	1,944	487	12	2	22	10	58	25	137	183	4,778	1,907
<b>LA</b>	4,058	1,104	13	5	51	28	15	8	167	419	7,054	3,807
<b>MS</b>	732	201	0	1	1	4	1	34	59	44	1,146	992
<b>TX</b>	1,819	612	17	4	10	8	0	34	96	136	5,460	3,444
<b>GOM</b>	8,553	2,404	117	37	84	50	74	101	459	782	18,438	10,150
<b>GA</b>	88	40	3	0	5	6	1	13	6	102	253	79
<b>NC</b>	4,986	763	125	193	130	34	269	1,790	209	751	1,400	428
<b>SC</b>	575	181	12	14	16	14	16	99	66	428	1,430	381
<b>S.Atl.</b>	5,649	984	140	207	151	54	286	1,902	281	1,281	3,083	888

could not be calculated at the species level. However, the questionnaire did ask about species specific effort (e.g., when targeting tuna how often did you fish for yellowfin tuna) with qualitative response options: always, often, sometimes, never. As shown above in Figure 10, about 80% of respondents in both the South Atlantic and Gulf of Mexico indicated they either “always” or “often” target yellowfin on trips when they target tuna. Similarly, in the Gulf of Mexico nearly 70% of respondents indicated they either “always” or “often” target blackfin on trips when they target tuna, and over 80% of respondents indicated they either “always” or “often” target blue marlin on trips targeting billfish (Figure 12, above). Targeted species group effort was used to calculate catch rates for these species since a large majority of trips targeting the species group were targeting these particular species. The mean number of yellowfin tuna reported caught per Angling category vessel trip targeting tunas was greater in the Gulf of Mexico than in the South Atlantic (Figure 19). Yellowfin tuna recreational landings estimates for the South Atlantic dropped precipitously starting in 2007, and 2008 represented the lowest value in over 25 years (source: MRFSS). Therefore, the difference in yellowfin tuna catch rates between the Gulf of Mexico and South Atlantic vessels is only for the study period (i.e., September 2007 through August 2008) which may not be indicative of a more typical year. Between three to four yellowfin were reported as kept for every one released alive in the Gulf of Mexico. Catch rates of blackfin tuna were higher than for yellowfin tuna in the Gulf of Mexico where four to five were caught per targeted tuna trip (Figure 20). The mean number of blue marlin caught per billfish target trip by Gulf of Mexico Angling category vessels ranged from 0.18-0.26 or about one fish caught every 4 to 5 trips (Figure 21).

Table 8. Angling category total number of sharks reported kept and released alive in past 12 months by state and species.

	<b>Blacktip</b>		<b>Blacknose</b>		<b>Shortfin Mako</b>		<b>Bull</b>		<b>Tiger</b>		<b>Sand Tiger</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>AL</b>	205	437	0	4	9	62	2	306	1	13	0	140
<b>LA</b>	207	1,962	1	24	7	76	2	247	0	4	0	163
<b>MS</b>	35	492	0	2	2	16	0	78	0	2	1	92
<b>TX</b>	105	2,088	0	6	3	61	20	457	8	22	2	170
<b>GOM</b>	552	4,979	1	36	21	215	24	1,088	9	41	3	565
<b>GA</b>	5	318	0	212	0	5	1	49	0	5	0	34
<b>NC</b>	9	2,070	0	20	20	83	4	300	43	80	21	1,677
<b>SC</b>	54	1,830	0	334	7	76	1	287	4	308	4	1,120
<b>S.Atl.</b>	68	4,218	0	566	27	164	6	636	47	393	25	2,831
	<b>Dusky</b>		<b>Hammerhead</b>		<b>Spinner</b>		<b>Lemon</b>		<b>Thresher</b>		<b>Sandbar</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>AL</b>	0	0	1	134	0	0	0	32	0	2	0	3
<b>LA</b>	0	43	1	136	0	19	0	9	0	28	0	0
<b>MS</b>	0	1	1	13	0	0	0	0	0	0	0	0
<b>TX</b>	2	9	1	117	1	27	0	8	0	1	0	19
<b>GOM</b>	2	53	4	400	1	46	0	49	0	31	0	22
<b>GA</b>	0	0	0	15	0	0	0	3	0	0	0	25
<b>NC</b>	0	13	4	83	0	70	0	33	0	11	0	54
<b>SC</b>	0	52	0	24	0	9	1	112	0	104	1	12
<b>S.Atl.</b>	0	65	4	122	0	79	1	148	0	115	1	91

1. Other species of shark reported as caught included Atlantic sharpnose, oceanic whitetip, blue, bonnethead, dogfish, leopard, nurse, reef, silky, and spinner.
2. Unknown sharks reported as caught included “unidentified” (2 kept, 258 released), “sand shark” (73 released), “brown shark” (135 released), and “whaler” (145 released).
3. Hammerhead includes smooth, great and scalloped species.

Table 9. Angling category total number of billfish and swordfish reported kept and released alive in past 12 months by state and species.

	<b>Blue marlin</b>		<b>White marlin</b>		<b>Sailfish</b>		<b>Swordfish</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>AL</b>	6	207	0	284	0	188	42	125
<b>LA</b>	0	242	0	85	2	86	18	15
<b>MS</b>	0	74	0	41	0	10	0	3
<b>TX</b>	14	587	1	184	0	531	22	39
<b>GOM</b>	20	1,110	1	594	2	815	82	182
<b>GA</b>	0	20	2	15	20	130	0	4
<b>NC</b>	5	360	8	670	14	1,473	41	8
<b>SC</b>	2	224	1	135	3	1,520	47	34
<b>S.Atl.</b>	7	604	11	820	37	3,123	88	46

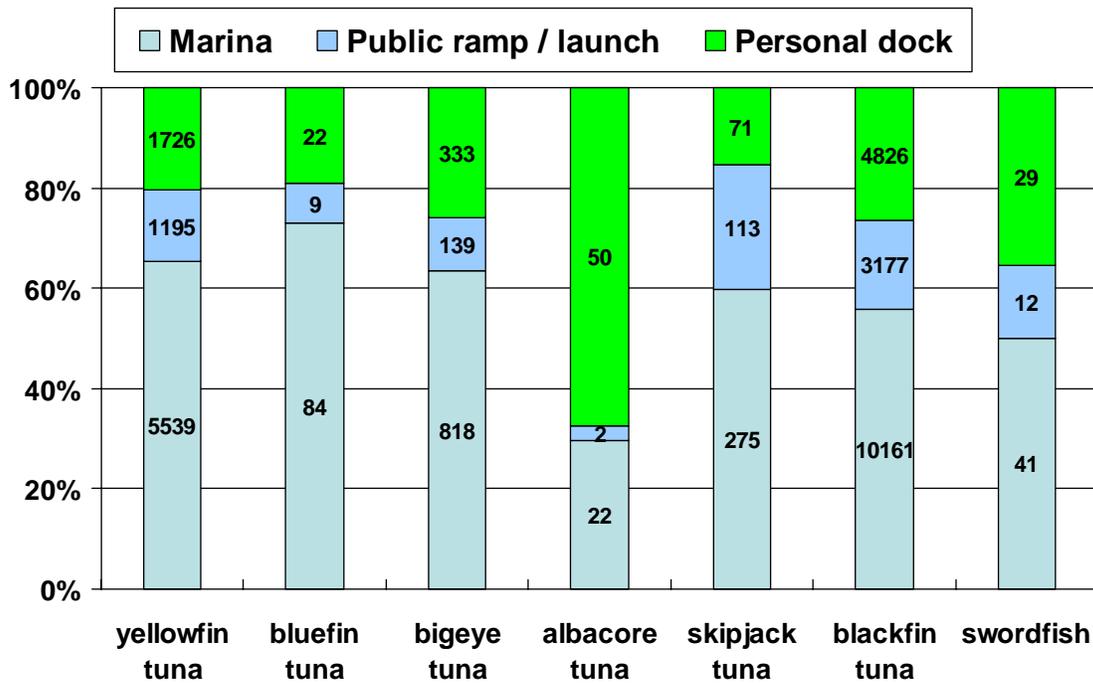


Figure 17. Proportion of Gulf of Mexico Angling category vessel reported landings by primary access site type (number of fish reported indicated on bars).

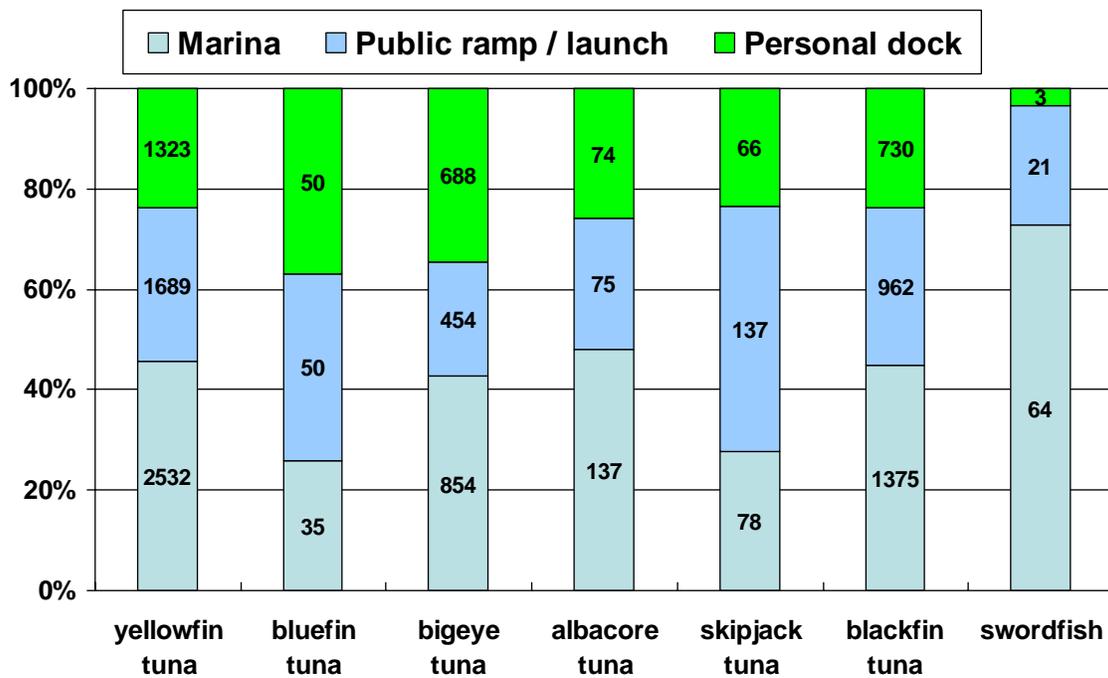


Figure 18. Proportion of South Atlantic Angling category vessel reported landings by primary access site type (number of fish reported indicated on bars).

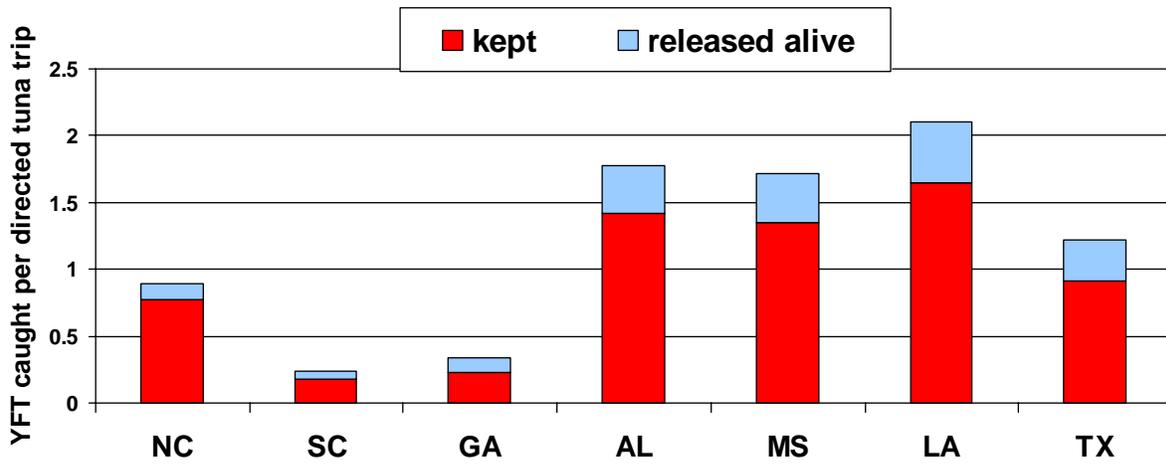


Figure 19. Mean number of yellowfin tuna reported as kept and released alive per trip targeting tuna by Angling category vessels.

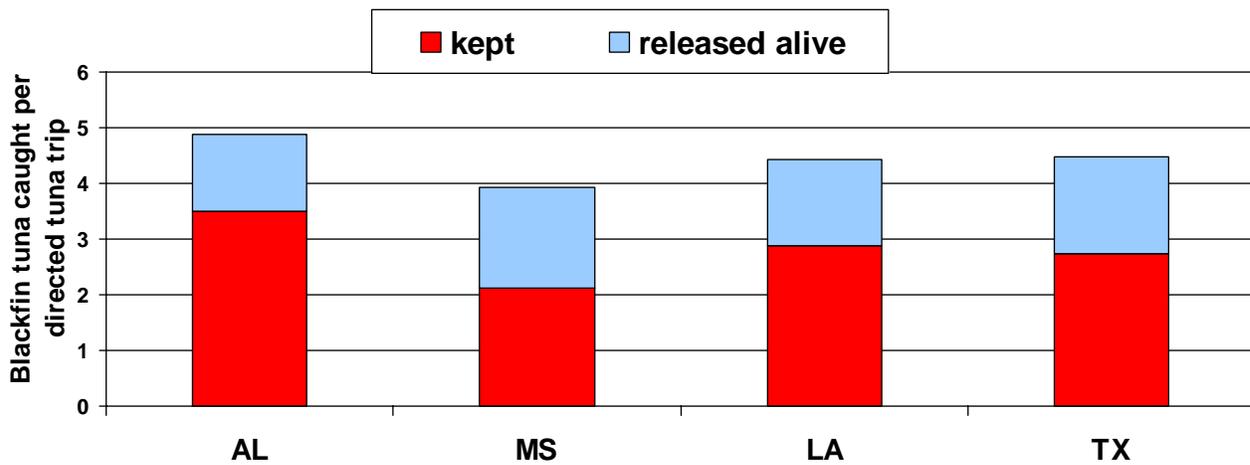


Figure 20. Mean number of blackfin tuna reported as kept and released alive per trip targeting tuna by Angling category vessels.

Only about 1% of Angling category permit holders said they ever sell the tunas, sharks, billfish or swordfish they catch. This was consistent across states. Only about 2% of Angling category permit holders indicated they owned more than one vessel they used for HMS fishing. About 2/3<sup>rds</sup> of angling category permit holders (68.6%) gave an email address and indicated willingness to provide information about their fishing activity through online internet surveys in the future.

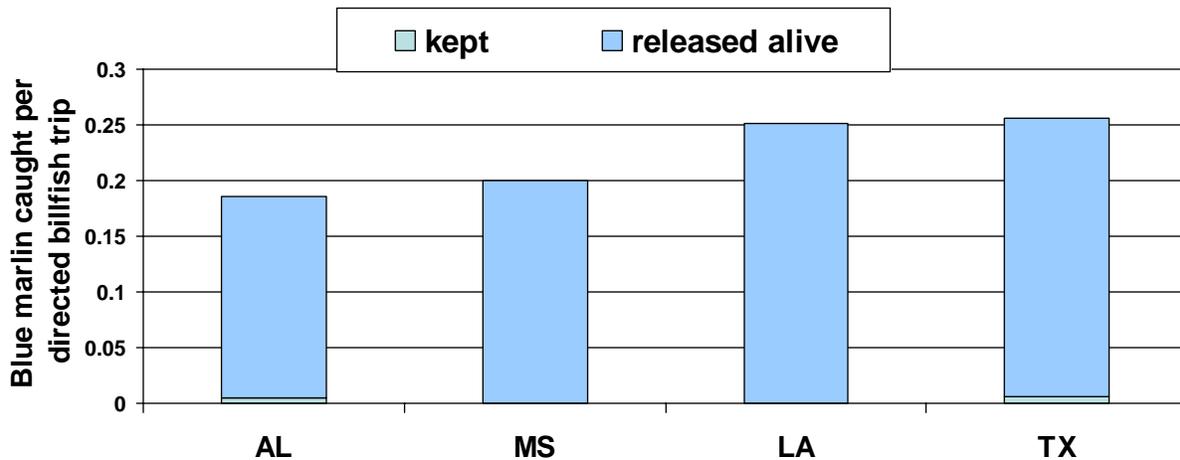


Figure 21. Mean number of blue marlin reported as kept and released alive per trip targeting billfish by Angling category vessels.

#### Atlantic Tunas General Category

North Carolina accounted for over three-fourths (78%) of all 867 Atlantic Tunas General category permit holders in the South Atlantic and Gulf. A total of 483 completed interviews were conducted with General category permit holders from North Carolina. The next largest state sample size was South Carolina with 65 completed General category interviews.

General category respondents indicated having about 26 years of saltwater fishing experience for any species, and about 12 years of experience fishing for HMS (Table 10). General category permitted vessels in the Gulf of Mexico were used for an average of 4.1 HMS trips per year, while General category vessels in the South Atlantic were used for an average of 7.5 HMS trips per year. About 43% of General category permitted holders interviewed indicated that they did not take any recreational fishing trips targeting HMS in the past 12 months. Mean HMS 12-month trip avidity for vessels with at least one HMS trip ranged was 7.8 and 12.9 trips in the Gulf and South Atlantic, respectively. For General category vessels, HMS 12-month avidity was positively correlated with number of years fished for HMS (Figure 22; only includes vessels reporting at least one HMS trip). Since detailed effort and catch data was only collected for vessels reporting at least one HMS trip, most analyses that follow were conducted using only this subset of vessels.

About 13% of Gulf of Mexico and 22% of South Atlantic General category vessels (that fished for HMS in the past 12 months) used more than one access site (Table 11). The primary access site accounted for over 90% of reported HMS trips in both regions. The mean number of HMS 12-month trips taken per General category vessels varied by primary access type. In the South

Atlantic, General category vessels with primary access from a marina took, on average, nearly twice as many HMS trips than vessels with primary access from a public boat ramp (Figure 23).

As shown in Figure 24, about 36% of General category vessels in the South Atlantic and Gulf of Mexico use either personal docks or private locked marinas as their primary access site for HMS fishing. These restricted access site types are extremely difficult (if not impossible) to sample using dockside intercepts. Respondents who indicated using a personal dock or private locked marina as their primary access site were asked whether they stop at a marina or fuel dock when returning from HMS fishing trips. The majority of respondents with vessels kept at restricted access sites (either a private dock or locked marina) indicated that they stopped at a marina or fuel dock, at least some of the time, when returning from HMS fishing trips (Figure 25). Only about 30% of respondents with vessels kept at restricted access sites indicated they “always” stop at a marina or fuel dock upon return from an HMS fishing trip. In the South Atlantic about 1/3<sup>rd</sup> of such respondents indicated that they “never” stop at a marina or fuel dock upon return from an HMS fishing trip.

Table 10. General category completed interviews, mean years fished, and HMS 12-month trip avidity by principle port state.

Principle Port State	Total HMS General Permits	Total completed interviews	Mean Years Fished	Mean Yrs. Fished HMS	Percent HMS Fishing past 12 months	Mean HMS 12-month Trips	Mean HMS 12-month Trips (excluding zeros)
TX	18	12	28.9	19.4	58.3	7.3	12.4
LA	49	33	29.6	10.4	48.5	4.1	8.5
MS	10	9	22.1	4.6	44.4	1.9	4.3
AL	24	19	19.8	11.0	57.9	3.1	5.3
All GOM	101	73	26.2	11.5	52.0	4.1	7.8
GA	11	6	9.3	10	66.7	11.2	16.8
SC	83	65	24.1	14.2	61.5	6.6	10.7
NC	672	484	26.9	12.5	57.7	7.6	13.2
All S. Atl.	766	555	26.3	12.6	58.2	7.5	12.9

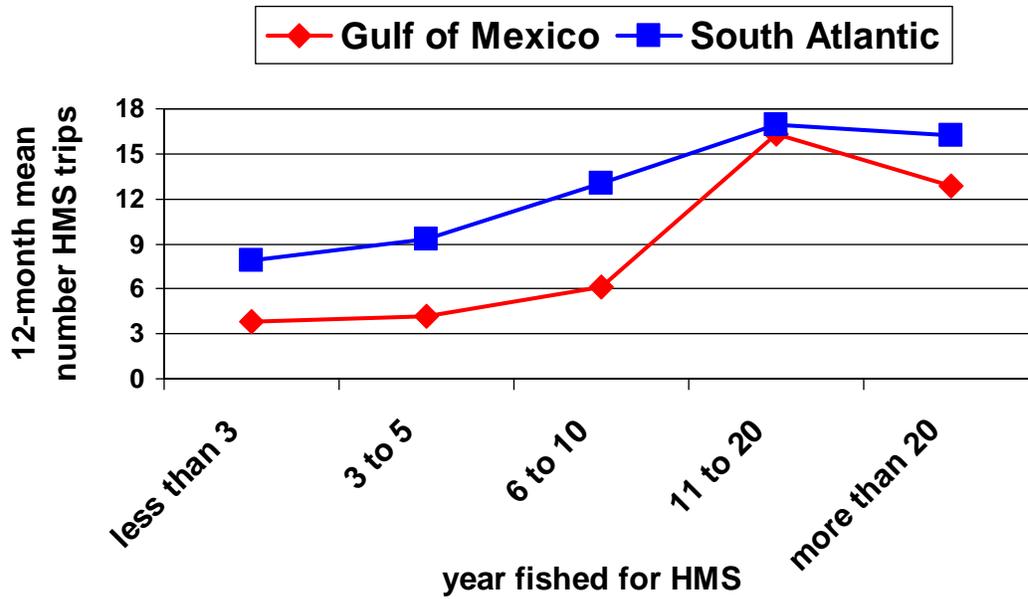


Figure 22. Mean number of General category HMS trips taken in the past 12 months by HMS years fished grouping. Only includes vessels that indicated taking at least one HMS trip.

Table 11. Percent of General category vessels that used a secondary or tertiary access site for HMS fishing, and the percent of HMS trips taken from the primary access site in the past 12 months.

Principle Port State	Number Fished HMS past 12-months	Percent with secondary access site	Percent with tertiary access site	Percent of HMS trips from primary access site
All GOM	38	13.2%	0.0%	93.8%
All S. Atl.	323	21.7%	3.7%	90.1%

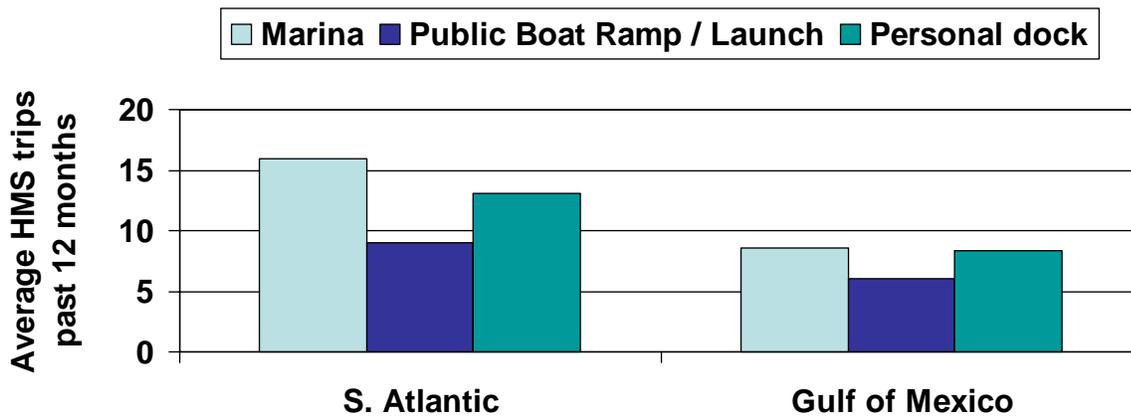


Figure 23. Average number of General category HMS boat trips in past 12-months by region and primary access type (note: only includes vessels with at least one HMS trip in past 12 months).

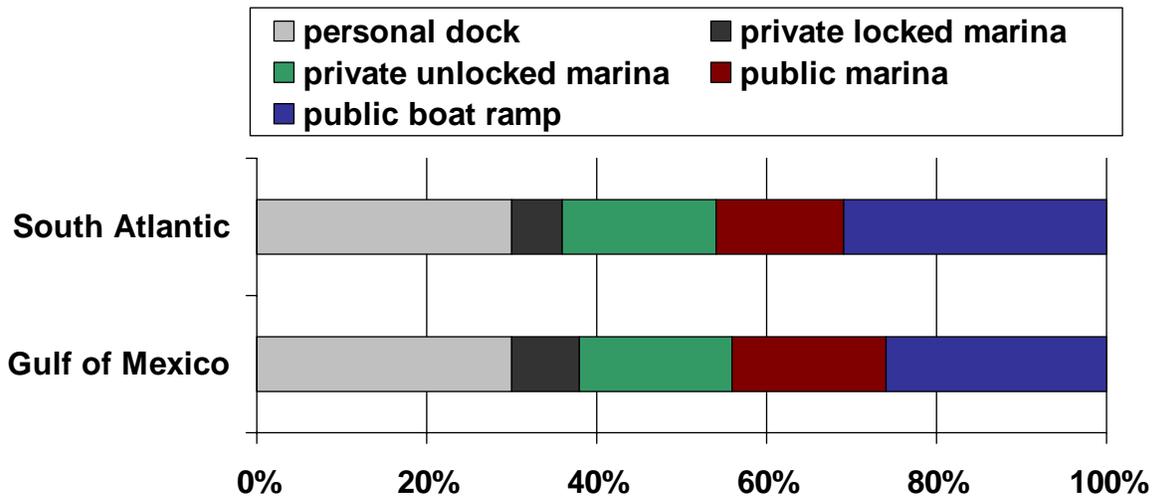


Figure 24. Type of access site primarily used by General category vessels to fish for HMS in past 12-months, by region (note: only includes vessels with at least one HMS trip in past 12 months).

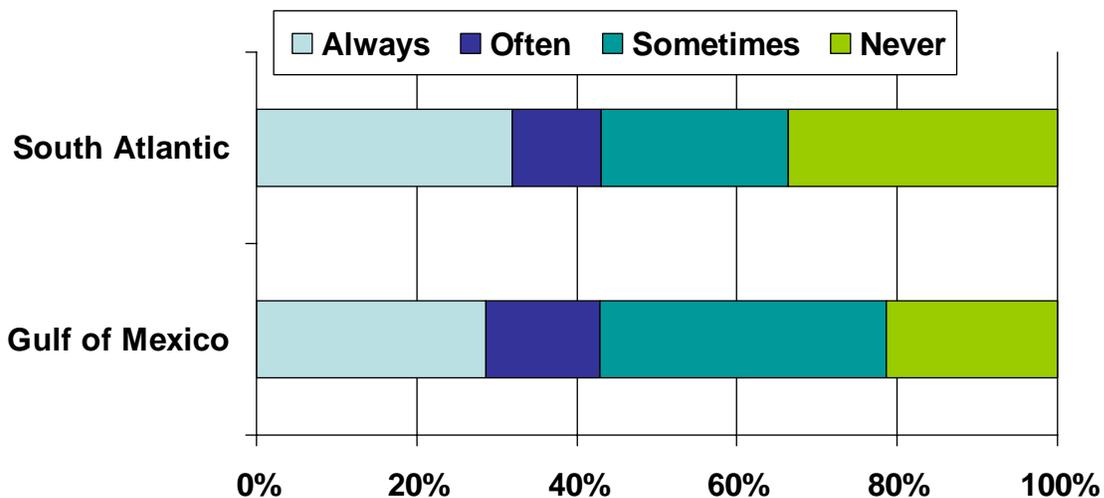


Figure 25. Response to General category question: *Does vessel stop at a marina or fuel dock when returning from HMS fishing?* (note: only includes vessels with at least one HMS trip in past 12 months).

General category permit holders were also asked to report the number of HMS trips taken in the past twelve months that were overnight trips consisting of more than one day of fishing. Overnight fishing for HMS was far more prevalent in the Gulf of Mexico than in the South Atlantic. In the Gulf of Mexico, nearly 3 out of every 4 General category vessels (74%) used for HMS fishing in the past 12 months took at least one overnight trip (Table 12). Nearly 37% of HMS General category trips reported by Gulf of Mexico respondents were overnight trips. By

comparison, only 13% of General category vessels used for HMS fishing in South Atlantic states in the past 12 months took an overnight trip. Overnight trips accounted for about 4% of all HMS trips taken by General category vessels in the South Atlantic.

Table 12. Percent of General category vessels that took at least one overnight HMS fishing trip, percent of HMS trips taken that were overnight, and mean number of overnight HMS trips per vessel in the past 12 months (note: overnight trip defined as a trip consisting of more than one day of fishing).

Principle Port State	Percent who took overnight HMS trips (of those who fished HMS)	Percent of HMS trips that were overnight	Mean number of HMS overnight trips past 12-months (of those who fished HMS)
All GOM	73.7%	36.9%	2.9
All S. Atl.	13.3%	4.2%	0.5

Respondents were asked to indicate the approximate time their General category vessel left the dock for HMS fishing trips. Differences in reported HMS trip start times were found between the South Atlantic and the Gulf of Mexico. In the South Atlantic nearly all HMS trips (96%) left the dock between 3:00 am and 9:00 am, compared to only about 73% in the Gulf (Figure 26).

Differences between regions were also found in times returned from HMS trips. A greater proportion of General category HMS trips in the Gulf of Mexico returned to the dock outside of the 3:00 pm to 9:00 pm time interval compared to HMS trips in the South Atlantic (Figure 27).

To more narrowly define time returned, respondents were also asked to indicate the “most common time to the nearest hour” their vessel returns to the dock from an HMS fishing trip. Responses to this question indicated a wider range of return times for HMS fishing in the Gulf of Mexico compared to the South Atlantic (Figure 28). Nearly 14% of General category permit holders in the Gulf indicated their most common return time as being at night or in the morning (i.e., between 9 pm and 11 am. By comparison less than 2% of General category permit holders in the South Atlantic Gulf indicated their most common return time as between 9 pm and 11 am.

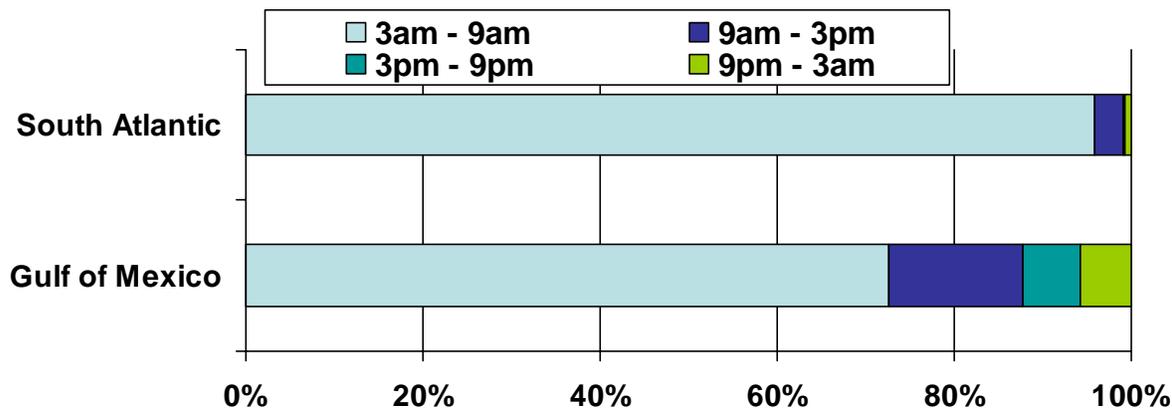


Figure 26. Distribution of time interval General category vessel **left the dock** on HMS trips taken in the past 12 months, by region.

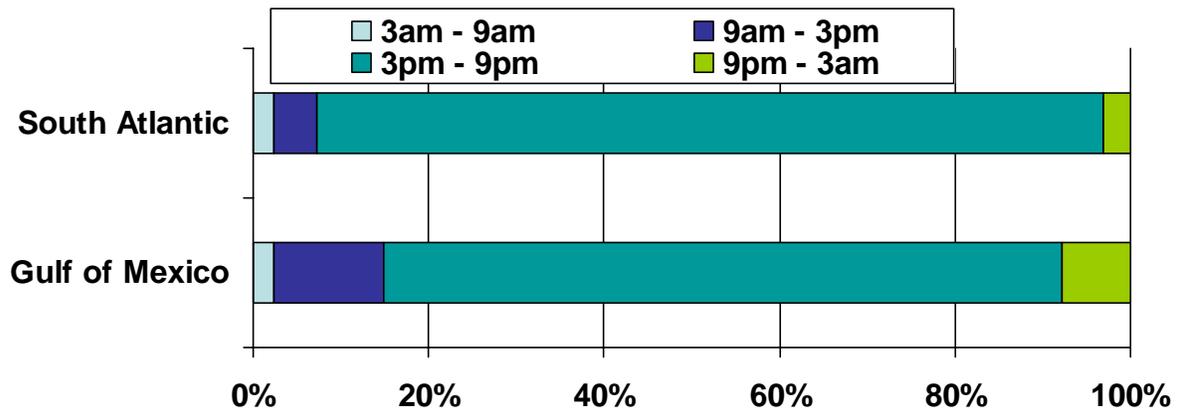


Figure 27. Distribution of time interval General category vessel **returned to the dock** on HMS trips taken in the past 12 months, by region.

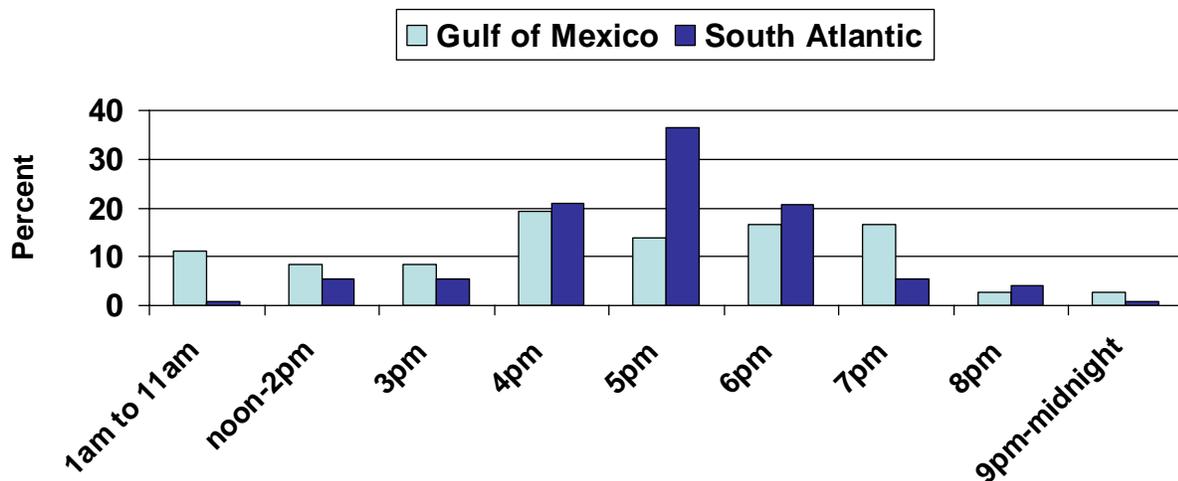


Figure 28. Distribution of most common time (to the nearest hour) General category vessels returned to the dock on HMS trips taken in the past 12 months, by region.

Respondents were asked to recall which months their General category permitted vessel was used for HMS fishing in the past year. The number of HMS trips taken was recorded for six 2-month waves beginning with September-October 2007 and ending with July-August 2008. Figure 29 shows the seasonal trend in mean number of HMS trips per vessel over this time period (note: vessels that took zero HMS trips in the past 12-months were not included in calculation of means). In the South Atlantic General category HMS effort is spread across all months but appears to peak in late spring and late fall. In the Gulf General category HMS effort is steady from early spring to late fall but drops off in the winter months.

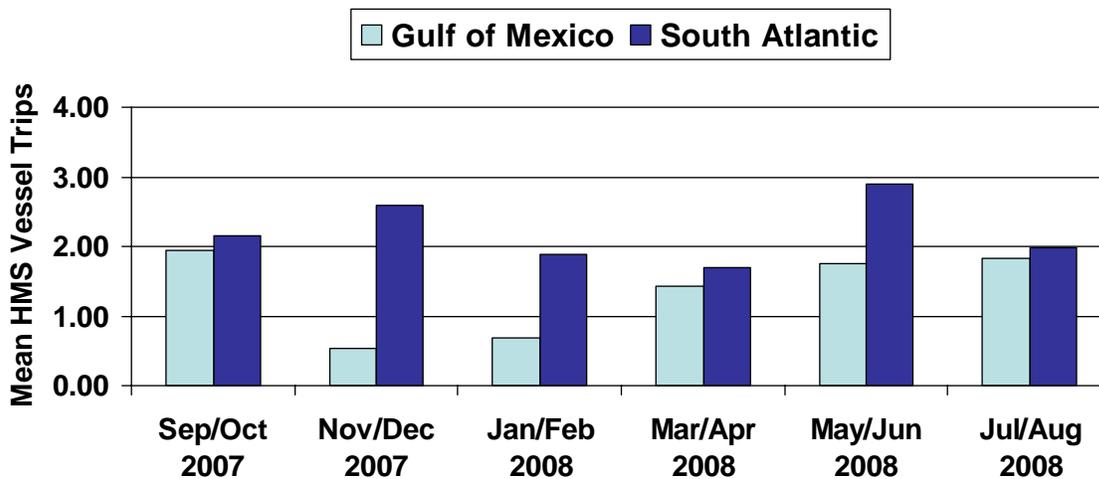


Figure 29. Mean number of HMS General category vessel trips in the past 12 months by region and two-month wave (note: means only include vessels that took at least 1 HMS trip in the past 12 months).

Table 13 shows the proportion of General category vessels that targeted a particular species or species group by region and primary access site type (marina, boat ramp, and personal dock). Tuna were consistently targeted by a large majority of vessels across both regions and all primary access site types. In the Gulf of Mexico, General category permit holders whose primary access site type was a marina were far more likely to have targeted billfish (71%) in the past twelve months than were vessels whose primary access site type was a boat launch (30%) or personal dock (27%). A little less than one-half of General category permit holders in the South Atlantic whose primary access was marina or personal dock indicated targeting billfish. Sharks did not appear to be a popular target species, regardless of site type used or region, among General category permit holders. Swordfish were by far a more common target species among General category permit holders in the Gulf than in the South Atlantic.

The proportion of HMS trips targeting each species group in the past 12 months was also analyzed. About 71% of HMS trips taken by General category vessels targeted tuna and 35% targeted billfish. Only about 2% of trips targeted sharks and 3% targeted swordfish. Swordfish were targeted on over 12% of General category HMS trips in the Gulf compared to less than 3% in the South Atlantic. Trips targeting tuna consistently made up the greatest percent (between 61-85%) of all General category trips across both region and all access site types (Table 14; note: percentages do not add to 100% across rows since more than one species group could be targeted on the same trip.)

Table 13. Percent of General category vessels targeting each species group in past 12 months by region and primary access site. (excluding zero trip vessels)

State	Primary Access Site	% Targeting Tuna	% Targeting Shark	% Targeting Billfish	% Targeting Swordfish
Gulf of Mexico	Marina	76.5	5.9	70.6	35.3
	Public boat ramp	90.0	0.0	30.0	40.0
	Personal dock	90.9	0.0	27.3	18.2
South Atlantic	Marina	91.9	8.1	48.8	5.7
	Public boat ramp	94.9	2.0	25.5	5.1
	Personal dock	91.7	3.2	45.8	6.3

Table 14. Percent of HMS trips by General category vessels targeting each species group in past 12 months by region and primary access site.

State	Primary Access Site	% Targeting Tuna	% Targeting Shark	% Targeting Billfish	% Targeting Swordfish
Gulf of Mexico	Marina	85.0	2.0	53.1	10.2
	Public boat ramp	71.7	0.0	40.0	28.3
	Personal dock	61.5	0.0	26.4	5.5
South Atlantic	Marina	66.6	4.2	39.3	1.0
	Public boat ramp	80.5	0.6	19.8	3.5
	Personal dock	69.2	0.6	37.6	5.2

The two species most often targeted on directed tuna trips by General category vessels in the South Atlantic were yellowfin and bluefin tuna (Figure 30). About one-half of respondents in the South Atlantic indicated targeting blackfin tuna on at least some of their tuna trips. In the Gulf of Mexico the two species most often targeted on directed tuna trips by General category vessels were yellowfin and blackfin.

Respondents were asked to recall how many HMS they kept (i.e., landed) and released (by species) in the past 12 months aboard their General category vessel. Table 15 shows the number of tuna reported kept and released by General category vessels by species and sub-region. In the South Atlantic more yellowfin were reported as landed (1,884) than any other tuna species, followed by blackfin (833). In the Gulf, blackfin was reported as landed most often (856), followed by yellowfin (606). General category permit holders reported catching 1,694 blacktip sharks (South Atlantic and Gulf combined), all but 23 were released alive (Table 16). In the South Atlantic a large number of sand tiger sharks (1,327) were reported as released alive. Table 17 shows the number of billfish reported kept and released alive by General category vessels.

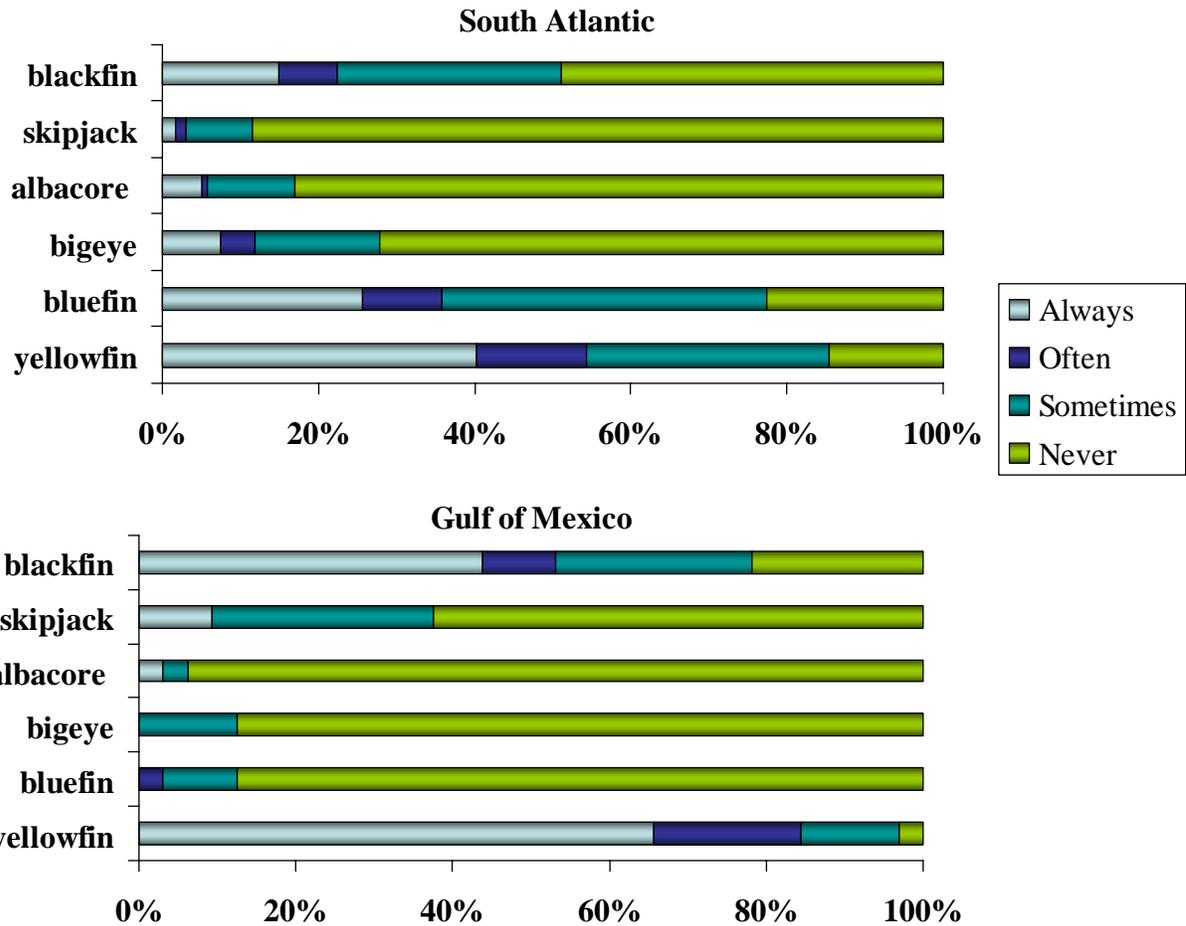


Figure 30. General category permit holder responses to the question: *When targeting tuna how often do you target each of the following species?*

Table 15. General category total number of tuna reported kept and released alive in past 12 months by region and species.

	Yellowfin		Bluefin		Bigeye		Albacore		Skipjack		Blackfin	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>GOM</b>	606	79	4	2	0	2	1	10	16	353	856	739
<b>S.Atl.</b>	1,884	261	111	191	101	7	175	578	135	267	833	221

Table 16. General category total number of sharks reported kept and released alive in past 12 months by region and species.

	<b>Blacktip</b>		<b>Blacknose</b>		<b>Shortfin Mako</b>		<b>Bull</b>		<b>Tiger</b>		<b>Sand Tiger</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>GOM</b>	21	361	0	0	3	10	0	25	0	1	0	4
<b>S.Atl.</b>	2	1,310	0	56	11	113	5	252	0	34	0	1,327
	<b>Whitetip</b>		<b>Hammerhead</b>		<b>Spinner</b>		<b>Lemon</b>		<b>Thresher</b>		<b>Sandbar</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>GOM</b>	0	20	0	56	1	6	0	0	0	0	0	1
<b>S.Atl.</b>	0	0	0	71	0	10	0	46	0	9	0	10

1. Other species of shark reported as caught included Atlantic sharpnose, bonnethead, spiny dogfish, leopard, nurse, and reef shark.
2. Unknown sharks reported as caught included “unidentified” (67 released), “gray shark” (12 released), and “bronze whaler” (4 released).
3. Hammerhead includes smooth, great and scalloped species.

Table 17. General category total number of billfish and swordfish reported kept and released alive in past 12 months by region and species.

	<b>Blue marlin</b>		<b>White marlin</b>		<b>Sailfish</b>		<b>Swordfish</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>GOM</b>	0	20	0	12	0	20	11	12
<b>S.Atl.</b>	4	169	1	306	1	611	30	7

In the Gulf of Mexico 42.1% of General category vessels (that took at least one HMS trip) participated in at least one HMS tournament. In the South Atlantic 19.3% of General category vessels (that took at least one HMS trip) participated in at least one HMS tournament. The percent of General category trips targeting HMS that were associated with tournaments was 11.7% in the Gulf and 7.8% in the South Atlantic. In both sub-regions about 1/3<sup>rd</sup> of General category vessels (that reported at least one trip) reported taking more trips targeting billfish than tournament trips.

The Atlantic Tunas General category permit allows captains to fish commercially (i.e., sell fish) for Atlantic bluefin, bigeye, yellowfin, albacore, or skipjack tunas using a combination of rod and reel, handlines or harpoon gear. This category typically includes a diverse range of interests from purely commercial fishermen who sell tunas and other species to make a living to purely recreational anglers who occasionally sell tuna to off-set their operating costs. Historically, the General category is a popular choice among some recreational anglers in states from North Carolina through Maine where highly valued sushi-quality giant bluefin tuna are pursued. In addition to providing the opportunity to sell large valuable tuna, the General category permit has no current bag limit on yellowfin tuna (whereas the Angling category limit is 3 per person per trip). Over 50% of General category permit holders indicated they had fished recreationally for HMS in the previous 12 months. Although the General category is considered a commercial permit, of those respondents who indicated taking at least one recreational HMS trip in the past

12 months, only about 5% in the Gulf of Mexico and 25% in the South Atlantic said they ever sell the HMS they catch. Therefore, the General category contains a large number of permit holders who fish recreationally and never sell their catch. These results suggest that many recreational anglers fishing in the General category are still waiting for the opportunity to sell their first giant bluefin tuna, or they have other incentives for fishing under this commercial permit. Another possible explanation is that some HMS recreational anglers accidentally get the wrong permit type due to confusion over the different permit types or difficulty navigating the online permit web site.

About 3% of General category permit holders indicated they owned more than one vessel that was used for HMS fishing. Over one-half of General category permit holders (55%) gave an email address and indicated willingness to provide information about their fishing activity through online internet surveys in the future.

### Texas HMS Charter/headboat Category Permit Holders

Completed interviews were obtained from 115 out of 185 (62.2%) HMS Charter/headboat category permit holders in Texas. Respondents indicated having 28.4 years of saltwater fishing experience for any species, and about 14 years of experience fishing for HMS. Texas Charter/headboat permitted vessels were used for an average of 14.5 HMS trips in the past 12 months (21.7 trip average for vessels taking at least one trip). About 9% of respondents indicated they owned more than one vessel they used for HMS fishing.

About 1/3<sup>rd</sup> of respondents indicated that they did not use their Charter/headboat vessel for HMS fishing in the previous 12 months. Of the 77 vessels that took at least one HMS trip in the past 12 months, 35% said that all of their HMS trips were with paying passengers, while nearly one-quarter (23%) of respondents indicated that none of their trips were with paying passengers. About 70% of all reported HMS Charter/headboat category trips were actual charters with paying passengers. None of the Charter/headboat category permit holders interviewed said they ever sell the HMS they catch.

About 14% of Texas HMS Charter/headboat category vessels (that fished for HMS in the past 12 months) used more than one access site. The primary access site accounted for nearly 97% of reported HMS trips. As show in Figure 31 the HMS Charter/headboat vessels in Texas use a variety of primary access site types. About 1/3<sup>rd</sup> of permit holders (35%) indicated using either a personal dock or private locked marina as their primary access site type. These restricted access site types are extremely difficult (if not impossible) to sample using dockside intercepts. Respondents who indicated using a private locked marina were more likely to stop at another marina or fuel dock when returning from HMS fishing trips than were those who indicated using a personal dock (Figure 32).

Texas HMS Charter/headboat category permit holders were also asked to report the number of HMS trips taken in the past twelve months that were overnight trips consisting of more than one day of fishing. Only about 1/3<sup>rd</sup> (36.4%) of Charter/headboat category permit holders indicated taking at least one overnight HMS trip. One out of every eight HMS trips (in the past

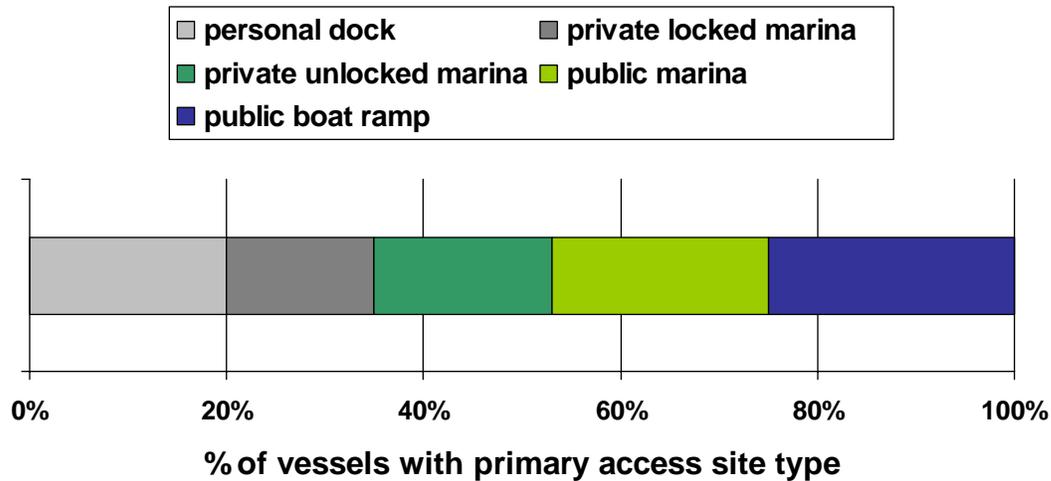


Figure 31. Type of access site primarily used by Texas Charter/headboat category vessels to fish for HMS (note: only includes vessels with at least one HMS trip in past 12 months).

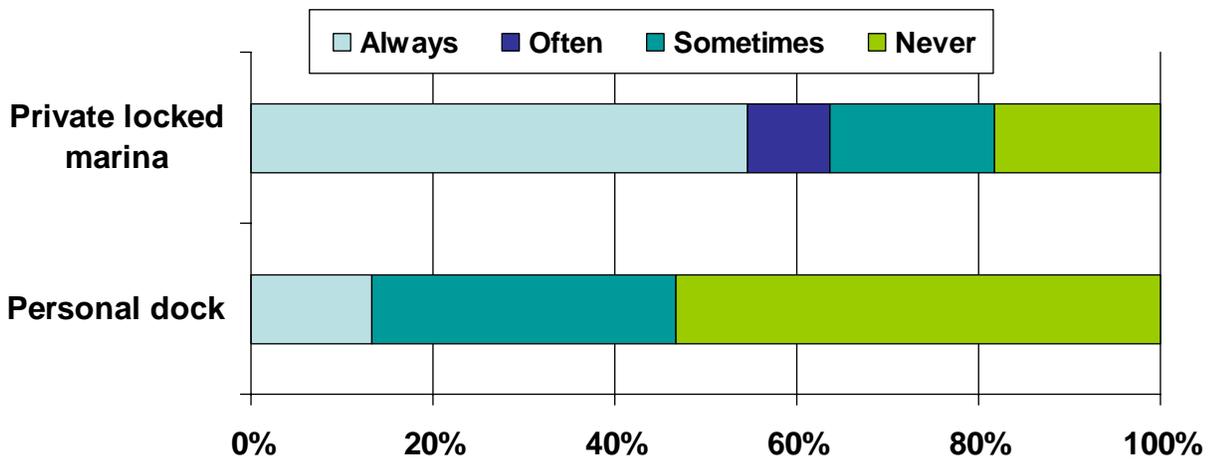


Figure 32. Response to Charter/headboat category question: *Does vessel stop at a marina or fuel dock when returning from HMS fishing?* (note: only includes vessels with at least one HMS trip in past 12 months).

twelve months) reported by Texas HMS Charter/headboat category permit holders were overnight.

Respondents were asked to indicate the approximate time their vessel left and returned from the dock for HMS fishing trips (Figure 33). About 90% of the HMS trips reported left the dock between 3:00 am and 9:00 am and returned between 3:00 pm and 9:00 pm. To more narrowly define time returned, respondents were also asked to indicate the “most common time to the nearest hour” their vessel returns to the dock from an HMS fishing trip. (Figure 34). The most

common return times were between 5:00 and 7:00 pm. One of out five respondents indicated their most common return time in the early afternoon between noon and 3:00 pm.

Respondents were asked to recall which months their HMS Charter/headboat category permitted vessel was used for HMS fishing in the past 12 months. The number of HMS trips taken was recorded for six 2-month waves beginning with September-October 2007 and ending with July-August 2008. Figure 35 shows the seasonal trend in mean number of HMS trips per vessel over this time period (note: vessels that took zero HMS trips in the past 12-months were not included in calculation of means). The HMS charter/headboat fishery in Texas occurs primarily from late spring through early fall, peaking from July through August.

About 38% of respondents indicated that their vessel was used in at least one HMS tournament in the previous 12 months (of those that took at least one HMS trip). Only about 8% of HMS trips taken by Texas Charter/headboat category vessels were associated with a tournament

Of those Texas HMS Charter/headboat category vessels that took at least one HMS trip, about three-fourths (76.6%) targeted tuna at least once in the past 12 months, over one-half (54.6%) targeted billfish, one-third (32.5%) targeted sharks, and 15.6% targeted swordfish. Table 18 shows the proportion of Charter/headboat HMS trips that targeted a particular species group by primary access site type. Tuna were consistently targeted on about 37% of HMS trips regardless of primary access site type. Trips targeting sharks (37%) make up a far greater component of the HMS for-hire fishery in Texas than the HMS private boat (Angling category) fishery (7.5%). Although more Charter/headboat permit holders indicated targeting tuna than shark, the proportion of trips targeting each species group was about the same. Nearly one-half (47.3%) of HMS trips taken aboard Texas Charter/headboat category vessels whose primary access was a personal dock indicated targeting sharks. The relatively large proportion of HMS Charter/headboat vessel trips targeting shark overall (37%) was due largely to five very avid vessels that accounted for two-thirds all shark trips reported.

The two species primarily targeted on directed tuna trips by Charter/headboat category vessels in Texas were blackfin and yellowfin (Figure 36). Over 62% of respondents indicated they 'always' target blackfin tuna and 37% indicated they 'always' target yellowfin tuna when fishing for tuna. Other tuna species such as skipjack, albacore, bigeye and bluefin were seldom cited as target species by Texas Charter/headboat category permit holders.

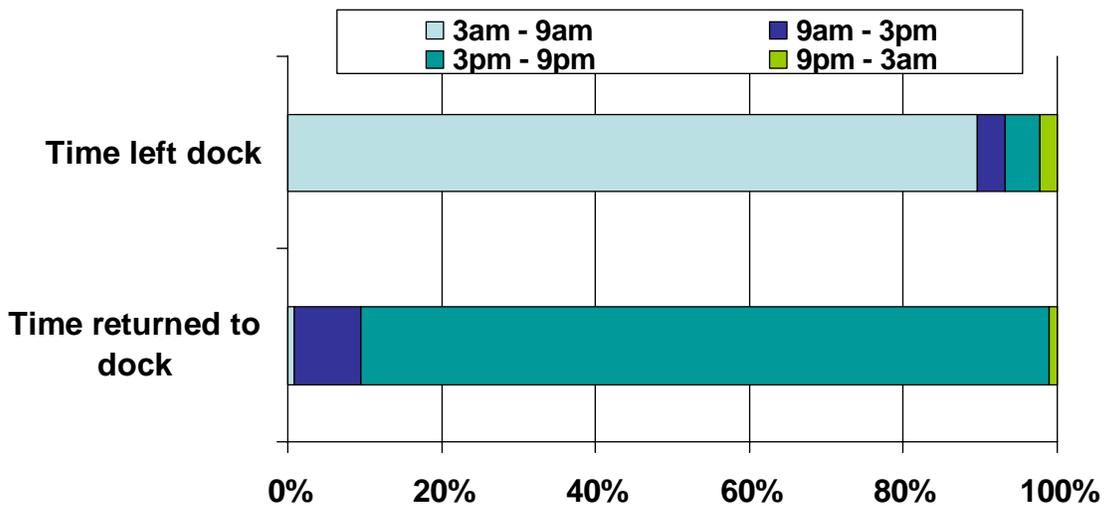


Figure 33. Distribution of time interval Texas HMS Charter/headboat category vessel left and returned from the dock on HMS trips taken in the past 12 months.

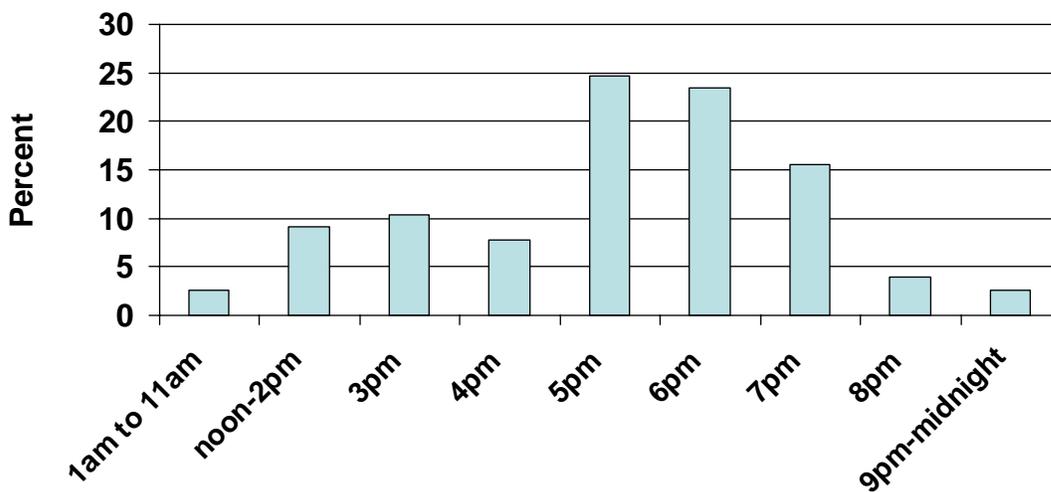


Figure 34. Distribution of most common time (to the nearest hour) Texas HMS Charter/headboat category vessels returned to the dock on HMS trips taken in the past 12 months.

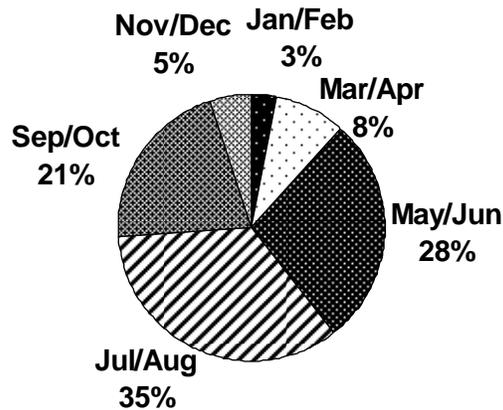


Figure 35. Seasonal distribution of Texas HMS fishing trips by Charter/headboat vessels.

Table 18. Percent of Texas HMS Charter/headboat trips in the past 12 months targeting each species group by primary access site.

State	Primary Access Site	% Targeting Tuna	% Targeting Shark	% Targeting Billfish	% Targeting Swordfish
Texas	Marina	37.4	33.6	29.1	4.3
	Public boat ramp	36.6	38.4	20.9	0.7
	Personal dock	37.5	47.3	17.8	2.8

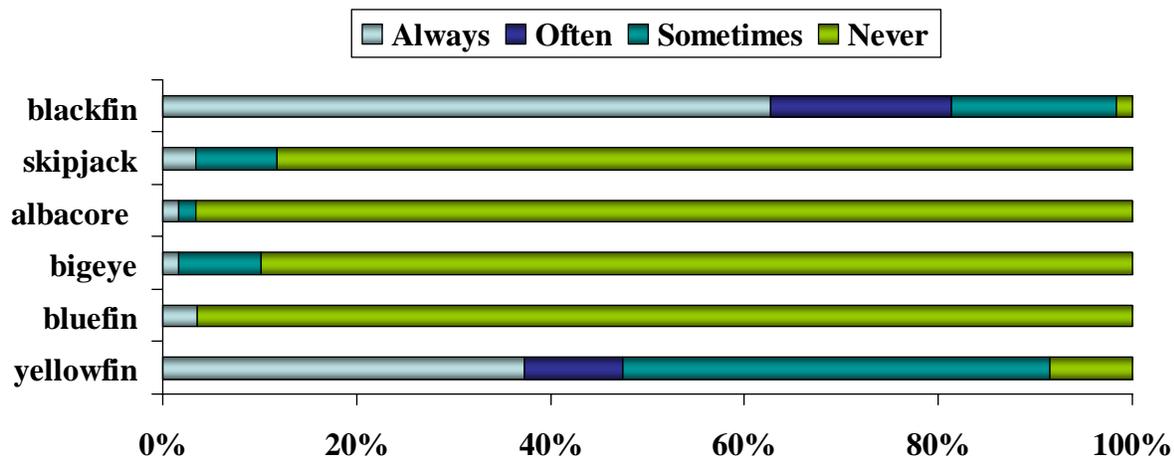


Figure 36. Texas HMS Charter/headboat category permit holder responses to the question: *When targeting tuna how often do you target each of the following species?*

Blacktip sharks were targeted by all respondents who indicated targeting sharks in the past 12 months (Figure 37). Over 83% of these respondents indicated that they ‘always’ or ‘often’ target blacktips on directed shark trips. The next most targeted species by Texas Charter/headboat permit holders were bull sharks and mako sharks. Of those respondents who targeted sharks about one-half (48%) said they targeted bull sharks at least some of the time, and 40% said they

targeted mako sharks at least some of the time. All three billfish species appear to be important to Texas charterboat fishermen who target billfish. Of those respondents who indicated targeting billfish in the past 12 months, sailfish were targeted on a least one trip by all (100%), blue marlin were targeted by 93%, and white marlin by 74% (Figure 38).

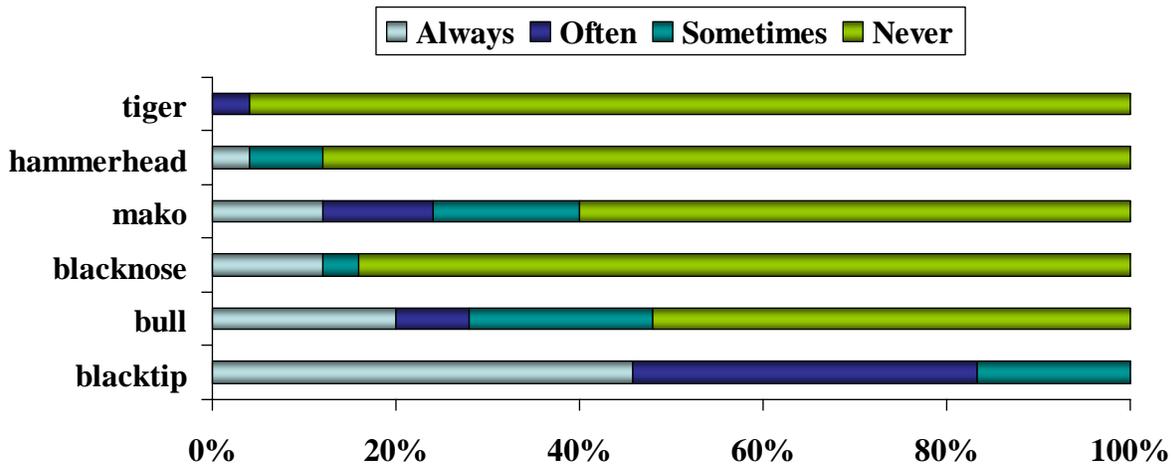


Figure 37. Texas HMS Charter/headboat category permit holder responses to the question: *When targeting sharks how often do you target each of the following species?*

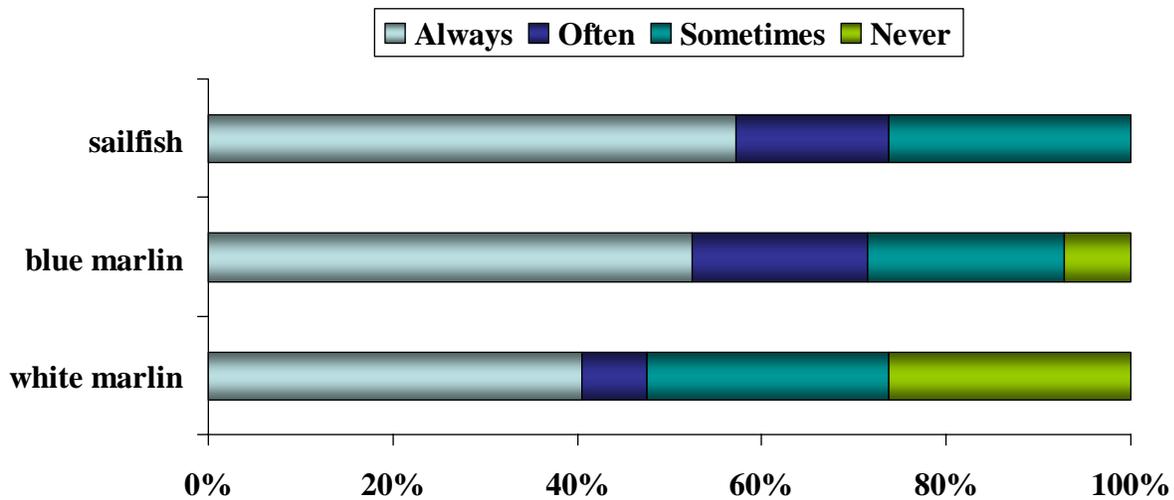


Figure 38. Texas HMS Charter/headboat category permit holder responses to the question: *When targeting billfish how often do you target each of the following species?*

Respondents were asked to recall how many HMS they kept (i.e., landed) and released (by species) in the past 12 months aboard their Charter/headboat category vessel. Table 19 shows the number of tuna reported kept and released alive by species. Blackfin tuna was reported as

landed most often (3,183), followed by yellowfin tuna (480). On trips targeting tuna, Texas Charter/headboat category vessels kept, on average, over 5 blackfin tuna per trip. Blacktip sharks were by far the most frequently caught shark species by Texas HMS Charter/headboat vessels. Respondents reported catching 1,599 blacktip sharks of which 1,332 (83%) were released alive (Table 20). Bull sharks were the second most frequently caught species (332), over 96% of which were released alive. Table 21 shows the number of billfish reported kept and released alive by species.

Table 19. Texas HMS Charter/headboat category total number of tuna (by species) reported kept and released alive, and the number kept and released alive per targeted tuna trip in the past 12 months.

	<b>Yellowfin</b>		<b>Bluefin</b>		<b>Bigeye</b>		<b>Albacore</b>		<b>Skipjack</b>		<b>Blackfin</b>	
	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
<b>Number reported</b>	480	158	8	1	5	0	0	3	34	13	3,183	1,462
<b>Catch per trip</b>	0.770	0.253	0.013	0.002	0.080	0.000	0.000	0.005	0.055	0.021	5.105	2.345

Table 20. Texas HMS Charter/headboat category total number of sharks reported kept and released alive in past 12 months by species.

<b>Blacktip</b>		<b>Blacknose</b>		<b>Shortfin Mako</b>		<b>Bull</b>		<b>Tiger</b>		<b>Sand Tiger</b>	
Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
267	1,332	0	56	6	17	13	319	0	8	0	86
<b>Dusky</b>		<b>Hammerhead</b>		<b>Spinner</b>		<b>Night</b>		<b>Thresher</b>		<b>Whitetip</b>	
Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
0	9	0	32	0	51	0	12	0	2	0	1

1. Other species of shark reported as caught included Atlantic sharpnose and “whitenose.”
2. Hammerhead may include smooth, great and scalloped species.

Table 21. Texas HMS Charter/headboat category total number of billfish (by species) reported kept and released alive, and the number kept and released alive per targeted billfish (or swordfish) trip in the past 12 months.

<b>Blue marlin</b>		<b>White marlin</b>		<b>Sailfish</b>		<b>Swordfish</b>	
Kept	Rel	Kept	Rel	Kept	Rel	Kept	Rel
0	87	0	48	1	155	16	1
0.0	0.203	0.0	0.112	0.002	0.362	0.286	0.018

About 61% of Texas HMS Charter/headboat category permit holders provided an email address and indicated a willingness to provide information about their fishing activity through online internet surveys in the future.

## *Comparisons with MRFSS and RBS Data*

### Approach

The Marine Recreational Fisheries Statistics Survey (MRFSS) has been conducted along the Atlantic and Gulf coasts (except Texas) for over 30 years. MRFSS interviews (on-site and phone) are conducted with anglers who target and catch highly migratory species (i.e., tunas, sharks, billfish, and swordfish) and estimates of catch and directed effort are produced for these species. However, as a generalized recreational fishing survey that attempts to cover all species the MRFSS estimates for these rare event, often pulse-like species often lack the precision and accuracy needed for management and assessment purposes. MRFSS interviewers are also instructed not to sample at sites serving as official weigh stations for tournaments, which are an important component of recreational HMS fisheries. Results of this attempted census were compared to MRFSS catch estimates for highly migratory species. Comparisons between characterization survey catch estimates and MRFSS catch estimates were only conducted for select species with relatively large landings and/or releases based on characterization results. The goal of these comparisons was to test how well the MRFSS estimates catch of some of the more commonly landed (and released) HMS species. Comparisons were not conducted for species that are caught very infrequently by HMS anglers in these subregions since it is assumed that MRFSS estimates for these extremely rare event species are very imprecise and not worth comparing. Even a specialized survey approach aimed at HMS may not achieve the desired precision level for species caught in such small numbers.

For comparisons with MRFSS private/rental boat mode, results from the Angling and General categories were combined into a single private boat mode. Rental boats are not likely to be used for HMS fishing due to the typical vessel size needed for off-shore fishing and the vessel permit requirements. Comparisons were made at the sub-regional level (South Atlantic, Gulf of Mexico) since MRFSS HMS data are too sparse for meaningful state-level comparisons. Texas was not included since MRFSS is not conducted there, and Florida was not included since the characterization survey did not cover Florida.

Characterization survey interviews were conducted between September 2<sup>nd</sup> and September 23<sup>rd</sup>, 2008. Respondents were asked to report on their HMS fishing activity in the previous 12-month period from September 2007 through August 2008. This coincides with the following MRFSS 2-month waves: waves 5 and 6, 2007 and waves 1-4, 2008. These six MRFSS waves, straddling two calendar years, were used for comparisons with characterization survey results. MRFSS is not conducted in Georgia or South Carolina during January/February (wave 1). Since characterization catch data were not collected by wave, some wave 1 HMS catches may have been included from Georgia or South Carolina. However, this contribution to the catch was expected to be very small and would not likely have changed the overall comparison between MRFSS and characterization survey data.

Differences in coverage between the two surveys still existed even after limiting the comparison to only the 6 states covered by both the characterization survey and MRFSS (i.e., NC, SC, GA, AL, MS, or LA). The characterization survey catch estimates cover HMS catches from North Carolina through Texas by HMS permitted vessels whose principal port state was either NC, SC,

GA, AL, MS, or LA. By contrast, MRFSS HMS catch estimates reflect fish caught in NC, SC, GA, AL, MS, or LA by all vessels (i.e., permitted vessels from **any** principal port state as well as **non-permitted** vessels). Table 22 shows the difference in coverage between the two data collection approaches. If permitted vessels from these six states take a large proportion of HMS trips in Florida and Texas the characterization survey estimates may be inflated compared to MRFSS. Likewise, if a large proportion of HMS trips in these six states are taken by permitted vessels from another state or by non-permitted vessels, then MRFSS estimates maybe inflated compared to the characterization results. One would expect the large majority of HMS catch represented in Table 22 to come from Angling category vessels whose principle port state is one of the 6 comparison states and on trips that return to one of these 6 states (represented by the box with both ‘C’ and ‘M’). Coverage mismatches should be small enough relative to the overlap coverage (and may even cancel each other out) so as to not significantly affect comparisons between characterization results and MRFSS.

Table 22. Difference in coverage of HMS catches between characterization survey and MRFSS approaches (‘C’ indicates catch covered by characterization survey; ‘M’ indicates catch covered by MRFSS).

Trip Return State	HMS Angling or Atlantic Tunas General Category Permit Principle Port State		
	NC, SC, GA, AL, MS, or LA	Any Other State	No HMS Angling category permit
NC, SC, GA, AL, MS, or LA	C, M	M	M
FL or TX	C	---	---
Any other state	---	---	---

For the characterization survey, Angling and General category permit holders were asked to recall how many HMS were kept and released by species aboard their vessel in the previous 12-month period. Individual permit type/state estimates were added to produce the sub-region level estimates of HMS catch by species in the past 12-months. Since completed interviews were conducted with only about 70% of permit holders on the frame, reported HMS catch had to be extrapolated to account for non-response. For each permit type/state/species combination, the mean number of fish kept and released per vessel was multiplied by the total number of permitted vessels to arrive at estimated HMS kept and released by species for all vessels. Use of this extrapolation approach to account for non-response assumes that HMS catch rates did not differ between respondents and non-respondents. If more avid or more successful (i.e., higher catch rates) HMS anglers were more likely to respond to the survey this straight expansion could result in catch estimates biased high.

The long recall period (12 months) associated with the characterization survey could also result in a unidirectional bias if anglers have a propensity towards either overestimating or underestimating HMS catch in the past 12 months. Shorter recall periods are typically used for recreational fisheries surveys designed to produce highly accurate effort and catch estimates needed for monitoring and assessment purposes. A 12-month recall period was, however, a cost effective way to achieve the projects primary objective of characterizing the HMS fisheries. One might expect recall bias to be somewhat less of an issue with rare-event HMS fisheries since

catching large pelagics may be a more memorable experience compared to species that are more commonly targeted and typically caught in greater numbers. At the end of each interview, interviewers were asked to rate the accuracy of respondents answers on a 5-point scale from ‘very inaccurate’ to ‘very accurate.’ Overall about 75% of interviews were recorded as ‘very accurate’ and another 20% as ‘somewhat accurate.’ Less than 1.5% of interviews were recorded as either ‘very inaccurate’ or ‘somewhat inaccurate.’ However, follow-up studies would be needed to truly validate the accuracy of HMS reported catches using a 12 month recall period.

Comparisons were also made between characterization survey results and the NMFS Recreational Billfish Survey (RBS) in an effort to estimate the proportion of billfish released alive during HMS tournaments in the South Atlantic and Gulf. The primary difference between these is that the characterization survey includes releases during all HMS trips, not just tournament trips as in the RBS. The RBS is an attempted census of all tournaments targeting billfish based on tournament operators catch and effort summary reports. Comparisons were made using RBS results for billfish releases covering the same spatial and temporal range as the characterization survey covered (NC, SC, GA, AL, MS, LA, TX; September 1, 2007 – August 31, 2008). Characterization results for billfish releases were adjusted for non-response (as described above for MRFSS comparisons) and were also summed across all permit categories (Angling, General and Charter/headboat for Texas). Differences in coverage also exist between the two data collection approaches. That is, RBS totals also include charter boat catches for all states (not just Texas), catches by permitted vessels from other states (outside characterization range), and catches by non-permitted vessels. Catches by vessels included in the RBS but not included in the characterization survey are thought to be relatively small compared to those that were included in the characterization survey. RBS estimates of released billfish may also be underestimated as a result of tournaments non-compliant with the RBS or tournaments that don’t routinely collect data on released fish and therefore only report fish that were weighed in.

## Results

The relative difference between characterization survey catch estimates and MRFSS catch estimates varied considerably by sub-region and species. MRFSS yellowfin tuna landings estimates for the South Atlantic were about 21% lower than HMS characterization survey results (Figure 39). Due to low precision on the MRFSS yellowfin estimate the South Atlantic characterization survey estimate was within the 95<sup>th</sup> % confidence interval. 2008 was an uncharacteristic year for yellowfin tuna in the South Atlantic as landings declined sharply from a previous 5-year average (2003-2007) of nearly 105,000 to only 477 fish. MRFSS precision for South Atlantic private-rental yellowfin tuna landings is more typically in the 15-30% PSE range. Including Florida and with all modes combined PSE’s for South Atlantic yellowfin tuna landings generally are between 9-16%.

MRFSS yellowfin tuna landings estimates for the Gulf of Mexico were considerably smaller than the HMS characterization survey results. Despite low precision on the MRFSS yellowfin estimate the expanded Gulf characterization survey estimate was outside the 95% confidence interval. Annual PSE’s for Gulf of Mexico yellowfin tuna landings (including Florida and with all modes combined) are still fairly high (range 24-45% in past 10 years).

MRFSS private-rental mode blackfin tuna landings estimates were greater than the characterization survey results for the South Atlantic by about 13%, but smaller for the Gulf by about 21%. An HMS permit is not required to fish for blackfin tuna. Therefore, the characterization survey estimates do not include fish caught by non-permitted vessels. For both sub-regions MRFSS blackfin tuna estimates are fairly imprecise at this level of analysis. However, when Florida is included and all modes combined annual PSE's for blackfin landings typically range from 18-25% in the South Atlantic and 15-25% in the Gulf.

For billfish species, reported fish released alive from the characterization phone survey (expanded for non-response) were compared to MRFSS estimates of fish released alive. Even though the large majority of billfish caught are released alive, intercepted trips with any billfish catch (released or kept) is extremely rare in the MRFSS and estimates are typically imprecise. The one exception to this is sailfish in Florida where PSE's on releases are consistently below 20% for both east and west Florida independently. For the states covered in the characterization phone survey MRFSS billfish released estimates were either zero or had very large confidence intervals (Figure 40).

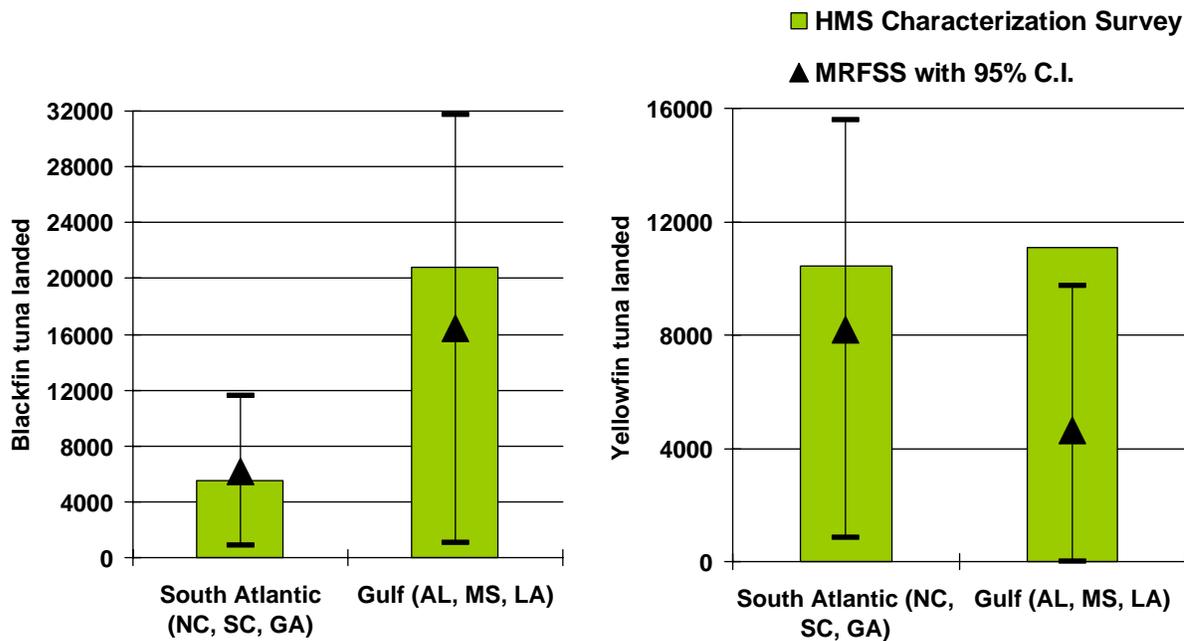


Figure 39. Comparison of Angling category HMS characterization survey reported tuna landings (adjusted for non-response) and MRFSS private/rental mode estimates over same 12-month reporting period (i.e., waves 5 and 6, 2007, plus waves 1-4, 2008). Note: South Atlantic only includes NC, SC, and GA and Gulf only includes AL, MS, and LA.

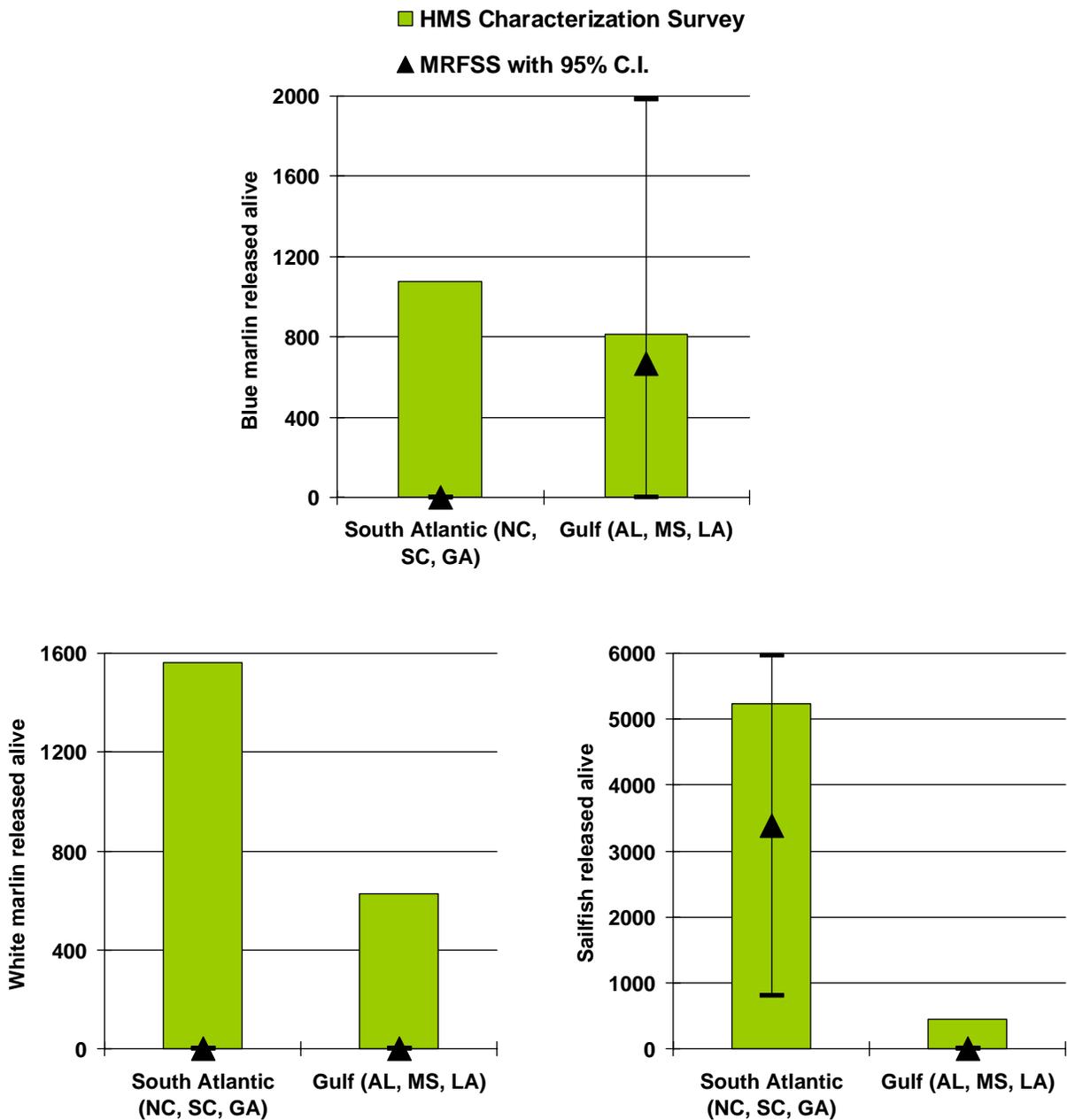


Figure 40. Comparison of Angling category HMS characterization survey reported billfish releases (adjusted for non-response) with MRFSS private/rental mode estimates over same 12-month reporting period (i.e., waves 5 and 6, 2007, plus waves 1-4, 2008). Note: South Atlantic only includes NC, SC, and GA and Gulf only includes AL, MS, and LA.

MRFSS HMS landings estimates at the sub-region level are generally imprecise, even for the most commonly targeted and caught HMS species. The total number and relative proportion of MRFSS intercepted trips that targeted a highly migratory species are both exceedingly small, particularly in the Gulf of Mexico (Table 23). HMS catch estimates are generally derived from just a few positive intercepts in each cell. Gulf of Mexico private boat recreational landings

estimates for yellowfin tuna may be biased significantly low. Loftus and Stone<sup>1</sup> (2003) reached a similar conclusion regarding MRFSS Gulf of Mexico charterboat yellowfin tuna landings estimates. Billfish are landed in such small numbers that one would not expect precise estimates from a randomized survey design. For such extremely rare events a census approach that attempts to account for every fish landed is probably needed (e.g., catch card program). Surveys may be effective for estimating billfish releases which are far more common than billfish landings. Characterization survey results show that thousands of billfish are released alive annually in the South Atlantic and Gulf of Mexico. By comparison, MRFSS estimates for billfish species (blue marlin, white marlin, and sailfish) releases are either zero or extremely imprecise. The extremely rare event nature of MRFSS intercepts with billfish releases is at least partially due to the fact that MRFSS interviewers do not interview at official tournament sites.

Table 24 shows RBS results for billfish releases covering the same spatial and temporal range as the characterization survey covered (NC, SC, GA, AL, MS, LA, TX; September 1, 2007 – August 31, 2008). Results of this comparison suggest that somewhere between 5-15% of billfish released alive in the South Atlantic and Gulf of Mexico are caught during tournaments. However, the actual proportion may be somewhat different considering the caveats identified in the “Approach” section above. Further study is needed to determine the relative accuracy of RBS reported billfish releases.

Table 23. The frequency and relative proportion of MRFSS intercepted trips that targeted a highly migratory species (primary or secondary target) by state of intercept. Includes all intercepts conducted in the private/rental boat mode from September 1, 2007 through August 31, 2008.

State	Total MRFSS intercepts	Intercepts targeting HMS	Percent targeting HMS
North Carolina	5,840	165	2.8%
South Carolina	1,216	16	1.3%
Georgia	780	6	0.8%
Alabama	1,189	4	0.3%
Mississippi	1,225	3	0.2%
Louisiana	5,018	33	0.7%

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<sup>1</sup> Loftus, A.J. and Richard B. Stone. 2003. Evaluating Potential Bias in the Large Pelagic Survey for the Atlantic Bays Tuna Fishery. Technical report submitted to NOAA Fisheries, Office of Sustainable Fisheries, HMS Division.

Table 24. RBS results for billfish releases covering the same spatial and temporal range as the characterization survey covered (NC, SC, GA and AL, MS, LA, TX; September 1, 2007 – August 31, 2008), and characterization results adjusted for non-response and summed across permit categories (Angling, General and Charter/headboat for Texas).

	<b>Blue marlin released</b>		<b>White marlin released</b>		<b>Sailfish released</b>	
	Characterization survey	RBS	Characterization survey	RBS	Characterization survey	RBS
<b>GOM (AL, MS, LA, TX)</b>	979	155	723	69	702	100
<b>S.Atl (NC, SC, GA)</b>	1,311	233	1,983	175	6,333	419

## Discussion / Recommendations

### *HMS Recreational Fisheries: General Characteristics*

Based on the study results, HMS recreational fisheries in the U.S. South Atlantic and Gulf of Mexico (excluding Florida) can be described as having the following general characteristics:

- HMS anglers use a variety of access site types ranging in interviewer accessibility (personal docks/private locked marinas, private unlocked marinas, public marinas/public boat ramps).
- Overnight fishing trips are an extremely important component of the Gulf of Mexico HMS fishery (significantly less common in the South Atlantic).
- Recreational HMS fishing occurs year-round from North Carolina through Texas. Peak months are July/August in the Gulf and May/June in the South Atlantic.
- About 1 out of every 10 HMS Angling category vessels trips is associated with a fishing tournament.
- HMS tournament participation is positively correlated with years of experience fishing for HMS.
- A large majority of HMS recreational trips target tunas and/or billfish.
- Yellowfin tuna is the most frequently targeted and caught HMS managed species throughout the region.
- Although not managed by NMFS, blackfin tuna are also highly pursued by Angling category permit holders.
- Sailfish, blue marlin, and white marlin are all important target species for billfish anglers throughout the southeastern U.S.
- The large majority of sharks caught by HMS permit holders are caught incidentally on trips targeting other (non-shark) species.
- The Atlantic Tunas General category includes many permit holders who fish recreationally and have never sold their catch. These results suggest that many General category permit holders are still waiting for the opportunity to sell their first giant bluefin tuna, or they have other incentives for fishing under this commercial permit (e.g., less restrictive bag limits). An alternative explanation is that some General category permit holders may unknowingly be fishing with the wrong permit type.
- Most permit holders interviewed indicated a willingness to participate in online internet surveys in the future.

Survey results also suggest that a fair number of permit holders are either unaware of or disregard HMS regulations regarding allowable target species. A relatively large number of Gulf of Mexico Angling category permit holders indicated they target bluefin tuna. Nearly 20% of Angling category permit holders in the Gulf indicated targeting bluefin on at least some of their tuna trips, and 8% indicated targeting bluefin on all tuna trips. Directed fishing (recreational or commercial) for bluefin tuna is prohibited in the Gulf of Mexico in recognition of the area's value as an important spawning ground. HMS Angling and Charter/headboat permit holders are allowed to keep one trophy BFT (73" or greater) per vessel per year caught in the Gulf of Mexico, but only if it's caught incidentally while targeting other species. These results suggest

that many anglers are either unaware of the prohibition on targeting bluefin or are knowingly in violation. As opposed to landings prohibitions, a prohibition on targeting a particular species is difficult to enforce since anglers may claim to be fishing for a similar species (e.g., bigeye tuna) using the same gear types and methods.

Another example related to compliance with HMS regulations is the relatively large proportion (about 1/3<sup>rd</sup>) of General category permit holders who reported taking more trips targeting billfish than HMS tournament trips. Billfish have sportfish status and may only be targeted by anglers with a recreational HMS permit (either Angling or Charter/headboat). The one exception is when fishing in a registered HMS tournament a commercial Atlantic Tunas General category permit may be used to target and catch billfish. If General category vessels are being used to fish for billfish outside of tournaments this would represent a violation.

While the primary focus of this study was private boat HMS fisheries, Texas HMS Charter/headboat permit holders were also included to learn more about for-hire fishing for HMS in that state. This need was identified by NOAA Fisheries and Texas Parks and Wildlife Division, the agency that conducts marine recreational fishery surveys in Texas. The NOAA Fisheries For-Hire Survey (FHS) can be used as a data source for describing for-hire fishing throughout the rest of the Gulf and South Atlantic (excluding Texas). Although the FHS is a generalized (all species) saltwater survey, sampling rates on the telephone survey effort component should be sufficient (i.e., about 10% of frame weekly) to characterize for-hire HMS fishing effort in this region.

Texas HMS Charter/headboat permit holders use this permit for a combination of trips with and without paying passengers. Of those who fished for HMS in the previous 12 months about 1 out of 4 indicated all of their trips were without paying passengers. This suggests that some of the permit holders in this category are not actually HMS for-hire captains but rather private boat captains who get this permit for other reasons. One possible reason is that the HMS Charter/headboat permit allows captains the flexibility to fish either under recreational regulations or commercial regulations on any given trip. Another reason may be that some private boats get the charter permit for tax and business purposes – i.e., having a charter permit allows a company to take out clients without having to get fishing licenses and enables the vessel's operations to be written off as a business expense. The more captains that obtain the HMS Charter/headboat permit because of these advantages and not to actually charter the more difficult it is to distinguish true for-hire vessels for sampling purposes. Surveys that define fishing mode based on the vessel's permit category will be affected by this strategic permit selection.

Texas HMS Charter/headboat permit holders who indicated taking at least one HMS trip with paying passengers used a variety of primary access site types including personal docks (21%), public boat ramps (28%), public marinas (17%), and private marinas (34%). The use of personal docks and boat ramps in a for-hire fishery suggests a more transient, and potentially difficult to sample, component of the fishery compared to for-hire vessels with consistent and identifiable dockage location at a marina.

Texas permit holders in all rod and reel categories reported some relatively large catches of tunas, sharks and billfish. With all three permit categories combined, Texas respondents reported landing 2,364 yellowfin tuna, 8,848 blackfin tuna, and releasing alive 1,626 billfish (all species combined) and 3,426 blacktip sharks. These numbers only reflect catches of the 720 respondents interviewed, out of 1,058 total Texas permit holders, and do not include catches by non-permitted vessels. Similar to the MRFSS, the Texas Parks and Wildlife survey of recreational saltwater fishing is a generalized (all species) survey that was not designed for rare event species and has too small a sample size for offshore fishing to accurately or precisely estimate catch. Thus, a more specialized survey approach may be needed to improve on recreational catch data for tunas, sharks, billfish and other offshore species in Texas.

### ***HMS Trip Sampling Coverage Issues: Private Access, Return Times, Tournaments***

The National Research Council's review of recreational fisheries survey methods<sup>2</sup> suggested that access point intercept surveys are potentially biased due to under-coverage of difficult to sample trips. In particular, trips taken from restricted access sites (e.g., private docks or locked marinas) are often underrepresented in access point intercept surveys. To determine the potential for under-coverage bias associated with access point surveys of HMS fisheries in the Gulf and South Atlantic, respondents were asked to indicate the type of primary access site used for HMS fishing trips. In both sub-regions, about one out of every four Angling category permit holder interviewed indicated using a personal dock as their primary access site for HMS fishing. Under-coverage of private access HMS trips is more likely in Alabama (nearly 40% primary access site type) than Louisiana (only 13%). Nearly one-third of General category respondents indicated using a private dock as their primary access site for recreational HMS fishing trips. Respondents indicated that over 90% of HMS trips taken were from their primary access site. Therefore, although not directly asked in this survey, the proportion of HMS recreational trips returning to private access sites is expected to be around 25-30% in the Southeast region. Results from the Large Pelagics Telephone Survey conducted from Maine through Virginia suggest that use of private access site for HMS fishing may be even more prevalent in the Northeast region. From 2003-2008, 41% of LPTS trips reported by Angling and General category permit holders were from private access sites.

Trips returning to personal docks can possibly be interviewed if the vessel stops at a marina or fuel dock on the way in. However, such interviews can be difficult to obtain since these temporary stops are typically of short duration and site operators may object to an interviewer tying up traffic at temporary slips. Even if such transient interviews are obtainable, results indicate that HMS vessels returning to private access docks only stop on the way in about half of the time. Another 10% of Angling category permit holders (all states combined) indicated using a private locked marina as their primary access site. While some locked marinas are accessible to interviewers with site manager permission, the ones that are not would contribute to potential under-coverage bias.

Under-coverage of private (or restricted) access site fishing trips will only result in biased estimates if the attributes of what is being estimated (i.e., directed effort, catch rates) differ from

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<sup>2</sup> National Research Council of the National Academies. 2006. Review of Recreational Fisheries Survey Methods. The National Academies Press, Washington, D.C.

the sampled trips. Results showed that the proportion of HMS trips targeting a particular species group varied considerably by primary access site type. For example, billfish were far more likely to be targeted on Angling category vessel trips returning to personal docks than on trips returning to public boat ramps. The opposite was true for trips targeting sharks. Therefore, directed effort estimates that are based on the proportional distribution of targeted trips from an access point intercept survey would likely be biased low for directed billfish trips and high for directed shark trips.

Results also showed differences in catch rates for particular HMS species across access site types. In general, Angling category vessels returning to personal docks reported catching fewer sharks but releasing more billfish than vessels returning to public boat ramps. Angling category permit holders who used a boat ramp as their primary access were also considerably less likely to have fished in an HMS tournament than those who used a personal dock. Large differences in some tuna species landings rates were also found across access site types for some states. For example, in Louisiana personal dock trips landed 2.6 yellowfin and 5.7 blackfin per HMS trip, compared to 1.1 yellowfin and 2.9 blackfin per public boat ramp trip, and 1.2 yellowfin and 1.8 blackfin per marina trip. Such differences between personal dock trips and marina trips were found for other particular state/species combinations, although these differences were generally smaller and less consistent than comparisons between personal docks and public boat ramps. Considering the differences found between personal dock and public boat ramp HMS trip catch rates, the potential for bias associated with under-coverage of private access HMS trips should be positively correlated with both 1) the relative prevalence of inaccessible personal dock trips, and 2) the proportion of accessible public boat ramp trips of all intercepted HMS trips.

These results suggest that potential for bias associated with under-coverage of restricted access site HMS trips is relatively high and should be addressed in the design of future recreational HMS surveys in this region. The issue of under-coverage associated with private access fishing sites is not unique to HMS fisheries and is currently being investigated by the MRIP Design and Analysis Work Group.

The NRC report also indicated that potential bias may result from disproportionate distribution of access point interviews by time of day. For most access point surveys, interviewing effort is concentrated during the daylight hours when most anglers are returning from fishing trips. For offshore trips targeting HMS this is typically between 3:00 pm and 9:00 pm. This is done to increase interviewing productivity and in some instances for safety reasons. While the majority of saltwater fishing trips return during this window, trips returning outside this time (i.e., after dark or early morning) are often under-covered. In this study, respondents were asked to indicate the 6-hour time block their boat returned to the dock on each of their HMS fishing trips. Angling category permit holders in the Gulf indicated that nearly 37% of their HMS trips taken in the past 12-months were overnight trips. Overnight offshore trips are more likely to return to the dock in the morning or early afternoon compared to single day trips. In the Gulf of Mexico about 20% of HMS trips return outside the 3:00 pm to 9:00 pm window. Therefore, due to the prevalence of overnight trips for HMS in the Gulf of Mexico potential bias associated with under-coverage of trips returning during off-peak times does exist. Potential bias associated with under-coverage of trips returning during off-peak times is less of a concern in the South Atlantic where overnight trips accounted for less than 4% of all HMS trips and only about 5% of HMS

trips returned outside the 3:00 pm and 9:00 pm window. This survey did not collect trip specific information on targets or catch. Additional data are needed to determine if these “off-peak” trips differ from “peak” trips in terms of target species, catch rates or other variables that may be of interest.

The Large Pelagics Telephone Survey (LPTS) asks Angling category permit holders in the Northeast region (Maine through Virginia) to recall return times and the number of multi-day (i.e., overnight) trips taken for large pelagic species during a specified 2-week reporting period. Interestingly, LPTS results show that while return times for Northeast Angling category vessels are more similar to those for Gulf of Mexico Angling category vessels, the proportion of overnight large pelagic trips taken in the Northeast is more similar to South Atlantic Angling category vessels. In the past 3 years between 20-25% of reported LPTS trips returned outside the 3:00 pm to 9:00 pm window but only between 6-11% of trips were reported as being overnight. These results suggest regional differences exist in terms of HMS fishing trip duration and return times among Angling category permit holders.

In a specialized access point intercept survey focused on offshore fishing (e.g., the Large Pelagics Intercept Survey), trips returning outside the “peak” return window (i.e., 3:00-9:00 pm) are often under-covered. In generalized (all species) intercept surveys even HMS trips returning within this “peak” window could be under-covered. Since offshore HMS trips typically return later than trips targeting species closer to shore, the “peak” HMS trip return window may not correspond with the “peak” interviewing window for a more general (all species) access point intercept survey (e.g., MRFSS). HMS trips may also be under-covered if interviewers are restricted to working only during certain designated times (e.g., 9:00 am to 5:00 pm). Characterization survey results showed that the most common return times (to the nearest hour) for South Atlantic Angling category HMS trips were between 4:00 and 6:00 pm. MRFSS data on interview assignment end times suggests that for the South Atlantic the “peak” return time window for HMS trips is adequately being covered by the survey. Over one-half (56%) of all MRFSS South Atlantic (NC, SC, and GA) private/rental boat assignments from September 2007 through August 2008 ended between 5:00 pm and 8:00 pm. The same is not true for the Gulf of Mexico where the large majority of HMS trips return to the dock after the MRFSS assignment has ended. Characterization survey results showed that 70% of Gulf Angling category permit holders indicated their most common HMS trip return time was between 5:00 pm and 10:00 pm. By contrast, 94% of all MRFSS Gulf (AL, LA, MS) private/rental boat assignments from September 2007 through August 2008 ended at or before 5:00 pm.

The basic MRFSS design consists of a complemented surveys approach that includes telephone surveys of fishing effort and an access-site intercept survey of angler catch (Figure 41).

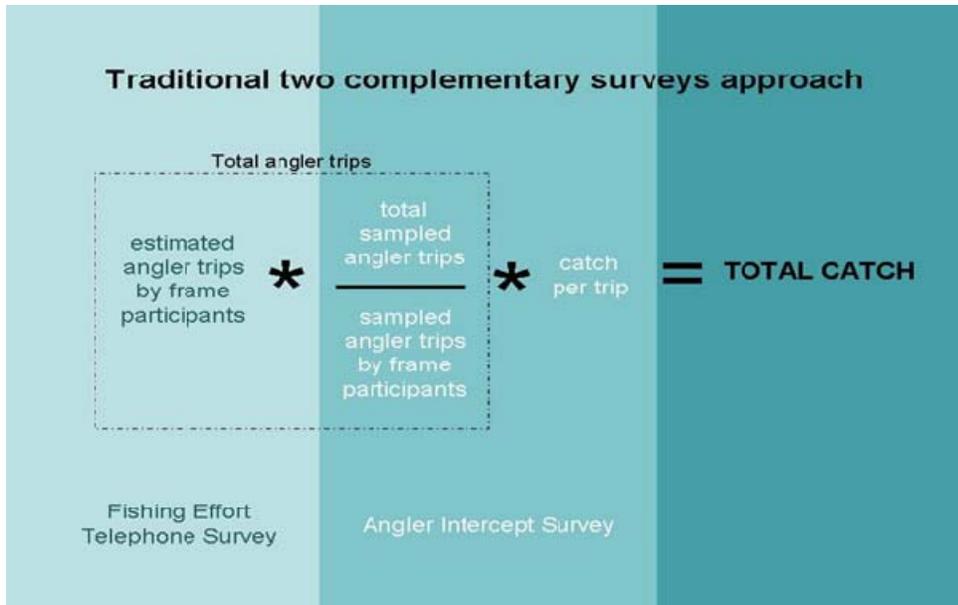


Figure 41. Basic MRFSS complementary surveys approach for estimating catch and effort.

From the access-point angler interviews a catch per trip estimate (CPUE) can be made for each type of fish encountered, either observed or reported. These CPUE estimates are combined with the effort estimates by sampling stratum to produce the catch and harvest estimates. One would expect the mis-match between HMS trip return times and MRFSS access-point interviewing assignment times to result in MRFSS catch rates for highly migratory species in the Gulf of Mexico being biased low since catch rates of HMS are likely higher for private boat trips (i.e., all trips, not just HMS trips) returning after 5:00 pm than before 5:00 pm. If HMS catch rates are biased low due to this mis-match then catch estimates will be biased low as well.

The potential for bias associated with under-coverage of HMS trips returning to dock during off-peak hours (i.e., early morning, after dark) does exist in the Gulf of Mexico and should be addressed in the design of future HMS recreational surveys. The magnitude and direction of such bias depends on the extent to which catch rates differ between covered and non-covered trips. In the South Atlantic, the potential for bias associated with off-peak trips is less because off-peak trips are relatively rare. As with private access under-coverage, the issue of under-coverage associated with night fishing is not unique to HMS fisheries and is also being investigated by the MRIP Design and Analysis Work Group. These results also highlight the potential difficulties associated with sampling trips targeting HMS as part of a more general survey covering all saltwater fishing trips. Not only are HMS trips rare events relative to most other fishing activities, but they typically return to the docks later in the day, often after interviewers have left the site. If sampling HMS is to be incorporated into a generalized survey it is important that assignment start and end times are varied and cover a wider range of time intervals. One component of an on-going MRIP pilot project in North Carolina is to draw intercept assignments using four 6-hour time blocks (full 24-hour coverage). While weighting will result in more common return time blocks (e.g., 3:00 pm to 9:00 pm) being selected more often, this new design should result in a more proportional distribution of sampling times relative to fishing effort.

Fishing competitively in tournaments is a popular activity among many highly migratory species anglers. Since tournament trips are typically clustered within a relatively small number of site/day combinations they can also represent a sampling challenge. Either over-sampling or under-sampling tournaments can lead to bias if tournament trip catch rates differ from those of non-tournament trips. Sampling within a tournament can also lead to bias if interviewers are fixed at the official tournament weigh station where only boats with catch will be intercepted. Boats without catch are often more difficult to sample as they tend to be dispersed throughout the site, spend less time at the site after returning, and may not even return to the tournament weigh station if they're docked at a satellite location.

HMS tournament participation rates (of those vessels that fished for HMS in the past 12 months) were twice as large for Gulf of Mexico respondents (40%) compared to South Atlantic respondents (20%). The proportion of HMS trips associated with tournaments was also twice as large (16% Gulf, 8% S. Atlantic). These proportions are similar to tournament trip rates for Angling category permit holders in the Northeast (i.e., Maine through Virginia). In 2008, 11% of all reported HMS trips on the Large Pelagics Telephone Survey were associated with an HMS tournament. Another MRIP HMS work group project is currently assessing HMS tournament coverage in the Large Pelagics Survey (LPS) and exploring alternative approaches to collecting HMS tournament data. Initial results suggest that tournament trips are being over-sampled in the LPS dockside intercept survey. By contrast, tournament trips are likely under-covered in the MRFSS intercept survey since interviewers are instructed not to sample at official tournament weigh station sites.

All HMS tournaments in the Atlantic, Gulf and Caribbean are required to register with NOAA Fisheries. There is also a federal reporting requirement for directors of all billfish tournaments as part of the Recreational Billfish Survey (RBS). A total of 225 responses to the question "tournament name" could not be matched to a registered tournament on the federal list. This suggests that a large number of HMS tournaments are not complying with the mandatory registration requirement. Other reasons for tournament name not matching include:

- The same tournament could have several names by which anglers refer to it
- Several of these tournaments are not HMS and therefore not required to register (e.g., king mackerel or wahoo tournaments not targeting tunas, sharks or billfish)
- Respondents may have mistakenly listed tournaments outside the study area.

Even if only a proportion (e.g., 25% or 30%) of the unmatched tournament names represent legitimate, unique, HMS tournaments within the study area, this would indicate a significant non-compliance problem with the mandatory registration requirement. It is also highly probable that at least some of the non-registered tournaments target billfish and are therefore non-compliant with the RBS mandatory reporting requirement as well. More investigation into these unmatched tournament names is needed to confirm the level of non-compliance. Since registration is relatively quick, easy, and free, non-compliance may be due more to unawareness rather than intentional. An educational outreach effort informing tournament directors and participants of these federal requirements will likely increase compliance rates.

### *Data Collection Recommendations*

At present, there is no comprehensive, on-going data collection effort in the Gulf of Mexico or South Atlantic that focuses specifically on HMS effort and catch. The NMFS Recreational Billfish Survey only covers tournaments targeting billfish. There is also a mandatory reporting requirement for all landed recreational bluefin tuna and non-tournament billfish and swordfish whereby anglers are supposed to report every fish landed either by telephone or internet. However, this requirement is only for this select group of species, does not cover releases, and compliance is thought to be low. While MRFSS does produce catch estimates for all HMS, due to the extremely rare event nature of an HMS trip being intercepted MRFSS estimates for most HMS species are highly variable, imprecise and unreliable. Findings from the characterization survey also suggest that, in addition to lacking the desired level of precision, MRFSS intercept survey catch rates may be biased low for some of the most frequently targeted and caught HMS species in this region. As discussed above, biased MRFSS catch rates for highly migratory species may be due to under-coverage of overnight HMS trips, trips returning to private access sites, trips associated with tournaments, or likely some combination of these factors. If the management and assessment of these species rely upon precise and accurate total catch and landings estimates for the recreational sector, NMFS should consider either modifying current surveys or implementing new data collection approaches focused specifically on offshore fishing for large pelagics. Characterization results from this study can be used to either implement a new data collection pilot for HMS in the Gulf of Mexico and South Atlantic or to assist in the redesign of the MRFSS to more adequately cover “rare event” species. For example, data on specific marinas and launch sites can help develop an initial sampling frame (or site register) with HMS fishing pressures, or to establish reporting stations for a catch card landings or similar program. Characterization data can also be utilized in setting initial target sampling levels representative of fishing effort across states, months, and sampling times. This study also highlights some important sub-regional differences between the HMS recreational fisheries in the Gulf of Mexico and the South Atlantic that should be considered in the design of future data collection approaches. The potential for biased HMS catch rates due to coverage error is greater in the Gulf fishery due to a greater mis-match between MRFSS assignment end times and HMS trip return times, and a higher prevalence of HMS tournament trips.

More yellowfin tuna are landed recreationally in both sub-regions than any other federally managed highly migratory species. In the South Atlantic, the proportional standard error (PSE) on MRFSS yellowfin tuna landings (all modes) has fluctuated between 9-19% over the past decade (all modes with Florida included). This relatively good precision level is due, in large part, to a sizeable state add-on to the MRFSS intercept sample size in North Carolina which accounts for the large majority of yellowfin landings in this sub-region. MRFSS yellowfin tuna recreational landings estimates are considerably less precise in the Gulf (range 24-45% past 10 years, including Florida, all modes) than the South Atlantic and have a greater potential for bias due to coverage error (i.e., undercoverage of trips for HMS relative to non-HMS trips). Although not federally managed, blackfin tuna are also landed in large numbers in both sub-regions. PSEs for blackfin tuna are typically in the 15 -25% range. In addition to yellowfin and blackfin tuna, other commonly reported caught (although mostly released rather than landed) HMS in this region include skipjack tuna, bull shark, sand tiger shark, blue marlin, white marlin, and sailfish. For these more commonly caught species on HMS trips, improvements in the

accuracy and precision of catch estimates will be achieved through a redesign of the MRFSS that 1) addresses potential under-coverage biases identified in this study, 2) increases sample sizes in cells with HMS catches, and 3) utilizes a list frame (e.g., saltwater license, angler registry, or HMS permit list) approach for estimating effort. All of these changes are currently being evaluated as part of the overall effort to improve marine recreational fisheries data collections through the Marine Recreational Information Program (MRIP). Prospective survey design changes associated with the replacement of MRFSS with MRIP will likely improve the quality of yellowfin and blackfin tuna estimates in both sub-regions. However, more significant survey design changes and sample size enhancements will be needed in the Gulf of Mexico to attain the same level of accuracy and precision for these species. Therefore, a specialized survey focused on HMS fishing may be a more efficient and cost effective way to improve the accuracy and precision of catch estimates for these species in the Gulf of Mexico. For both sub-regions the relative advantages and disadvantages of modifying a generalized survey, such as the MRFSS, to accurately and precisely estimate rare event HMS catches must be weighed against those of implementing a specialized data collection program focused specifically on HMS. This decision should be based on several factors including: 1) the specific management or stock assessment need for a specified level of data quality and timeliness for particular species or species groups, 2) what changes to the MRFSS are actually implemented in the coming years under MRIP, and if this re-design will accommodate the need for improved data on “rare event” species in general, and 3) the relative cost associated with each approach.

All other HMS species of tuna (i.e., bluefin, bigeye, albacore, and skipjack), shark, billfish, and swordfish are landed in relatively small numbers in both the South Atlantic and Gulf. If intercepting a trip targeting any HMS is considered a “rare event” (i.e., < 1%) for a generalized survey, intercepting a trip that landed an HMS other than yellowfin tuna or blackfin tuna is extremely rare. For such species that are infrequently landed (e.g., billfish, swordfish, and most shark species) even on directed HMS trips, accurate and precise landings estimates will not be attainable through modifications of a generalized survey such as the MRFSS, and may not even be feasible or cost effective through a specialized survey approach. If accurate counts of fish landed are needed for management or assessment purposes, NMFS should consider alternatives to randomized survey designs. In response to an International Commission for the Conservation of Atlantic Tunas (ICCAT) recommendation, NOAA Fisheries has recently passed a rule establishing an annual domestic landings limit of 250 Atlantic blue and white marlin, combined. An attempted census of all landings that is widely publicized, requires mandatory reporting, has adequate enforcement, and can be independently validated, may be the only way to achieve the desired level of data quality for these and other rarely landed species.

In 2002 NMFS passed a rule creating a telephone system for mandatory reporting of all Atlantic billfish and swordfish (Automated Landings Reporting System or ALRS). In 2007 an online reporting option was added to this system. However, based on a compliance rate analysis using LPIS raw data and anecdotal reports, compliance with this reporting requirement has been dismally low. This rule also expanded bluefin tuna catch card programs in North Carolina and Maryland to assess billfish and swordfish landings. HMS catch card programs in North Carolina and Maryland attempt to account for all recreationally landed bluefin tuna and non-tournament blue marlin, white marlin and swordfish. While not all landed fish are actually reported, validation checks suggest that compliance rates with these programs are much higher than

compared with the mandatory call-in or internet reporting system (ALRS) for these species throughout the rest of the Atlantic, Gulf and Caribbean. If implemented in other states, catch card programs could improve the accuracy of non-tournament blue and white marlin landings. The programs in North Carolina and Maryland rely on marinas to hand-out landings tags and collect cards from anglers. One would expect compliance with a catch card program to be inversely related to the prevalence of HMS trips returning to private docks or boat ramps. Such anglers would be less motivated to try to locate a catch card reporting station, and fear of enforcement will be minimal, particularly for vessels returning to private docks. HMS anglers returning to the dock after most marinas have closed (i.e., late night or early morning) may also be less motivated to report their landings. Results from the characterization survey could inform decisions regarding where catch card programs might work, and what special provisions would need to be put in place to increase motivation to comply. For example, characterization survey results suggest that a catch card program may be more effective in Louisiana, where 75% of HMS vessels use marinas, 13% use personal docks, and 12% use boat ramps), compared to Alabama where only 41% use marinas, 39% use personal docks, and 20% use boat ramps as their primary access. Boats returning from HMS fishing “after hours” when landings tags and catch cards are not available is more of a problem in the Gulf than South Atlantic. A catch card program implemented in the Gulf would therefore need to accommodate these vessels with some type of widely publicized after hours reporting system such as a self-serve kiosk. In North Carolina HMS catch card reporting stations have been established at 25 marinas, fishing centers, and yacht clubs along the coast from Manteo to Calabash. Characterization survey results indicate that nearly one of every three HMS trips in North Carolina return to a private dock and another 25% return to a public boat ramp. Follow-up validation studies would be needed to determine whether HMS landings from trips returning to sites that are not catch card reporting stations are being reported. Data from this study could be used to try to match individual permit holders who indicated using personal docks with catch card landings reports. A question could also be added to future catch cards to indicate the access site type and name used for that trip.

## Appendices

### Appendix A. Pre-notification Letter Sample



Dear «First\_name»,

This is to notify you that your vessel(s) the *insert vessel name(s) here* has/have been selected for a telephone survey about fishing activity for highly migratory species (HMS) such as tunas, sharks, billfish and swordfish. The purpose of this study is to characterize the HMS fisheries in your region in order to improve upon the reliability and accuracy of future data collections efforts for these important species.

Your contact information was obtained from a list of *insert permit type here* permit holders. Our data collection contractor SRG will attempt to call you beginning on **September 2<sup>nd</sup> 2008** to ask you questions about your fishing activity for highly migratory fish. Some examples of the questions SRG interviewers will ask include:

- How many trips did you make targeting tunas, sharks, billfish or swordfish in the past 12 months?
- What months of the year do you fish for HMS species?
- Which particular HMS species do you fish for?
- What access points or marinas do you use on HMS trips?
- What time of day do you leave from and return to the dock on HMS trips?

The interview should take between 10 and 15 minutes on average to complete. Your participation in this survey is greatly appreciated and is an important step toward fulfilling your mandatory reporting requirement as an HMS permit holder. Even if you do not fish for HMS it is still important that you participate by letting us know this.

Responses to survey questions are classified as confidential and are maintained by NOAA Fisheries Service consistent with the confidential fisheries statistics provisions of the Magnuson-Stevens Act and NOAA Administrative Order 216-100. Once collected, data may only be released in accordance with the Privacy Act of 1974.

If you have any questions concerning this survey please call me at (301) 713-2328 or send an email to [ron.salz@noaa.gov](mailto:ron.salz@noaa.gov). If you would like to contact SRG to schedule a convenient interview time, please call toll-free **1-800-???????**. Thank you in advance for your cooperation.

Sincerely,

A handwritten signature in black ink, appearing to read "Ronald Salz".

Ronald Salz, *Fishery Biologist*  
NOAA Fisheries

**Appendix B. HMS characterization questionnaire.**

Hello, I'm calling for a survey being conducted for NOAA Fisheries as part of the Marine Recreational Information Program or MRIP. Can I please speak to name of contact? **If person sought is not available, ask if they will be available anytime in the next few weeks. If yes, schedule convenient time to call back to talk to that person, thank respondent, and terminate interview. If no, thank respondent and terminate interview.**

Are you still the captain, owner or designated representative of the vessel name(s)?

**If “yes”, ask:** Can you provide information on the activity of the vessel name (or vessels) during the past 12 months?

If “yes”, continue to survey description.

**If “no”, ask:** Is someone else currently operating the name of the vessel (s)?

**If “yes”, then ask:** Do you know the name and telephone number of new contact?

**If “yes”, take name and telephone number, thank respondent and terminate interview.**

**If “no”, denote whatever information is given and terminate interview.**

Your name and phone number were obtained from a list of (code CATI to read either “HMS Angling” “Atlantic Tunas General” or “HMS Charter/headboat”) category permit holders. The purpose of this study is to gather information about recreational fishing activities targeting highly migratory species such as tunas, sharks, billfish, and swordfish. This survey is being conducted in accordance with the Privacy Act of 1974. Any information you provide will remain confidential. The survey should only take about 10 to 15 minutes of your time per HMS vessel you operate. **(Continue with interview.)**

Q1. How many years total have you been saltwater fishing?

Q2. How many years total have you been saltwater fishing for tunas, sharks, billfish or swordfish?

Q3. Thinking about the past 12 months, about how many **recreational** saltwater fishing trips targeting tunas, sharks, billfish or swordfish did the name of vessel make in North Carolina through Texas?

**(Note: trips targeting bonnethead or Atlantic sharpnose should not be included; clarify this if respondent asks about these species)** If none skip to Q16 Else go to Q4

Q4. All of the remaining questions have to do with those (response to Q3) trips taken on the (vessel name) in the past 12 months for tunas, sharks, billfish or swordfish in NC-TX? What state did you leave from on the majority of those trips (from Q3)?

Q5. Thinking about the response to Q3. trips taken in the past 12 months for tunas, sharks, billfish or swordfish, can you tell me about how many were taken during (Interviewer note: if respondent can't come up with exact number probe by asking for a percent):

September and October 2007	record number or percent
November and December 2007	record number or percent
January and February 2008	record number or percent
March and April 2008	record number or percent
May and June 2008	record number or percent
July and August 2008	record number or percent

Q6. How many of the trips targeting tunas, sharks, billfish or swordfish in the past 12 months were with paying passengers? **(charter questionnaire only)**

Q7. Do you ever sell any of the tunas, sharks, billfish or swordfish you catch?

Appendix B. (continued)

Q8. How many of the response to Q3, trips taken in the past 12 months for tunas, sharks, billfish or swordfish were overnight trips consisting of more than one day of fishing?

Q9. What type of access site did you **primarily** use for the vessel name?

- Marina Go to Q9a
- Public boat ramp/launch **Record MRFSS 4-digit site code or new site name/location. Go to Q.10**
- Personal residence or dock Go to Q.9b
- Other Specify other and record. Go to Q.10

Q9a. What type of marina did you **primarily** use?

- public **Record MRFSS 4-digit site code or new site name/location. Go to Q.10**
- private property unlocked marina **Record MRFSS 4-digit site code or new site name/location. Go to Q.10**
- private locked-gate marina **Record MRFSS 4-digit site code or new site name/location. Go to Q.9b**

Q9b. Does the vessel name stop at a marina or fuel dock when **returning** from fishing trips for tunas, sharks, billfish or swordfish?

- Always - Go to Q9c
- Often - Go to Q9c
- Sometimes - Go to Q9c
- Never - Go to Q10

Q9c. What is/are the name(s) of the marinas/fuel docks that the vessel name stops at when **returning** from fishing?  
**Record MRFSS 4-digit site code or new site name/location for all sites used.**

Q10. Was the response to Q9 (or Q9a if Q9=marina) the only access site used for the vessel name when fishing for tunas, sharks, billfish or swordfish?

- Yes – Go to Q11
- No – Go to Q10a

Q10a. What other access sites were used? (record all MRFSS 4-digit site codes and/or names of new sites)

Q10b. Of the response to Q3 HMS trips taken on the vessel name in the past 12 months can you tell me the number taken to each of the access sites you named?(Interviewer note: if respondent can't come up with exact number probe by asking for a percent)

- Access site #1 Record number of total trips or percent
- Access site #2 Record number of total trips or percent
- Access site #3 Record number of total trips or percent

Next, we'd like some information regarding the time of day the vessel name leaves and returns to the dock when fishing for tunas, sharks, billfish or swordfish.

Q11a. Thinking about the response to Q3, HMS trips taken in the past 12 months, can you tell me about how many left the dock between (Interviewer note: if respondent can't come up with exact number probe by asking for a percent)

- 3:00 AM and 9:00 AM** record number or percent
- 9:00 AM and 3:00 PM record number or percent
- 3:00 PM and 9:00 PM record number or percent
- 9:00 PM and 3:00 AM record number or percent

Q11b. Thinking about the response to Q3, HMS trips taken in the past 12 months, can you tell me about how many returned to the dock between (Interviewer note: if respondent can't come up with exact number probe by asking for a percent)

- 3:00 PM and 9:00 PM** record number or percent
- 9:00 PM and 3:00 AM record number or percent
- 3:00 AM and 9:00 AM record number or percent
- 9:00 AM and 3:00 PM record number or percent

Appendix B. (continued)

Q11c. To the nearest hour can you tell me the **most common time** the vessel vessel name returns to the dock from a fishing trip for tunas, sharks, billfish or swordfish.

Q12. Thinking about the response to Q3, trips taken for tunas, sharks, billfish or swordfish on the vessel name, can you tell me about how many were targeting (Interviewer note: if respondent can't come up with exact number probe by asking for a percent; these don't have to add to 100% of trips as anglers can target more than one species per trip):

- |   |                           |
|---|---------------------------|
| Q12a. Tunas                                   | Record number or percent. |
| Q12b. Sharks                                  | Record number or percent. |
| Q12c. Billfish (marlins, sailfish, spearfish) | Record number or percent  |
| Q12d. Swordfish                               | Record number or percent  |

Next I'm going to ask you some questions about particular HMS species you fish for and catch. I realize that not all these species occur in your area but these questions were designed for a survey covering all South Atlantic and Gulf HMS fisheries.

Q13a. When targeting tuna aboard the vessel name how often do you fish for the following species?

- |                 |                                 |                                |                                    |                                |
|-----------------|---------------------------------|--------------------------------|------------------------------------|--------------------------------|
| Yellowfin tuna  | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Bluefin tuna    | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Bigeye tuna     | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Albacore tuna   | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Skipjack tuna   | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Blackfin tuna   | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Other (specify) | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |

Q13b. When targeting sharks aboard the vessel name how often do you fish for the following species?

- |                 |                                 |                                |                                    |                                |
|-----------------|---------------------------------|--------------------------------|------------------------------------|--------------------------------|
| blacktip        | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| bull            | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| blacknose       | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| shortfin mako   | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Other (specify) | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |

Q13c. When targeting billfish aboard the vessel name how often do you fish for the following species?

- |                 |                                 |                                |                                    |                                |
|-----------------|---------------------------------|--------------------------------|------------------------------------|--------------------------------|
| White marlin    | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Blue marlin     | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Sailfish        | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |
| Other (specify) | <input type="checkbox"/> always | <input type="checkbox"/> often | <input type="checkbox"/> sometimes | <input type="checkbox"/> never |

Q14. Of the response to Q3, trips for HMS in past 12 months how many were associated with tournaments **(Interviewer note: if respondent can't come up with exact number probe by asking for a percent): ?**  
If zero – Go to Q15

Q.14a What tournament(s) did you fish in (list all, search for tournament codes from pull-down menu: Note to interviewer to not include long-term seasonal or derby type tournaments)?

Q15. Now I'd like to ask you a few questions about the fish you caught aboard the vessel name in the past 12 months.

Q15a. Did you catch any tunas? Yes – Go to Q 15b. No – Go to Q15c

Appendix B. (continued)

Q15b. About how many bluefin tuna did you catch aboard the vessel name in the past 12 months? Of those bluefin tuna caught how many did you release?

Record \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many bigeye tuna \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many yellowfin tuna \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many albacore tuna \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many skipjack tuna \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many blackfin tuna \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

Q15c. Did you catch any sharks aboard the vessel name in the past 12 months? Yes – Go to Q15d.

No – Go to Q15e

Q15d. About how many blacktip sharks did you catch aboard the vessel name in the past 12 months? Of those blacktip sharks caught how many did you release?

Record \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many blacknose sharks \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many shortfin mako sharks \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many bull sharks \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

Any other sharks (record species) \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

Q15e. Did you catch any billfish aboard the vessel name in the past 12 months? Yes – Go to Q15f.

No – Go to Q15g

Q15f. About how many blue marlin did you catch aboard the vessel name in the past 12 months? Of those blue marlin caught how many did you release?

Record \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many sailfish \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

About how many white marlin \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

Q15g. Did you catch any swordfish aboard the vessel name in the past 12 months?

Yes – Go to Q15h. No – Go to Q16

Q15h. About how many swordfish did you catch aboard the vessel name in the past 12 months? Of those swordfish caught how many did you release?

Record \_\_\_\_\_ total caught \_\_\_\_\_ released (of those caught)

Q16. CATI should indicate if respondent is listed for any other vessels in the sample.

If more than one vessel ask respondent:

Can you provide information on the activity of the (other vessel name) during the past 12 months?

**If yes, loop back to Q3**

**If “no”, ask:** Is someone else currently operating the name of the vessel (s)?

**If “yes”, then ask:** Do you know the name and telephone number of new contact?

**If “yes”, take name and telephone number, thank respondent and terminate interview.**

**If “no”, denote whatever information is given and continue to Q17.**

Appendix B. (continued)

Q17. Would you be interested in providing information about your fishing activity through online internet surveys in the future?

Q18. Do you have an email address through which we can notify you about future fishing surveys?  
If yes, record email address\_\_\_\_\_

END: Those are all of the questions that I have for you, thank you for your time and cooperation. Have a good day/evening. Goodbye.

*Appendix C. Complete accounting of final call dispositions Angling and General categories.*

HMS Angling Category Permit Dialing Results	AL		GA		LA		MS		NC		SC <sup>4</sup>		TX	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<b>Completed Interviews</b>														
Did not fish for HMS- past 12 months	84	15.76	23	18.25	130	16.33	56	25.00	550	22.09	226	18.60	161	18.83
Did fish for HMS- past 12 months	268	50.28	72	57.14	380	47.74	100	44.64	1259	50.56	614	50.53	432	50.53
<b>Did not Complete Interview</b>														
Partial Completes	1	0.19	0	0.00	4	0.50	1	0.45	5	0.20	1	0.08	6	0.70
Soft refusal	9	1.69	1	0.79	8	1.01	1	0.45	23	0.92	21	1.73	9	1.05
Hard refusal	14	2.63	2	1.59	12	1.51	3	1.34	36	1.45	14	1.15	14	1.64
Gone during study- too ill	4	0.75	0	0.00	11	1.38	2	0.89	21	0.84	15	1.23	13	1.52
Does not speak English	0	0.00	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00	0	0.00
Does not own boat	20	3.75	6	4.76	21	2.64	8	3.57	81	3.25	54	4.44	23	2.69
At least 6 no answers	17	3.19	5	3.97	21	2.64	16	7.14	97	3.90	60	4.94	48	5.61
Called 6+ times but no interview	69	12.95	7	5.56	126	15.83	22	9.82	248	9.96	112	9.22	100	11.70
Deceased	0	0.00	0	0.00	1	0.13	1	0.45	5	0.20	1	0.08	2	0.23
Institutionalized (military- prison)	0	0.00	0	0.00	0	0.00	0	0.00	2	0.08	1	0.08	0	0.00
Invalid (disconnects, not enough contact information, wrong numbers)	47	8.82	10	7.94	82	10.30	14	6.25	162	6.51	96	7.90	47	5.50
<b>TOTAL</b>	533	100.0	126	100.0	796	100.0	224	100.0	2490	100.0	1215	100.0	855	100.0

Appendix C. (continued)

<b>HMS General Category Permit Dialing Results</b>	<b>AL</b>		<b>GA</b>		<b>LA</b>		<b>MS</b>		<b>NC</b>		<b>SC</b>		<b>TX</b>	
	<b>N</b>	<b>%</b>												
<b>Completed Interviews</b>														
Did not fish for HMS- past 12 months	8	33.33	2	18.18	17	34.69	5	50.00	205	30.51	25	30.12	5	27.78
Did fish for HMS- past 12 months	11	45.83	4	36.36	16	32.65	4	40.00	279	41.52	40	48.19	7	38.89
<b>Did not Complete Interview</b>														
Partial Completes	0	0.00	0	0.00	0	0.00	0	0.00	2	0.30	0	0.00	0	0.00
Soft refusal	0	0.00	0	0.00	0	0.00	0	0.00	9	1.34	0	0.00	0	0.00
Hard refusal	0	0.00	0	0.00	2	4.08	0	0.00	5	0.74	1	1.20	1	5.56
Gone during study- too ill	0	0.00	0	0.00	0	0.00	0	0.00	3	0.45	0	0.00	0	0.00
Does not speak English	0	0.00	0	0.00	0	0.00	0	0.00	1	0.15	0	0.00	0	0.00
Does not own boat	1	4.17	1	9.09	0	0.00	0	0.00	20	2.98	1	1.20	1	5.56
At least 6 no answers	1	4.17	0	0.00	2	4.08	0	0.00	30	4.46	6	7.23	0	0.00
Called 6+ times but no interview	2	8.33	3	27.27	4	8.16	1	10.00	68	10.12	4	4.82	3	16.67
Deceased	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Institutionalized (military- prison)	0	0.00	0	0.00	0	0.00	0	0.00	1	0.15	0	0.00	0	0.00
Invalid (disconnects, not enough contact information, wrong numbers)	1	4.17	1	9.09	8	16.33	0	0.00	49	7.29	6	7.23	1	5.56
<b>TOTAL</b>	24	100.0	11	100.0	49	100.0	10	100.0	672	100.0	83	100.0	18	100.0