

Highly Migratory Species For-Hire Survey – Florida Pilot Study Final Report

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1. EXECUTIVE SUMMARY

Each year, millions of recreational anglers enjoy Florida's diverse marine fisheries. Florida's popularity as an international fishing destination currently supports the world's largest for-hire fleet of 2,100 charterboats and guides; sustaining thousands of jobs and generating significant economic benefits to local communities. A large segment of the state's for-hire fleet regularly targets highly migratory species (HMS), including billfish, swordfish, tunas, and sharks. The NOAA Fisheries Marine Recreational Fisheries Statistics Survey (MRFSS) has been the primary method for monitoring recreational catch in Florida since 1980. Conducted by the State's Fish & Wildlife Research Institute since 1998, the MRFSS Access Point Angler Intercept Survey (APAIS) has averaged 40,000 angler trip interviews annually.

Despite the robust sample size of the general survey, HMS-targeted trips comprise a small portion of all recreational saltwater fishing trips, and therefore are a "rare event" in any survey not directly targeting this specific segment of the recreational fishery. Several factors associated with HMS fishing contribute to the low number of intercepted trips including: 1) the rare occurrence of many HMS in general, 2) spatial and temporal characteristics of some HMS fisheries that make them more difficult to monitor (*e.g.*, night swordfish trips), and 3) high voluntary release rates of billfish and sharks that limit the likelihood of encountering landed catches. As a result, typically low MRFSS APAIS sample sizes result in highly imprecise catch estimates for nearly all HMS species.

The apparent deficiencies and data gaps with the MRFSS and alternative federal HMS data collection programs, such as the HMS Non-Tournament Reporting (NTR) telephone hotline/website, warrant a more directed approach to adequately monitor recreational HMS fisheries. This study was initiated as part of the Marine Recreational Information Program (MRIP), to assess the feasibility of employing a directed HMS survey with for-hire vessels in the southeastern United States, similar to the Large Pelagic Survey (LPS) conducted from Maine to Virginia. Over a 14-month period, directed sampling was conducted through weekly field and telephone surveys with the aim of intercepting for-hire trips in which HMS were targeted and/or caught (referred to as HMS trips). Sampling activities for this study were limited to the Florida Keys (Keys) and Southeast Florida (SEFL) where a high concentration of for-hire vessels that regularly target HMS is present. In addition, a one-time characterization census of all for-hire vessels in Florida and HMS Charter/Headboat permitted vessels in South Florida was conducted to better describe the scope and magnitude of HMS fishing within this sector of the recreational fishery. The study results were expanded to produce preliminary estimates of HMS effort and species-level catch. Spatial and temporal patterns of each HMS fishery were also characterized, as well as the extent of nighttime fishing activity, the use of private access sites, and tournament participation among the for-hire vessels and HMS permit holders.

The primary objective of the Field Intercept Survey (FIS) design was to efficiently and comprehensively intercept for-hire HMS trips and landed catches while maintaining the integrity of the survey design. This was achieved through a clustering approach that grouped multiple access sites with for-hire vessels that transited a common ocean access point (*i.e.*, inlets, passes, cuts). The design also included conducting interviews at the vessel-level with the captain or crew member. Conducted as a modified roving creel survey, the site cluster design extended coverage to all vessels operating from both high and low pressure sites within a central area, enabling each field assignment to collect a more representative sample of for-hire fishing for that day. By designating the site cluster as the primary sampling unit, sampler movement to all sites within the cluster was accounted for in the probability sampling design of the survey; with more than half of all vessel interviews being collected at secondary

sites. Overall, samplers missed less than 10% of all for-hire vessels actively fishing within the cluster, and only 7% of vessels at the primary site. The expanded coverage and high sampling efficiency achieved by the cluster sampling approach would not have been possible had vessel interviews been collected at the angler-trip level. The frequent departure of for-hire customers immediately after the conclusion of a trip limits the ability of samplers to interview all vessels at an access site that return at similar times, let alone at different sites. For-hire captains overwhelmingly expressed their preference that they or their crew be interviewed during the FIS instead of their customers as in the APAIS. The FIS design also collected a more representative sample of for-hire fishing activity compared to the APAIS by conducting FIS assignments until all for-hire vessels had returned to their dock for the day or until 20:00 hours.

The existing For-Hire Telephone Survey (FHS) was modified to include an HMS add-on questionnaire to expand the collection of HMS catch data. The FHS estimated HMS effort, and produced HMS released catch and landings estimates by species. The collection of catch data through a recall survey has traditionally been discouraged due to reliability concerns for self-reported information. This study utilized a relatively short recall period (1-week) to minimize recall bias and employed a complementary on-site intercept survey (the FIS) for catch rate comparisons. In addition, the FHS was complemented by the HMS Charter/Headboat Telephone Survey (CHS) that used the HMS Charter/Headboat permit list as a dual sample frame to expand coverage of for-hire vessels with the HMS permit that were not on the FHS frame. Vessels were moved from the CHS frame to the FHS frame once they were confirmed to be active for-hire vessels. The dual frame design successfully improved coverage of the for-hire fishery by reducing the proportion of “off-frame” vessels intercepted by the FIS and by facilitating more timely updates to the FHS vessel frame.

FIS sampling was initiated on April 29, 2008 and concluded on June 28, 2009. Of the 488 attempted assignments, 440 (90.2%) resulted in at least one vessel interview being completed. A total of 2,276 vessel interviews were conducted throughout the study area, with 39.0% classified as HMS trips. FIS results indicated 91.8% of HMS trips were conducted by vessels on the FHS sample frame, with an additional 2.5% by vessels on the CHS frame.

The modified FHS was conducted throughout the same time period as the FIS. A total of 4,242 vessel selections were drawn, of which 62.4% were contacted and cooperative, 25.3% were unable to be contacted, and 12.4% were non-cooperative. Of the 4,165 trips reported during the FHS, 23.7% were classified as HMS trips. The CHS was conducted over 12 months from July, 2008 through June, 2009, during which 1,043 vessel selections were drawn. Although 68.0% of permit holders were contacted and cooperative (24.2% unable to be contacted, 7.8% non-cooperative), large proportions of vessels were reported to be inactive or ineligible, with only 42.2% of all selected permit holders reporting their vessels were available to fish in South Florida.

The combined results of the FHS and CHS (Combined Telephone Surveys or CTS) produced an effort estimate of 15,439 HMS trips (proportional standard error - PSE 5.2%) conducted by for-hire vessels from July, 2008 through June, 2009. Approximately 73% of the trips occurred during a 6-month period from November through April, with a peak activity of 4,603 trips (PSE 10.6%) taking place during the January-February sample wave. This is consistent with South Florida’s traditional tourism season, as well as with the peak abundance of sailfish in this area.

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HMS trips were classified into five HMS groups for the trip-level analysis: sailfish, marlin, swordfish, tunas, and sharks. Results from both the FIS and CTS showed catches for all HMS groups occur throughout the year, with seasonal shifts among the preferred target species. Sailfish was the most common and widely targeted HMS in South Florida, accounting for 71.5% of all HMS charter trips and more than two thirds of the estimated HMS total catch. More than two thirds of sailfish trips occurred from November to April, tuna and marlin trips occurred primarily during the late spring to summer months, and swordfish trips were more common during the summer and fall. Shark trips were more evenly distributed throughout the year, but were more frequent during the winter-spring tourism season.

Study results showed differences in trip durations, distance from shore, and vessel return times among the HMS groups. More importantly, a regression analysis comparing sailfish CPUEs from trips that returned before and after 15:00 hours confirmed there are significant differences in catch rates from for-hire vessels that return at different times of the day. The results demonstrate the necessity to extend sampling coverage to trips returning throughout the day in order to account for the diversity of trip types that occur within this region. Discontinuing field assignments prematurely would have biased the sample towards trips that fished less time, closer to shore, and/or earlier in the day.

The CTS estimated a total of 20,631 sailfish (PSE 9.7%) caught during the 12-month period, of which only 56 sailfish (PSE 50.1%) were estimated to have been landed. The total catch estimate for blue marlin was 131 fish (PSE 40.0%), all of which were reported to have been released alive. An estimated 421 swordfish (PSE 29.8%) were caught, of which 123 fish (PSE 41.4%) were landed. Skipjack tunas were the most common tuna species caught, accounting for 75% of the total tuna catch estimate (2,479 fish, PSE 25.1%), more than half of which were landed (1,323 fish, PSE 26.7%). Yellowfin tuna were the next most common tuna species reported, with a total catch estimate of 502 fish (PSE 38.9%), of which 437 were landed (PSE 43.4%). The total shark catch (all species combined) was estimated to be 5,562 sharks (PSE 15.8%), with only 122 sharks (PSE 35.5%) estimated to have been landed. Lemon sharks accounted for largest portion of the total shark catch estimate with 2,144 sharks (PSE 33.1%), all of whom were released. Bull sharks had the highest precision among the shark groups, with a PSE of 23.8% (total catch 757 sharks).

A total of 592 vessels in the Keys and SEFL possessed HMS Charter/Headboat permits at the end of the study. Approximately 80% of these permitted vessels were reported to be active in South Florida, of which most were for-hire vessels on the FHS frame. It should be noted nearly 19% of these active vessels were used exclusively for private recreational trips, with the vessel representatives reporting no intention of conducting for-hire trips in the near future.

The characterization survey successfully interviewed 57.8% of all 2,077 for-hire vessels throughout the State of Florida, but only 40.0% of 260 CHS frame vessels in South Florida. Of the 520 for-hire vessels throughout Florida that possessed HMS permits (FHS-HMS vessels), 67.6% reported having targeted HMS within the past 12 months, averaging 54.3 targeted trips/year. By comparison, 23.9% of 1,557 FHS vessels without permits (FHS-Only vessels) reported having targeted HMS at least once, averaging 37.4 trips/year. Of the FHS-HMS vessels, most targeted billfish (78.2% - averaging 52.6 billfish trips/year), followed by sharks (39.9%, 18.7 shark trips/year), swordfish (37.8%, 10.7 swordfish trips/year), and tunas (24.9%, 16.7 tuna trips/year). In contrast, most FHS-Only vessels targeted sharks (77.6%, 22.4 trips/year) and billfish (44.4%, 40.9 trips/year), whereas only 10.7% targeted swordfish (13.3 trips/year) and 5.6% tunas (8.8 trips/year). Among the characterized CHS vessels, 93.3% reported targeting HMS at

least once within the past 12 months, but only averaging 27.8 targeted trips/year. Most CHS vessels targeted billfish (91.3%, 22.7 trips/year), whereas 53.3% targeted swordfish (6.3 trips/year), 32.6% targeted tuna (12.1 trips/year), and 13.0% targeted sharks (8.4 trips/year).

Characterization survey results clearly indicate HMS fishing is common among many for-hire vessels that do not possess HMS permits. Likewise, both the FIS and CTS results showed a large proportion of HMS charter trips were conducted by non-permitted vessels (FIS=44.5%, CTS=40.4%). Although many of these trips occurred in State waters where the permit is not required (except for tunas), approximately 20% of all HMS targeted charter trips reported were by non-permitted vessels fishing in Federal waters. Compliance with the permit requirement was lowest among vessels targeting marlin, with only 43.6% of FIS marlin trips being conducted by permitted vessels. Non-permitted vessels also accounted for nearly 40% of FIS and 25% of CTS targeted tuna trips (the State waters exemption does not apply to tunas).

A comparison of catch rates between field and telephone survey methods clearly showed sailfish catches reported to the FHS were significantly greater than those collected during the FIS (FHS=1.63 sailfish per targeted trip, FIS=1.12 sailfish per targeted trip; $P<0.01$). The apparent difference in catch rates between the surveys could be attributed to vessel representatives over-reporting trips in which at least one sailfish was caught in the FHS, rather than inflating the number of sailfish caught on these successful trips. In spite of short recall periods, vessel representatives may have confused trips, especially during weeks when they fished more frequently (or even multiple times a day), often targeting similar species. This would be consistent with other studies that have noted more active participants being more susceptible to recall errors.

Potential recall bias in the self-reported catch was investigated by comparing matching trips sampled by both the field and telephone surveys. Analysis of 36 matched sailfish trips sampled by both the FIS and FHS did show identical sailfish catch information for 81% of the trips and an overall mean difference of less than $1/10^{\text{th}}$ of one fish between the two records that was not significant (mean difference=-0.06, $P=0.53$). When the comparison was limited to only trips reporting at least one sailfish caught ($N=17$ trips), similar catches were reported for only 59% of the matched trips; however, the mean difference again was small and not statistically significant (mean difference=-0.12, $P=0.54$). Although the matched trip sample size is low, the results indicate differences in sailfish catches reflect random variability and not systematic recall error. In contrast, the matched trip analysis indicated recall of the number of customers reported to be carried on for-hire vessels in the telephone surveys was poor. Among 95 matched HMS and non-HMS trips, only 50.5% of the responses were in agreement and the mean difference of 0.34 more FHS anglers was statistically significant ($P<0.01$). Considering the FHS produces angler-trip estimates for the MRFSS, these results warrant further study to determine if there is a systematic bias towards over-reporting the number of anglers in the FHS.

Collecting catch information in the FHS did increase HMS catch sample sizes, especially for less common species such as swordfish and blue marlin. In addition, the FHS catch data was used to determine compliance rates with the mandatory reporting requirement for landed sailfish and swordfish catches to assess the accuracy of the attempted NTR census. Considering the minimal cost involved with collecting HMS catch data during FHS sampling, this data source could be used to help monitor changes in HMS catch rates if collected over an extended period of time across a larger geographic area.

Both survey methodologies failed to significantly increase the number of landed HMS catches. During 14 months of directed sampling in one of the most active HMS fishing areas within the United States,

billfish, swordfish, and shark landings were rare events; with a combined total of only 28 fish observed at the dock. To a large degree, this is a reflection of the growing conservation trend to release these species alive. The onset of the economic recession in September 2008 is also believed to have reduced the number of landed HMS catches as for-hire captains anecdotally reported fewer customers were interested in paying for taxidermy mounts (the primary disposition of landed shark and sailfish catches in this region). Landed HMS catches were reported even less frequently during the telephone surveys, despite recording more catch reports, indicating that there may also be a reluctance to self-report landed catches for some species. The great expenditure of effort by the FIS to intercept so few fish, and the poor precision of CTS self-reported landings estimates, clearly demonstrates surveys will not be a cost-effective method for accurately monitoring HMS landings by the for-hire industry in this region. Unfortunately, the study results provide clear evidence that compliance with the existing mandatory reporting requirement of landed billfish and swordfish is poor, indicating the program is not achieving a complete census of landed catch. Only 32% of sailfish (N=22) and 62% of swordfish (N=13) reported or observed to have been landed during the FIS and CTS were matched to fish in the NOAA Fisheries NTR database. A modified census-based approach is recommended if accurate landings are required for these species.

The National Research Council's (NRC) 2006 review of the MRFSS identified potential under-coverage bias associated with access point surveys with regards to nighttime fishing, trips returning to private access sites, and tournament fishing. Overall, results of this study indicate that the potential for bias associated with each factor is limited in the South Florida for-hire HMS fishery. The fishery is conducted almost exclusively during daylight hours (97% of all HMS charter trips). The characterization survey indicated that the use of private access sites was limited, as less than 10% of all for-hire vessels within the Keys and SEFL study area used private access sites as their primary site for directed HMS fishing. Trip level results showed under-coverage was even less evident, as private access fishing accounted for less than 3% of all HMS charter trips reported in the telephone surveys. Tournament fishing during HMS trips was also rare, accounting for only about 4% of all charter trips sampled in both survey formats.

Nonetheless, the study results highlight two aspects of the for-hire HMS fishery that warrant more attention. Approximately 40% of CTS swordfish trips returned at night between 20:00 and 08:00. Directed night sampling was conducted as part of the FIS, but yielded only four vessel intercepts over an eight-month period (May through December 2008) before being discontinued. The significantly higher costs and safety concerns associated with nighttime sampling are not warranted simply to extend coverage to less than 3% of all HMS for-hire trips. Improved coverage of the swordfish fishery (daytime and nighttime) can be better accomplished through modifications to the FHS and NTR. Analysis of HMS tournament trip data also showed only 56% of the reported HMS-targeted tournaments had registered with NOAA Fisheries HMS Management Division. The mandatory registration requirement is necessary for monitoring tournament landed catches through the Recreational Billfish Survey (RBS). Education and enforcement of the registration and RBS reporting requirements are needed to address this gap.

1.1 Management Recommendations

Florida’s HMS fisheries are highly diversified, requiring different approaches to adequately monitor each segment. The following recommendations address identified deficiencies and data gaps and are aimed at improving future monitoring efforts:

1. The for-hire fishing mode requires sampling methods that are different from private boat and shore fishing modes. Thus, the for-hire fishery should be sampled by an independent program that employs methods specifically designed for the mode, both for effort and catch estimation, regardless if the new program employs surveys and/or logbooks.
2. A modified field intercept survey will provide the most reliable information on HMS released catches for more common species such as sailfish and sharks, as well as total catch information for skipjack tunas and small coastal sharks. The following modifications are recommended:
 - Designate site clusters as the primary sampling unit (PSU) in the MRIP access point intercept survey to incorporate all sites into the probability selection of PSUs. This will facilitate greater sampling efficiency to intercept for-hire vessels returning to multiple access sites and increase opportunities to sample vessels operating out of less active sites. Factors that should be considered when determining site clusters include:
 - a) Activity levels and vessel return time patterns at each site,
 - b) Distance between sites and local traffic patterns,
 - c) Ability to directly observe the ocean access point vessels transit to increase the likelihood of intercepting vessels immediately upon their return.
 - Clusters should be re-evaluated periodically to account for variations in these factors (*e.g.*, seasonal variations and movement of vessels to other ports).
 - Conduct interviews at the vessel-trip level with for-hire captain or crew members. Eliminates reporting burden on for-hire customers and facilitates sampling of for-hire vessels even if customers are unavailable or uncooperative. Cooperation rates and data quality are anticipated to be higher with for-hire vessel representatives in this region. This will also minimize under- and over-inflated frame adjustments based on number of on-board customers.
 - Temporal stratification of access point intercept survey assignment start and end times. This will provide adequate coverage to trips returning throughout the day to collect a representative sample of fishing activity, and reduce bias towards trips that fished less time, closer to shore, and/or returned earlier in the day.
3. Collect catch information for billfish and swordfish via the ongoing For-Hire Telephone Survey throughout Florida and the southeastern United States – Gulf of Mexico region. This will increase sample sizes of released and landed catches for rare species (*i.e.*, swordfish and marlin) to provide fishery managers with recreational CPUEs to supplement existing data gaps for these species. It will also facilitate validation of the NTR to measure compliance with the mandatory reporting requirement to help determine the accuracy of the census. At the same time, it will provide CPUEs for trips that are under-covered by access point intercept surveys (*i.e.*, trips that return at night and/or to private access sites). A more thorough assessment of the accuracy of FHS catch information is needed before production of swordfish and marlin catch estimates from self-reported phone survey data is recommended for these species.

4. The monitoring of HMS landings for billfish, swordfish, and some shark species should be primarily conducted by a census program due to the limitations of any survey to accurately estimate such rare event landings. Improvements to the existing NOAA Fisheries HMS NTR to increase the reporting rate include:
- Elimination of the 24-hour reporting period allotted to anglers to report landed catches upon returning from a trip to improve the enforceability of the reporting requirement. Landed catches will have to be reported prior to removal of the fish from the vessel.
 - Upgrade NTR to be capable of receiving landing reports and automatically provide a confirmation number. The new system must be capable of accepting landing reports from anglers that do not possess an HMS permit, as is currently possible with the existing telephone and website formats.
 - Provide additional reporting options to anglers to reduce reporting burden and facilitate more timely reporting. These include text messaging, E-mail, and smart phone applications.
 - Provide Law Enforcement real-time access in the field to the reporting system to verify a landings report has been submitted.
 - Extend the reporting requirement to include 7 shark species: bull, great hammerhead, lemon, scalloped hammerhead, smooth hammerhead, shortfin mako, and tiger.
 - Hold all individuals or businesses in possession of a landed billfish, swordfish, bluefin tuna, or above listed sharks, including any part of the fish (*i.e.*, jaws, fins, rostrum, etc.), accountable for ensuring the reporting requirement has been fulfilled.

The results and subsequent recommendations of this study highlight the need for significant modifications as MRIP develops. These recommendations are not limited exclusively to Florida's for-hire fishery. Similarities among the for-hire industry throughout the southeastern U.S. and Gulf of Mexico will likely make these monitoring approaches applicable to addressing coverage gaps for HMS fisheries throughout the region.

2. INTRODUCTION

Florida is renowned as an international fishing destination. Each year millions of recreational anglers travel from across the U.S. and overseas to experience the state's fisheries. The annual influx of visitors, along with an even greater number of local anglers, has supported the world's largest for-hire fleet numbering in excess of 2,100 charterboats and guides. Florida's for-hire industry is a significant contributor to local economies, generating \$250 million in total sales expenditures and contributing \$148 million to gross domestic product in 2008 (NMFS 2010). While much of Florida's for-hire industry is directed towards edible reef fish (snappers and groupers), coastal pelagics (mackerels, jacks, and dolphin), and inshore sport fish (drums, snook, and tarpon), a large segment of the fleet caters to "big game" fishing, particularly in South Florida. Concentrated along the state's southeastern Atlantic coast and throughout the Florida Keys, this fishery primarily targets sailfish, and to a lesser extent large coastal sharks, marlin, yellowfin tuna, and more recently, swordfish.

Collectively as a group, billfish, swordfish, tunas, and sharks are defined as highly migratory species (HMS) by the Magnuson-Stevens Act and are managed by the Secretary of Commerce through NOAA Fisheries. The HMS group is managed within the United States exclusive economic zone (EEZ) under a Federal fishery management plan, while several of these species are also included in international treaties. Despite decades of management, assessing the impact of the recreational fisheries for most of these species continues to be a challenge due to a lack of accurate fisheries statistics data. Directed recreational HMS fisheries have been well established in South Florida since the early 20th Century (Gregg, 1902; Burgess, 1966; Jolley, 1974; Jolley, 1975; Rivkin, 2009). The region is home to the first and longest running sailfish release tournament in the country (Rivkin, 2009) and each year hosts approximately 50 HMS tournaments registered with NOAA Fisheries; and possibly an equal number of non-registered tournaments (MRIP, 2010). A significant number of recreational vessels in South Florida regularly target or catch HMS throughout the year.

In the southeastern United States, the NOAA Fisheries Marine Recreational Fisheries Statistics Survey (MRFSS) has been the primary method for monitoring recreational catch and landings since 1980. The MRFSS consists of a complemented surveys approach that includes telephone surveys of fishing effort and an access-site intercept survey of angler catch. Approximately 40,000 field intercepts are conducted each year in Florida since the state's Fish and Wildlife Research Institute took over sampling activities in 1998. Despite the robust sample size of the general survey, HMS-targeted trips comprise a small portion of recreational fishing trips, which makes them a "rare event" in any survey that is not directly targeting this specific segment of the recreational fishery. The low number of MRFSS positive catch intercepts for these species results in highly imprecise total catch estimates for most HMS. Although for more commonly caught HMS, such as sailfish, the MRFSS consistently produces relatively precise private boat catch estimates, estimates of total catch for the for-hire mode and landing estimates for all modes still have low precision.

The low HMS sample sizes of positive catch and landing intercepts in the general survey are a result of several factors associated with HMS fisheries. These include:

- High release rates that limit the likelihood of encountering a landed billfish or large coastal shark.
- Spatial and temporal characteristics of some HMS fisheries make them especially difficult to monitor.
- The rare occurrence of many HMS.

First, the vast majority of recreational anglers voluntarily release billfish and sharks alive, a practice that benefits the conservation of these species, but limits the number of observed landed catches. Since 2000, the MRFSS has recorded 2,954 positive catch intercepts for sailfish in Florida, of which only 126 fish (4.3%) were reported or observed to have been landed. Similarly, the survey recorded 3,800 large coastal shark catches, of which only 513 (13.5%) were landed. The low sample sizes not only reduce the precision of landed catch estimates, but the lack of direct observations makes confirmation of species identification problematic, especially for sharks. In regards to the second factor, the logistics associated with targeting marlin, yellowfin tuna, and swordfish in this region require greater expenditures of time and money; limiting participation to a relatively small group of anglers. Moreover, many HMS-targeted trips originate from private access sites and return late at night, making them particularly difficult to intercept in traditional access point surveys (MRIP, 2009; MRIP, 2010). Lastly, less common species of concern, such as blue marlin, white marlin, bigeye thresher, Caribbean reef, dusky, tiger, all large coastal hammerhead sharks (great, scalloped, and smooth), and tunas (bluefin, bigeye, and yellowfin) have all been observed on South Florida docks within the past decade. However, the design of the MRFSS precludes it from either accurately or precisely assessing the impact of the recreational fishery on these species because of their rare occurrence in the survey.

Recognizing these factors, alternative data collection programs have been implemented to improve HMS recreational monitoring efforts for particular species. NOAA Fisheries and the Florida Fish & Wildlife Conservation Commission (FWC) require that all billfish, swordfish, and bluefin tuna landed by recreational anglers during a non-tournament trip be reported to NOAA Fisheries within 24 hours (68 *Federal Register* 711, January 7, 2003; FL Administrative Code Ann. R. 68B-33 F.A.C.). These landing reports are tracked by the HMS non-tournament reporting (NTR) hotline and website (billfish and swordfish) and the Automated Landings Reporting System (ALRS - bluefin tuna). Unfortunately, compliance with this census of quota-managed species is believed to be poor, likely due to difficulty in monitoring and enforcing the reporting requirement. Subsequently, landing estimates from these census-based programs are likely under-estimated. HMS Tournament fishing effort is currently monitored by requiring all HMS tournaments to register with the HMS Management Division of NOAA Fisheries. Using this tournament registration list, the Recreational Billfish Survey (RBS) requests catch reports from all billfish tournaments and a subset of other HMS tournaments. Similar to the NTR census, the HMS tournament programs are hampered by the lack of enforcement and validation of the mandatory registration and reporting requirements. No reliable mechanism is currently in place across the South Atlantic or Gulf of Mexico that can determine the proportion of unregistered tournaments, and hence, the accuracy of the RBS census. Although tournament fishing accounts for roughly 10% of all Florida private boat billfish trips and 20% of the estimated billfish total catch, only about half of all reported HMS tournaments were registered with NOAA (51.3% of 39 tournaments) (MRIP, 2010).

The apparent deficiencies and data gaps with the MRFSS and these alternative HMS data collection programs warrant a more directed sampling approach to adequately monitor recreational HMS fisheries. Under the Marine Recreational Information Program (MRIP), the HMS Work Group implemented a series of pilot studies to collect baseline information on HMS fisheries throughout the United States to assess the effectiveness of current monitoring programs and to design and employ new methodologies to fill data gaps. This study was initiated to assess the feasibility of employing a directed HMS access point intercept survey with the for-hire industry in the southeastern U.S., similar to the Large Pelagic Intercept Survey (LPIS) conducted from Maine to Virginia. At the same time, it utilized an existing effort estimation program, the For-Hire Telephone Survey (FHS), to expand HMS data collection and provide an alternative source of information for comparison. The FHS was conducted under its

normal sampling procedures, with the addition of a series of catch data questions for trips in which any HMS were reported to have been targeted or caught. To ensure the for-hire HMS fishery was fully represented, the FHS was also complemented by an identical telephone survey that used the HMS Charter/Headboat permit list as a dual sample frame. In addition, a one-time characterization survey of all for-hire vessels in Florida and HMS permit holders in South Florida was conducted to better describe the scope and magnitude of HMS fishing within this sector of the recreational fishery.

Southeast Florida and the Keys were selected as the study area for this project due to the high concentration of for-hire vessels that regularly target billfish, swordfish, and large coastal sharks. Comprised of approximately 750 for-hire vessels, including over 300 with HMS permits, this region accounted for 98.7% of all sailfish positive catch intercepts collected by the MRFSS in Florida from 2000-2009. In the same 10-year span, this region also accounted for 85.4% of marlin, 66.7% of swordfish, 99.7% of skipjack tuna, 80.8% of hammerhead (excluding bonnethead), and over 60% of bull, blacktip, spinner, and lemon shark positive catch intercepts in the state. Furthermore, while billfish and shark landings are relatively rare, a small number of for-hire vessels in this region (approximately 50) continue to land billfish and large coastal sharks with some regularity (McGowan per. obs.).

Effort and catch rate data were expanded to produce preliminary HMS effort and species-level catch estimates. In addition, study results were used to characterize the extent of nighttime fishing activity, the use of private access sites, and tournament participation among the for-hire vessels and HMS permit holders. These three factors were identified as potential biases with access point surveys by the National Research Council during its 2006 review of the MRFSS. The dual data sources from the field and telephone surveys facilitated catch rate comparisons and investigation into potential recall and non-response bias. Additionally, landed billfish and swordfish catches were compared with the NOAA Fisheries NTR landing reports to ascertain the compliance rate with the mandatory reporting requirement and assess the accuracy of the landings estimates with the census count. Ultimately, this study will be used to aid the development and implementation of a future field intercept survey or alternative data collection methods to more effectively monitor HMS recreational fisheries throughout the South Atlantic and Gulf of Mexico.

3. METHODS

3.1 Overall Study Design

The For-Hire Telephone Survey (FHS) has been used to estimate the total angler fishing effort for the for-hire industry (charterboats and fishing guides) in Florida since 2001. It is conducted as a component of the Marine Recreational Fisheries Statistics Survey (MRFSS) that monitors recreational fishing throughout the Atlantic, Gulf of Mexico (excluding Texas), and Puerto Rico. CPUEs derived from MRFSS Access Point Angler Intercept Survey (APAIS) for-hire angler-trip intercepts are expanded to FHS effort estimates to produce catch estimates for the for-hire industry. MRFSS APAIS data is also used to adjust FHS effort estimates for off-frame vessels. Reliance on this correction factor may affect the precision and reliability of effort estimates. The HMS For-Hire pilot study employed a dual-frame approach to improve coverage and provide more timely vessel updates to produce a more complete primary sample frame (Currivan and Roe, 2004). The NOAA Fisheries HMS Charter/Headboat permit list was utilized as an accessory vessel frame to the FHS vessel register. The annual permit is required for all 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 (NOAA Fisheries, HMS Management Division, pers. comm.). The FHS vessel frame does not include vessels that hold this permit but are not known to be active in the for-hire fishery.

The FL HMS For-Hire Pilot Study consisted of four components: 1) a vessel-based field intercept survey (FIS) of all for-hire vessels within the study area, 2) an HMS add-on questionnaire to the FHS conducted for each HMS trip reported within the study area, 3) an independent weekly telephone survey of a randomly selected subset of HMS Charter/Headboat permitted vessels (HMS Charter/Headboat Permit Survey or CHS), and 4) a one-time characterization census of all for-hire vessels throughout Florida and all eligible HMS Charter/Headboat permit holders in the study area. Headboats were excluded from this study due to an ongoing logbook reporting requirement and observer coverage associated with these vessels, making this study's sampling activities redundant. The study followed the same sampling periodicity as the FHS, in which a sample week began on a Monday and ended 7 days later on a Sunday. Sample weeks were pooled into two-month sample waves (January-February, March-April, etc.). Sample weeks that overlapped waves were assigned to the wave based on the month of the sample period's first day (*e.g.*, sample week 09 began on February 23, 2009 and ended March 1, 2009, so it was assigned to the January-February 2009 wave).

Unlike the MRFSS, the FHS stratifies Florida into five smaller geographic subregions: the Florida Panhandle (PanH - Escambia to Dixie County), Southwest Florida (SWFL - Levy to Collier County), the Florida Keys (Keys - Monroe County), Southeast Florida (SEFL - Miami-Dade to Indian River County), and Northeast Florida (NEFL - Brevard to Nassau County) (Figure 1). Whereas HMS fishing occurs across Florida, directed trips by the for-hire fishery are concentrated in the Keys and SEFL. As such, sampling activities for this pilot study were confined to these two subregions (with the exception of the state-wide characterization survey for FHS vessels).

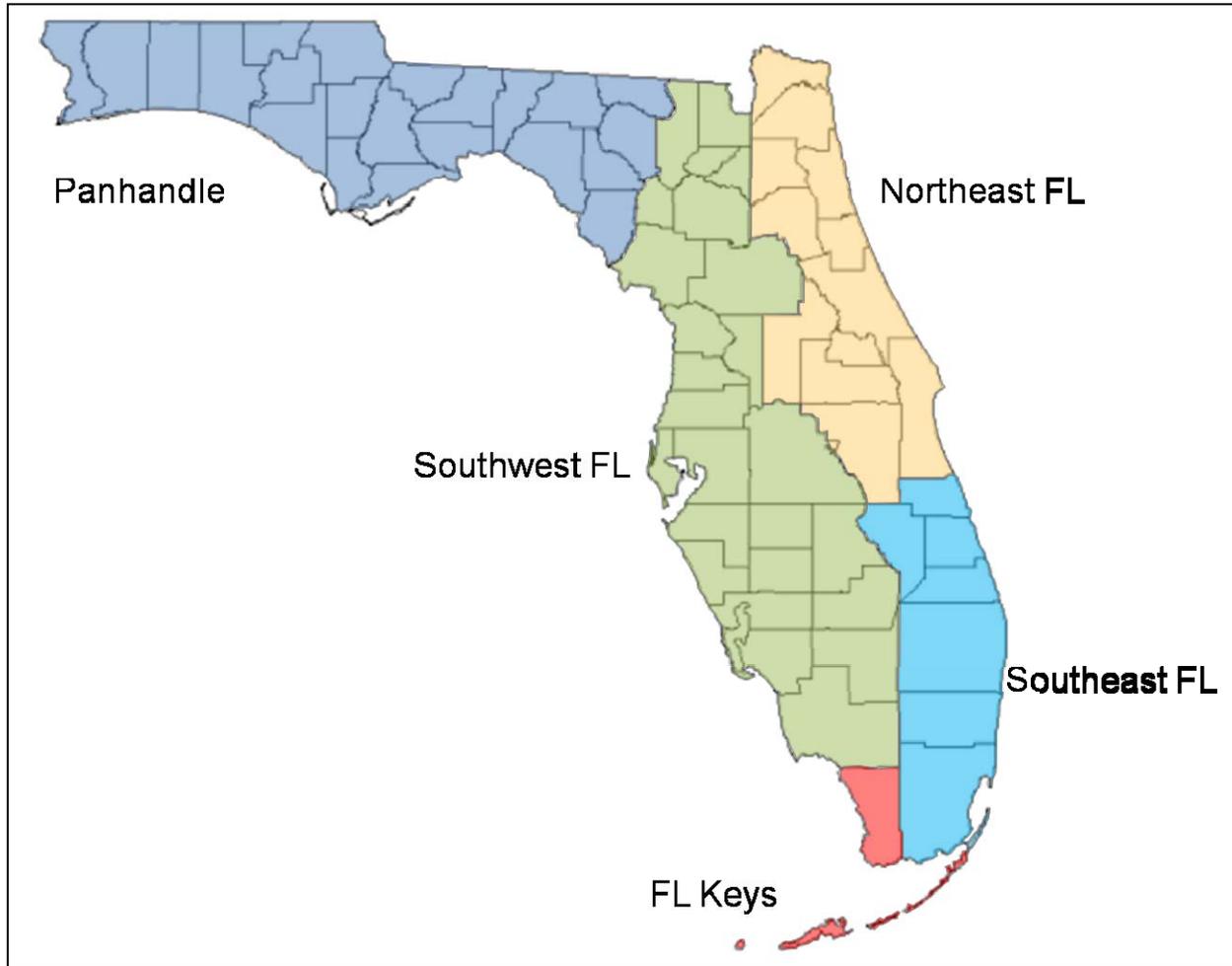


Figure 1 – The For-Hire Telephone Survey (FHS) stratifies Florida into five subregions: the Florida Panhandle (Escambia to Dixie County), Southwest Florida (Levy to Collier County), the Florida Keys (Monroe County), Southeast Florida (Miami-Dade to Indian River County), and Northeast Florida (Brevard to Nassau County). Sampling activities for this study were confined to the Florida Keys and Southeast Florida subregions.

3.1.1 Field Intercept Survey

The FIS targeted for-hire vessels returning from fishing trips to collect trip and catch information from the captain or crew. Several key design features from the Large Pelagic Intercept Survey (LPIS) were adopted to increase sampling efficiency and the likelihood of intercepting trips in which HMS were targeted or caught. These included designating a cluster of access sites as the primary sampling unit, conducting interviews at the vessel level with the captain or a crew member, and not limiting data collection to a maximum number of interviews during each assignment.

Access sites were organized into geographic site clusters. In SEFL, 37 access sites were assigned to 11 clusters while 33 sites were divided into 10 clusters throughout the Keys. Boat ramps were mostly excluded from the FIS site register due to the difficulties associated with determining the number of for-hire vessels actively fishing out of these sites on a given day (note: an exception was made for three boat ramps in the Keys at which it was possible to determine the specific for-hire activity). Clusters were randomly selected by a weighted probability using the SURVEYSELECT procedure in SAS® version 9.2,

and a primary access site was randomly selected within the cluster as the assignment's starting point. Clusters were assigned a pressure ranking, on a scale from 0 to 7, which represented the total number of for-hire vessels (in increments of five) operating out of access sites within the cluster (*e.g.*, a cluster containing 1 to 5 vessels would be assigned a pressure 0, 6 to 10 vessels = pressure 1, 11 to 15 vessels = pressure 2.... 36 or more vessels = pressure 7). The selection of site clusters for field assignments was determined by a weighted probability that reflected the total number of for-hire vessels actively operating at all access sites within the cluster. Eight field assignments were attempted on a weekly basis, of which four were conducted on weekdays and four on weekends, and were equally distributed between SEFL and the Keys. No site cluster was to be sampled more than once each sample week to ensure a broad coverage of fishing activities and minimize oversampling at some sites.

The FIS was a vessel-based survey in which the vessel captain or another crew member was interviewed to provide all trip and catch information for the vessel; this in contrast to the MRFSS APAIS, in which each customer is interviewed to provide their individual trip and catch information, although observed catch may be combined for a group of anglers and arbitrarily assigned to first angler of the group interviewed. Collecting interviews at the vessel level was deemed necessary to effectively execute site cluster sampling for the for-hire fishery in this region. In this case, cluster sampling is in essence a roving creel survey (more typically associated with low pressure situations). The method can be highly efficient, though, if all active vessels can be counted and sampled within the designated geographic area (Essig and Holliday, 1991). An angler-based survey could not accomplish this, as for-hire customers in South Florida frequently disembark from the chartered vessel and leave the site shortly after the trip's conclusion. In contrast, the vessel captain and/or a crew member often can be intercepted at the vessel more than an hour after returning from a trip. Additionally, landed HMS catches (*i.e.*, sailfish and sharks) typically stay with the crew in this region since they are primarily landed for taxidermy mounts; frequently they are available for several hours after the end of the trip, allowing more time for confirmation of the species identification and collection of biological samples. These characteristics enable samplers to visit multiple access sites in close proximity to each other in a short period of time, while still successfully intercepting most, if not all for-hire vessels within the cluster. The random selection of a primary access site within the cluster at which the sampler was required to sample all vessels (even at the expense of missing vessels at other sites) addressed concerns for sampler bias toward more active sites.

All trips conducted by intercepted for-hire vessels were sampled regardless of the trip mode (*i.e.*, paid charter or private trip), participation in a tournament, target species, or catch. Trips in which HMS were targeted or caught (HMS trips) were given precedence, while non-HMS trips were sampled when time permitted. In addition, no maximum interview limits were set, as opposed to the MRFSS APAIS 30 angler interview limit in the primary fishing mode. Samplers were required to sample all for-hire vessels that fished that day and were expected to return prior to 20:00 hours. This was to ensure coverage of all trip types of varying duration and return times.

3.1.2 For-Hire Telephone Survey HMS Add-on & HMS Charter/Headboat Permit Telephone Survey

The FHS is a weekly telephone survey with for-hire vessel representatives. Participation is mandatory for any vessel possessing a Federal Charter/Headboat permit for the Gulf of Mexico (*i.e.*, reef fish, pelagics). Vessel selection from the FHS was not changed for this study. The vessel list was first presorted in geographic order by county of port and by descending vessel length within each county. Next, a random starting point was selected and every subsequent *n*th vessel on the list where sampling

interval n is set to ensure a 10% sample was drawn on one complete pass through the list (GSMFC, 2001). The addition of an HMS add-on questionnaire was the only modification made to the FHS for this study. For purposes of consistency, vessel selection and sampling procedures for the CHS were identical to the FHS.

After much deliberation, the project team felt that recall of HMS catches would be relatively high with a one-week sample period, especially considering many captains already maintain personal trip and catch logs. Non-HMS catches were not recorded to minimize interview length and minimize the vessel representative's reporting burden. Additionally, two tuna species (little tunny and blackfin) and three shark species (Atlantic sharpnose, bonnethead, and nurse) were excluded from qualifying as an HMS trip. As such, HMS add-on questions for these trips were not asked during the FHS, nor were these trips recorded during the CHS. All five species are common occurrences in Florida's recreational fishery and are frequently documented by the MRFSS. In addition, the tuna species are not managed under the Consolidated HMS Fishery Management Plan, while these shark species in particular, are frequently caught as bycatch on trips that target non-HMS. These species were excluded from the HMS trip classification in order to focus the pilot study on the lesser known elements of the HMS fishery. The effect of their exclusion from the HMS analysis was examined, though, during the analysis of the FIS results since these trips were sampled in the field along with all other non-HMS trips.

3.1.3 Characterization Survey

The Characterization survey was conducted once per vessel, opportunistically as vessel representatives were selected for their respective telephone survey or encountered in the field during FIS sampling. Attempted contacts of all Southeast Florida and Keys vessel representatives that were not characterized upon the conclusion of the surveys were made to complete the Characterization survey. Characterization interviews with all for-hire vessels in the Florida Panhandle (PanH), southwest Florida (SWFL), and northeast Florida (NEFL) were initiated in June 2009. The survey was designed to 1) identify for-hire vessels that are actively fishing for HMS throughout Florida, and 2) characterize the extent of each for-hire and HMS Charter/Headboat permitted vessel's HMS fishing activity, species preferences, and accessibility to a field intercept survey or alternative sampling methods.

3.2 Interviewer Training, Supervision, and Monitoring

The FWC samplers recruited to conduct this study were all experienced field biologists. All samplers had prior experience conducting recreational fisheries surveys in the study area. As such, they all had received general training regarding approaching anglers, stating the Privacy Act disclosure, reading survey questions verbatim, conducting interviews without biasing the respondents' answers, and dealing with uncooperative or hostile anglers. Specific training for this study included an overview of the survey design and its objectives, extensive familiarization with each survey's questionnaire, guidelines for what qualified as an HMS trip, dialing procedures, procedures on how to fill out datasheets, and computer training for key-entering data into a Microsoft Access database. Furthermore, HMS-related training included species identification, historical overview of Florida's HMS fisheries, current stock assessment updates for species of interest, and a briefing on current HMS management and fishery related issues. All samplers were issued talking points provided by NOAA Fisheries HMS Management regarding these topics to facilitate answering of basic HMS fishery-related questions from respondents.

Samplers were remotely distributed throughout the study area to conduct the FIS, allowing only limited supervision while telephone interviews were being conducted. However, samplers were in regular contact with the project coordinator to provide updates on sampling and to receive corrective feedback. On-site visits by the project coordinator were conducted throughout the course of the study. Additionally, a subset of data for each sampler was periodically reviewed to ensure that samplers adhered to the study protocols.

3.3 Vessel Sample Frames

Under the dual-frame sample design, the FHS vessel register was designated the primary frame and the HMS Charter/Headboat permit list as the secondary frame. The FHS vessel frame includes all charter vessels that are currently active in for-hire fisheries. The HMS permit list was first compared to the FHS vessel list to match vessels, using a combination of the vessel name, registration number (Coast Guard documentation or State registration number), vessel length, and/or representative name. Vessels that were matched with the FHS were subsequently removed from the HMS permit frame so no vessel would simultaneously be on both frames. A vessel would only be on the CHS vessel frame and not on the FHS frame if it was not known to be actively engaged in for-hire fishing. Bimonthly updates to the sample frames were conducted throughout the study. These included: 1) moving vessels from the HMS permit frame to the FHS frame that were recognized as being active for-hire vessels within the study area, 2) removing vessels determined to be inactive, ineligible, or to have bad contact information from their respective frame, and 3) adding newly HMS permitted vessels to the HMS permit frame after attempts to match them with the FHS were unsuccessful. Table 1 shows the number of vessels that comprised each sample frame for every two-month sample wave. The table also reports the number of vessels on the FHS frame that possessed HMS Charter/Headboat permits, those possessing one of the other HMS permit types (*i.e.*, HMS Angling or Atlantic Tunas General permits), and the proportion of HMS-permitted vessels (all permit types) among all vessels within each subregion.

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Table 1 –FHS and CHS vessel frames for each two-month sample wave. Each frame is separated into the Keys and SEFL subregions. For the FHS frame, the total number of vessels possessing HMS Charter/Headboat permits or other HMS permits (*i.e.*, HMS Angling or Atlantic Tunas General permits) is reported, as well as the proportion of HMS-permitted vessels within each subregion.

Sample Wave	<i>May-Jun 2008</i>	<i>Jul-Aug 2008</i>	<i>Sep-Oct 2008</i>	<i>Nov-Dec 2008</i>	<i>Jan-Feb 2009</i>	<i>Mar-Apr 2009</i>	<i>May-Jun 2009</i>
# Vessels FHS Frame	649	702	744	775	786	789	782
<i>Keys</i>	415	451	463	471	476	482	478
<i>HMS Charter permit</i>	74	104	128	142	148	154	154
<i>w/ other HMS permit</i>	4	5	5	5	7	7	7
<i>% HMS permitted</i>	18.8%	24.2%	28.7%	31.2%	32.6%	33.4%	33.7%
<i>SEFL</i>	234	251	281	304	310	307	304
<i>HMS Charter permit</i>	78	104	137	152	157	155	156
<i>w/ other HMS permit</i>	3	3	3	4	7	10	10
<i>% HMS permitted</i>	34.6%	42.6%	49.8%	51.3%	52.9%	53.7%	54.6%
# Vessels CHS Frame	304	273	210	165	195	175	192
<i>Keys</i>	122	121	91	65	75	55	63
<i>SEFL</i>	182	152	119	100	120	120	129

The vessel selection draw used by the FHS was not modified for this study. The standard FHS vessel selection procedure resulted in an average of 9.7% of HMS-permitted vessels in the Keys and 10.1% of HMS-permitted vessels in SEFL on a weekly basis. It was assumed a large enough proportion of HMS-permitted vessels within the vessel frame would be selected each week. In addition, FL state regulations do not require an HMS permit to target and land billfish, swordfish, and sharks so long as the vessel fished exclusively within state waters (State of Florida jurisdiction included all waters within 3 nautical miles from shore in the Atlantic and less than 9 nautical miles in the Gulf of Mexico). The exclusion of for-hire vessels without an HMS permit would have created a potential under-coverage bias of HMS fishing activity. Thus, it was deemed all for-hire vessels selected in the FHS would be actively screened for HMS fishing activity and an add-on questionnaire completed for all HMS trips, regardless of permit status.

3.4 Sampling Procedures

3.4.1 Field Intercept Survey

FIS samplers were instructed to start assignments one hour prior to the selected cluster’s first for-hire vessel’s normal return time for morning half-day trips. Upon arriving at an access site the sampler would first check in with the site manager to inform them they would be conducting voluntary interviews on behalf of the Florida Fish & Wildlife Research Institute. The sampler would first visit the primary site to determine how many boats were out and when possible, what their expected return times were from dock masters, booking agents, and/or other for-hire crews. After the initial primary site assessment, the sampler would visit all other sites within the cluster to ascertain their activity levels and expected return times for vessels out on trips. The sampler was then allowed to wait at any access site or another vantage point (*i.e.*, an inlet or some other location where returning vessels could be

spotted prior to arriving at their home dock) within the cluster to conduct interviews with the earliest returning vessels, so long as all active vessels at the primary site would be sampled. In the event vessels returned and no crew member was present to be interviewed, samplers were to record each “missed” vessel per access site on the Assignment Summary Form (Appendix A). In addition, the number of vessels that did not return (recorded as “not done”), refused to participate as (initial refusal), refused during the interview (mid-interview refusal), did not speak English (language barrier), or were commercially fishing (“commer. vessels”) were also to be recorded for each site.

Upon the return of a vessel, the sampler would introduce themselves to the captain and request permission to conduct the interview and collect biological data. Captains could designate another crew member to provide all trip information if they preferred. If the captain was not available, samplers were permitted to initially speak with another crew member to seek permission, but were not permitted to request trip information from a customer.

When multiple for-hire vessels returned at the same time, samplers would attempt to interview all boats. To conserve time, collecting biological data from non-HMS catches (*i.e.*, measuring length, weights, determining sex ratios, etc.) was deemed a lower priority. Samplers were directed to complete all trip-level questions, collect the unobserved catch report, identify and count fish creels to species level, and collect biological data from HMS catches before moving on to the next interview. Only if time permitted were they to then sample non-HMS catches. The following information was collected during each vessel interview (Appendix B shows the complete FIS questionnaire):

- **Trip-level data** - trip type (charter or private), if it was a tournament trip, target species (up to 3 targets), body of water fished, location of fishing activity, average distance from shore, vessel return time, total fishing time, total HMS fishing time, bottom depth range fished (minimum, primary, and maximum), hook type(s) used, number of lines fished, number of customers that fished, number of crew members that fished, primary bait type used, primary fishing method employed, name and contact info for interviewed vessel representative.
- **Unobserved catch** - number of fish caught by disposition and hook type for each species. If species could not be determined, responses were recorded at the genus or family level.
- **Observed catch** - number of fish caught, fork length, total weight, catch disposition, hook type, fish condition (*i.e.*, whole, filleted, gutted), and sex). Observed catch was identified to species.

Rescheduling/canceling assignments

Assignments that occurred on days when weather conditions were not conducive to fishing could be rescheduled to another eligible day during that sample week. For example, a weekday assignment (Monday – Friday) could be reattempted until that Friday and Saturday assignments could be reattempted the next day. If the assignment was scheduled for a Friday or Sunday and poor conditions were expected on that day, the assignment could be attempted earlier in the week (*e.g.*, an approaching tropical storm would justify attempting the assignment early – so long as an evacuation order was not in effect). If poor conditions resulted in no fishing during an assignment scheduled for a Friday or Sunday, then the assignment was canceled. In the event no samplers were available to make up a “weathered” assignment on an eligible day, the assignment was canceled.

Interactions with the MRFSS

In the event a MRFSS sampler was encountered actively sampling for-hire vessels, the FIS would leave the site and continue sampling at other sites within the cluster. If there was no activity at other sites and at least one FIS interview had been collected prior to encountering the MRFSS sampler, the assignment was ended, with all remaining vessels at the MRFSS site recorded as being “not done”. If there was no activity at other sites and no interviews had been collected, the assignment would be rescheduled for another eligible day that week. If the assignment occurred on a Friday, Sunday, or could not be rescheduled due to the unavailability of a sampler, the assignment was canceled.

3.4.2 For-Hire Telephone Survey

The FHS was conducted according to the 2001 FHS procedures manual as this continues to be an ongoing program. This section only addresses modifications to the FHS procedures that relate to the HMS add-on questionnaire. During the course of a standard FHS interview (Appendix C), the vessel representative is asked what species were targeted for each charter trip reported, with the option to report up to two target species per trip. Trips in which any HMS was reported as a target species automatically qualified for the HMS add-on questionnaire. If no HMS was targeted and after all standard FHS questions were completed, the vessel representative was asked if the vessel caught any HMS during the trip to determine if the interview would continue to the HMS add-on. The change from the normal FHS questions and the purpose of the additional HMS questions were explained to vessel representatives. The add-on questionnaire (Appendix D) collected information pertaining to the trip’s fishing location, if it was a tournament trip, the average bottom depth, the primary and secondary fishing methods employed, and HMS catch (including numbers of fish caught by disposition and hook type for each species). In addition, since non-charter and/or tournament trips are excluded from the standard FHS, vessel representatives that reported the vessel being used for such trips were also asked if HMS were targeted or caught. If so, complete trip information and the HMS add-on data were requested, with the trips classified as non-charters so they would not affect the standard FHS effort estimation.

3.4.3 HMS Charter-Headboat Permit Telephone Survey

Unlike the FHS, the CHS only collected data for HMS trips (targeted or bycatch) in which the vessel returned to a Florida port, so permit holders were initially asked the screening question if their vessel was used for HMS fishing during their selected sample week. If permit holders had HMS trips to report, the sampler would ask the same questions used for the FHS and HMS add-on (Appendix E). Trips in which the fishing activity occurred outside Florida or adjacent Federal waters (*i.e.*, in the Bahamas) were counted if the vessel returned directly to a Florida port at the end of the trip without stopping at another port (foreign or in another state).

Upon the completion of the interview, permit holders were asked to provide their preferred time of day, contact number(s), and any other special instructions for future telephone contacts to facilitate their schedule, minimize their reporting burden, and increase the likelihood of a successful future contact. This also included asking them if they preferred to designate a vessel representative (*e.g.*, the vessel captain) for future contacts. Vessels that were reported to have been used as a for-hire vessel (part-time or full-time) in Florida were informed about the FHS and the vessel was added to the FHS frame.

Dialing procedures were similar to those employed for the FHS, designed to complete interviews within as short a period of time upon the end of the sample period to optimize recall, while minimizing the reporting burden on permit holders. Attempts to contact permit holders were initiated the first Monday after the sample period ended and ended after either a successful contact was made, the permit holder refused to participate, or at least five contact attempts were made. All call attempts were made between 08:00 and 20:00 hours local time on business days, unless alternative times or days of the week were requested by the permit holder. In the event the permit holder (or vessel representative for the FHS) did not speak English, the sampler first attempted to speak with someone else in the household. Permit holders that spoke Spanish were re-contacted by one of two bilingual samplers. Permit holders that did not speak English or Spanish were classified as language barrier.

3.4.4 HMS Characterization Survey

The Characterization survey was initially conducted opportunistically during the course of the FIS, FHS, and CHS sampling. The one-time survey collected information regarding the vessel representative's HMS fishing experience, the location and types of primary and secondary access sites used by the vessel, the total number of *targeted* HMS trips (charter and private combined) by species the vessel conducted in the past 12 months, and the vessel representative's willingness to participate in future monitoring surveys via email. A slightly modified questionnaire from the one used for the HMS permit holders sampled during the CHS, was used for FHS vessel representatives (Appendix F) from the one used for the HMS permit holders sampled during the CHS (Appendix F). The changes included an initial question on the FHS Characterization questionnaire of whether or not the for-hire vessel was used to *target* HMS during the past 12 months. If the response was no, then the sampler would only ask the last question regarding the vessel representative's willingness to use e-mail to submit trip reports for future FHS selections. If the response was yes, then the complete interview was conducted. In addition, unlike the questionnaire used for the HMS permit holders sampled by the CHS, FHS vessel representatives were not asked how long they had obtained an HMS permit due to the potential for confusing the HMS permit with one of the many other non-HMS licenses and permits the vessels possess or are also required to obtain. At the conclusion of the FIS, FHS, and CHS sampling, all vessels that had not been characterized were contacted following the same dialing procedures used for the telephone surveys.

3.5 Data Quality Control

Quality assurance measures included 1) scrutinizing phone records to ensure calls were being completed on the date and time reported, 2) monitoring each sampler's telephone sampling contact rate and weekly FIS intercept tallies, 3) periodically conducting both announced and unannounced on-site QA/QC visits while samplers were conducting FIS assignments, and 4) reviewing key-entered data on a regular basis to check for omissions, errors, or inconsistencies. The existing strong working relationships with for-hire crew members also facilitated informal updates to the project coordinator regarding how samplers conducted themselves in the field and over the telephone.

All data were key-entered into MS Access forms in which all response codes were preprogrammed and drop-down lists were utilized to prevent invalid entries. SAS data check programs were created to identify omissions, errors, or inconsistencies. SAS-generated error reports were reviewed by the Project Coordinator. Flagged responses were scrutinized by first reviewing the raw datasheet and then contacting the sampler for clarification. Any discrepancies or errors that could not be reconciled were

treated as “missing.” Trip records in which HMS were neither targeted nor caught were dropped from the analysis since they did not qualify as eligible HMS trips.

3.6 Data Analyses

Data analysis entailed assessment of each surveys’ sampling results, a thorough review of the trip and catch results, assessment of sampling coverage, analysis of effort and catch estimates, and catch rate comparisons to investigate differences between sampling methodologies (field versus telephone) and trips returning at different times of day (morning versus afternoon). Although non-HMS trips were sampled by both the FIS and FHS, only results from HMS trips are analyzed for this report. Trip and catch data analysis was conducted by assigning data to five HMS groups depending on the species targeted and/or caught: Sailfish, Marlin, Swordfish, Tuna, and Shark. The five groups were not mutually exclusive and trips in which species from multiple HMS groups were targeted and/or caught were included for each HMS groups’ analyses. Analyses were also conducted with all HMS trips combined; reflecting the true total number of trips for which permit holders provided responses (note: due to inherent overlap in trip categories, the sum of the trips for the Sailfish, Marlin, Swordfish, Tuna, and Shark groups would be greater than the all inclusive “HMS” group). Trip and catch results for the FIS were reported alongside the combined results of both telephone surveys.

Basic descriptive statistics derived from the survey results were used to determine the frequency and temporal distribution of HMS trips, trip type (mode, target species, and tournament participation), trip result, access site use, area and bottom depth fished, mean distance from shore, trip duration and return times, fishing time, mean number of customers per trip, fishing method employed, number of lines fished, bait and hook type used, and disposition of catch. Additionally, the sampling coverage of both survey methodologies was assessed by analyzing the distribution of FIS field assignments, proportion of on-frame vessels intercepted by the FIS, and by comparing the distribution of trips among site clusters recorded by each survey. Respondent recall was assessed by directly comparing responses from matched trips sampled both in the FIS and telephone survey. This allowed for direct comparison of trip mode, tournament participation, area fished, HMS target species, number of customers, and HMS catch. Paired t-tests were used to test for differences between the number of customers and HMS catches reported by each survey.

Weighted least squares regression analysis was used to test for differences in estimates of mean catch rate using the SURVEYREG procedure in SAS® version 9.2. A similar regression analysis was also conducted within each survey to test for differences between catch rates collected from trips that returned at different times of day. For each survey, the comparison separated catches into two categories based on median trip return time for daytime trips (08:00 to 20:00 hours); those collected from trips that returned prior to the median trip return time and those that returned afterwards.

Catch and effort estimation was conducted according to the study design shown in Figure 2. The two independent telephone surveys, the FHS and CHS, produced vessel-trip effort estimates and species-level catch estimates from CPUEs for HMS catches. FIS CPUEs were not used for catch estimation due to the design of the field assignment probability selection program. The selection of FIS assignments reflected both the output of a weighted probability selection draw and rules that dictated site clusters would not be sampled more than once during a sample week. The purpose to limiting how often site clusters would be sampled was 1) to extend coverage across each subregion to better ascertain the

distribution of HMS fishing activity between the site clusters (directed and incidentally), and 2) to minimize the sampling burden on for-hire crews that would continue to be sampled by the MRFSS throughout the study. Activity pressures assigned to each cluster also did not reflect HMS fishing pressure, instead indicating the aggregate number of active for-hire vessels operating across all its sites. This was simply because HMS fishing activity had never been quantified before in this region, and there were uncertainties regarding what proportion of targeted and incidental catches would comprise the total HMS catch. On the other hand, CPUEs collected by the telephone surveys would be derived from a more representative sample of HMS effort.

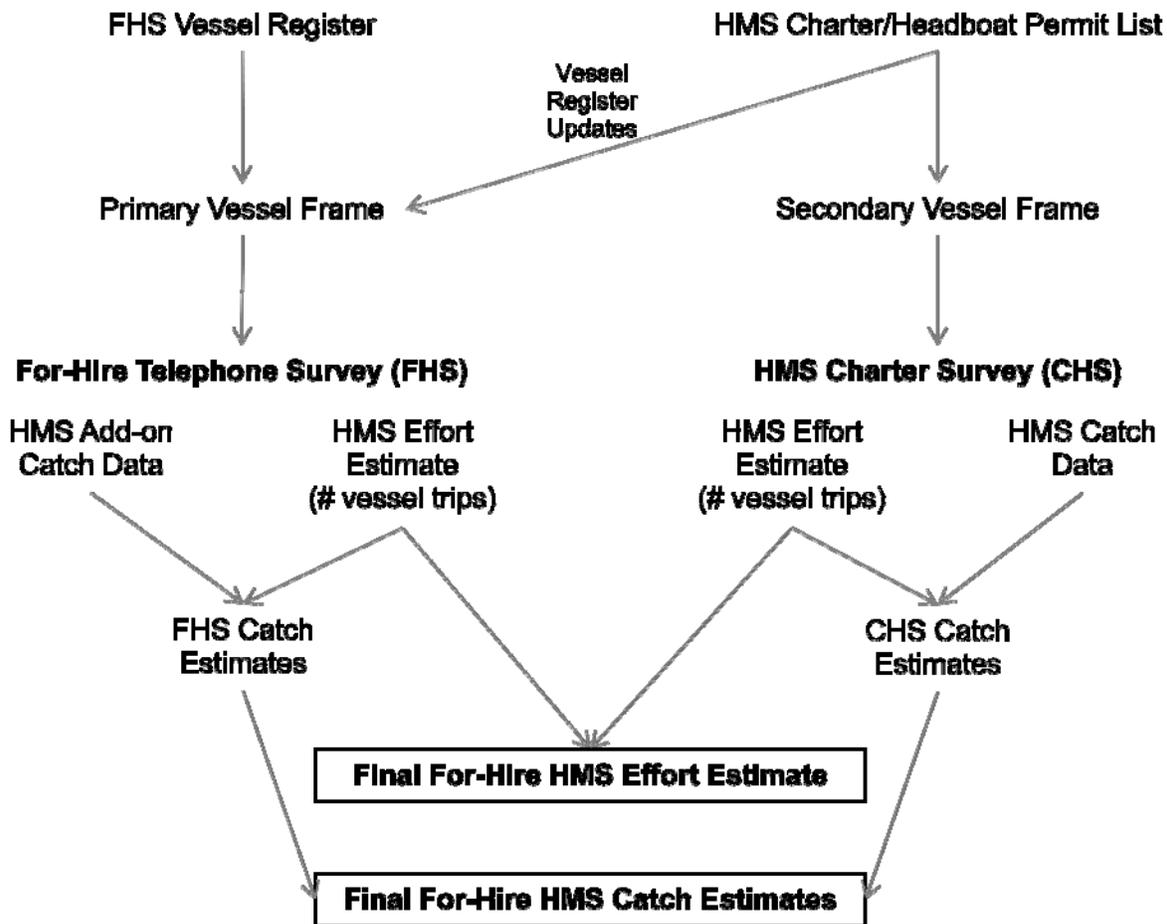


Figure 2 – HMS For-Hire pilot study effort and catch estimation design. The FHS vessel register served as the primary sample frame. Vessels on the HMS Charter/Headboat permit list that were identified to be operating as active for-hires boats were moved to the FHS vessel register at the beginning of next sample wave. While the FHS collected information for all for-hire trips, only trips in which HMS were targeted or caught were included for the final estimations (CHS did not collect information for non-HMS trips). Final effort and catch estimates reflect the combined results of the independent telephone surveys.

Following the pilot study’s sample design (Figure 2), standard estimation methodology for equal probability stratified random sampling was used to calculate weighted catch and effort point estimates and estimate variances. Strata cells were defined by each unique combination of year, two-month wave, one-week sample period, Florida subregion, and vessel frame.

Weights were calculated for the responding primary sampling units (PSU's), on frame vessels, as the inverse of selection probability with a simple adjustment for unit non-response. Separate weights were calculated for each cell:

$$w_h = \frac{N_h}{n_h^*}$$

where: h is a stratum cell (unique combination of year, wave, sample period, Florida subregion, vessel frame),
 w_h is the weight for responding PSU's in stratum cell h ,
 N_h is the frame size, count of vessels in h ,
 n_h^* is the actual or responding sample size (total sample size – non-responding units) in h .

Catch estimates (numbers of fish by species) and effort estimates (vessel trips) were calculated as weighted totals using standard equations for stratified samples:

$$\hat{Y}_h = \sum_{i=1}^{n_h^*} w_h y_i$$

$$\hat{Y} = \sum_{h=1}^H \sum_{i=1}^{n_h^*} w_h y_i = \sum_{h=1}^H \hat{Y}_h$$

where: y_i is the count (fish caught or vessel trips) reported by unit i in cell h ,
 \hat{Y}_h is the weighted total in h ,
 H is the total number of strata,
 \hat{Y} is the weighted grand total summed over all H cells.

PROC SURVEYMEANS in SAS® was used to calculate variances for estimated totals, which incorporates Taylor series approximation. Variances were estimated from the following equations:

$$\text{var}(\hat{Y}_h) = \frac{n_h^*}{n_h^* - 1} \sum_{i=1}^{n_h^*} (w_h y_i - \hat{y}_h)^2$$

$$\text{var}(\hat{Y}) = \sum_{h=1}^H \text{var}(\hat{Y}_h)$$

where: \hat{y}_h is the weighted mean count (fish caught or vessel trips) reported in cell h ,
 $\text{var}(\hat{Y}_h)$ is the variance of the weighted total in h ,
 $\text{var}(\hat{Y})$ is the variance of the weighted grand total summed over all H cells.

Estimate standard errors were calculated as the square root of the variance: $se = \sqrt{\text{var}}$.

Proportional standard errors (PSE) were calculated as the standard error divided by the estimate expressed as percent: $PSE(\hat{Y}) = 100 * se(\hat{Y})/\hat{Y}$.

Confidence intervals at 95% level (CI_{95}), were calculated using the normal approximation: $CI_{95}(\hat{Y}) = \hat{Y} \pm 1.96 * se(\hat{Y})$.

Data from the FIS portion of the study were weighted for catch rate comparisons to corresponding FHS/CHS estimates. As an important FIS design element (total trip counts by assignment), needed to create true design-based weights, was unavailable, model-based weights were created assuming stratified simple random sampling:

$$w_h = \frac{\hat{N}_h}{n_h}$$

where: h is a stratum cell (unique combination of year, wave, Florida subregion),

w_h is the weight for responding PSU's in stratum cell h ,

\hat{N}_h is the total of vessel trips in h as estimated by FHS/CHS,

n_h is the observed sample size in h .

Although modeled weights did not fully account for the complex FIS design, they did correct, to some extent, for differences in sample allocation and productivity among strata. For this reason, it was felt that incorporating modeled weights was preferable to using unweighted data in comparisons of summarized or aggregated estimates (*e.g.*, annual level estimates).

4. RESULTS

4.1 Field Intercept Survey Assignment Selection & Sampling Analysis

The Field Intercept Survey (FIS) was initiated on April 29, 2008 and concluded on June 28, 2009. Of the 488 attempted assignments, 440 (90.2%) resulted in at least one vessel interview being completed (Figure 3). Of the 48 unsuccessful assignments that resulted in no interviews, 29 were due to a lack of any fishing activity despite occurring on days with favorable weather conditions, while 16 were due to no activity as a result of poor weather (including hurricane evacuations). Additionally, an assignment was canceled due to the presence of a MRFSS sampler at the only access site within a site cluster with fishing activity, while two others were canceled by the designated sampler for personal reasons. The September-October 2008 sample wave had the highest proportion of canceled assignments due to a lack of fishing activity on both good and bad weather days (22.2% and 8.3% of 76 attempted assignments, respectively). Appendix H shows the complete FIS assignment sampling results.

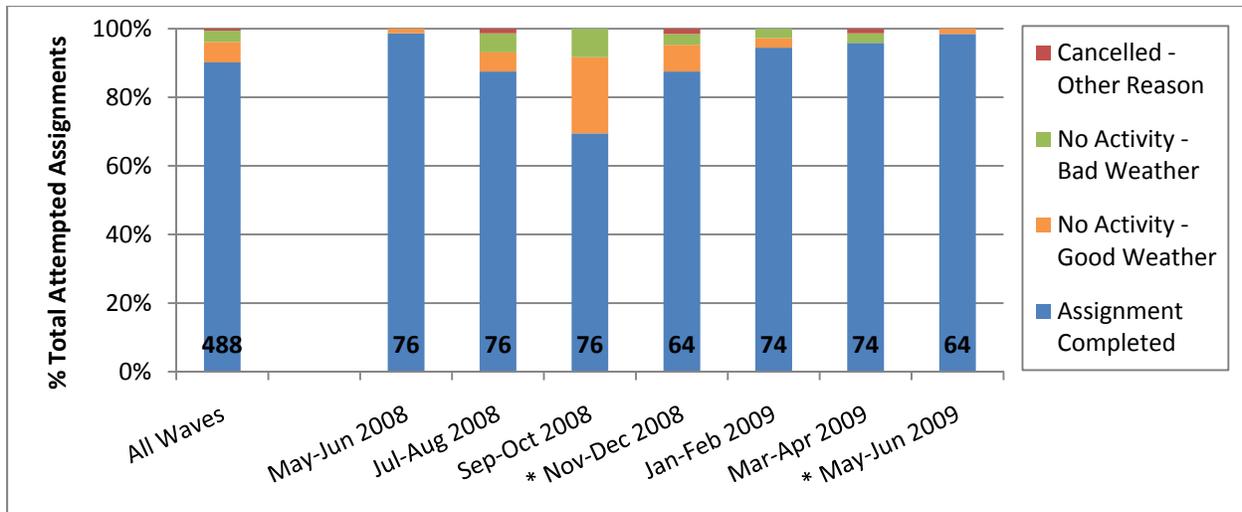


Figure 3 – Distribution of the status of all field assignments conducted during the FIS by each 2-month sample wave. “Assignment Completed” indicates the proportion of assignments that successfully resulted in at least 1 vessel interview. The remaining categories resulted in zero interviews. Data labels indicate total number of attempted assignments during each wave. (*indicates waves that were comprised of 8 weeks, while all others covered 9 weeks)

During the 14 months of FIS sampling, a total of 2,276 vessel interviews were conducted throughout the study area (Table 2). Of these, 888 interviews (39.0%) were classified as “HMS” trips, indicating a billfish, swordfish, tuna, or shark were targeted and/or caught during the trip. The remaining 1,388 interviews were classified as “non-HMS” trips. While assignments were equally distributed between the Keys and SEFL subregions, more HMS and non-HMS interviews were collected in the Keys (Keys=482 HMS and 829 non-HMS interviews; SEFL=406 HMS and 559 non-HMS interviews). It should be noted that for 33.9% of non-HMS trips (n=470), at least one of the five excluded tuna and shark species (blackfin tuna, little tunny, Atlantic sharpnose, bonnethead, and nurse shark) were targeted and/or caught. Had these trips been classified as HMS trips, it would have increased the total number of trips included in the HMS analysis by more than 50%. Little tunny occurred on 75.3% of these excluded trips, followed by blackfin tuna (20.2%), and the three shark species combined (15.1%). Whereas the tunas

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occurred primarily on trips targeting non-HMS pelagic species, the excluded shark species were mainly caught as bycatch on trips targeting bottom and inshore species.

Table 2 – Sampling results for the FIS by 2-month sample wave for each Florida subregion and combined. (*indicates waves that were comprised of 8 weeks, while all others covered 9 weeks)

Sample Wave	Keys		SEFL		Total		
	# Vessel Interviews		# Vessel Interviews		# Vessel Interviews		
	HMS	non-HMS	HMS	non-HMS	HMS	non-HMS	Total
May-Jun 2008	78	209	73	79	151	288	439
Jul-Aug 2008	60	127	23	79	83	206	289
Sep-Oct 2008	24	66	38	50	62	116	178
* Nov-Dec 2008	73	58	59	49	132	107	239
Jan-Feb 2009	99	98	91	70	190	168	358
Mar-Apr 2009	93	143	86	137	179	280	459
* May-Jun 2009	55	128	36	95	91	223	314
Total Results	482	829	406	559	888	1,388	2,276

The FIS collected 1.8 HMS and 2.8 non-HMS interviews per assignment, combining for an average of 4.7 interviews for every attempted assignment. Although HMS fishing activity was the primary focus of the study, 33.2% of all assignments resulted in no HMS interviews. HMS trips were more common in the Keys, occurring on 71.5% of all Keys assignments compared to 63.1% of SEFL assignments. FIS sampling productivity varied seasonally, from a low of 0.9 HMS and 1.6 non-HMS interviews per assignment during the September-October 2008 wave to a peak of 2.6 HMS interviews in the January-February 2009 wave and 4.0 non-HMS interviews in the May-June 2008 wave (Figure 4). HMS trips were more common than non-HMS trips only during the late-fall and winter months (November 2008 – February 2009). Overall, the least productive sampling period for HMS fishing comprised the late summer and early fall months (July-October 2008). This was most likely due to the poor weather associated with hurricane season and the lack of paying customers during the traditional “off-season” for South Florida’s tourism industry.

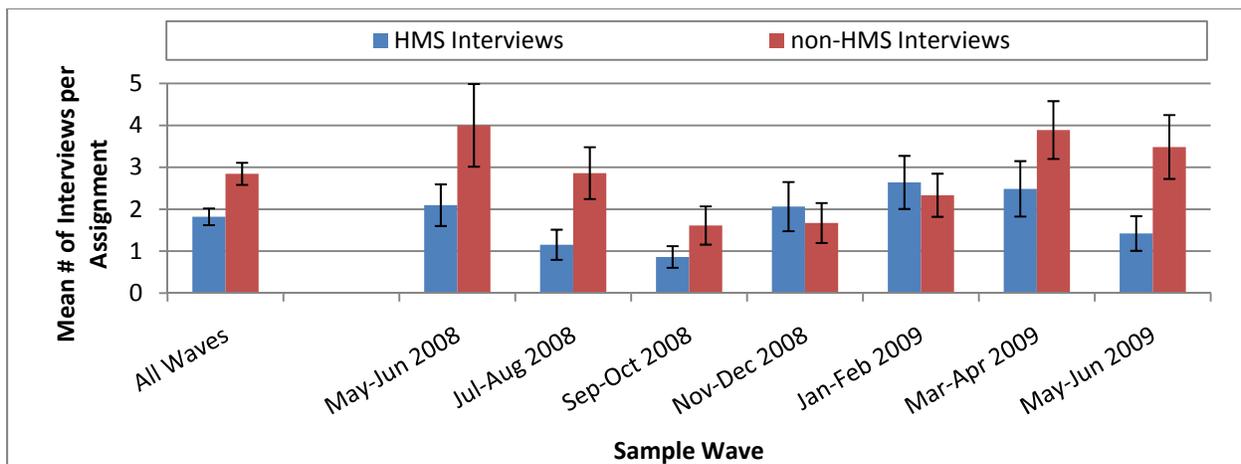


Figure 4 – Mean number of HMS and non-HMS interviews collected per field assignment during each 2-month sample wave, with 95% confidence intervals.

Although HMS trips were more frequently sampled in the Keys, cooperation rates were lower in this subregion, with samplers encountering 1 refusal for every 17 vessels that were approached to be interviewed (5.8%) compared to an average of 1 refusal for every 29 vessels approached in SEFL (3.4%) (Appendix H). Sampling in the Keys also resulted in more “missed” vessels, averaging 1 for every 9 vessels observed to be out fishing (11.2%) as opposed to 1 for every 13 vessels out on trips in SEFL (7.4%). “Missed” vessels were those within the site cluster that were believed to be out fishing (*i.e.*, marina slip was empty or reported to be fishing on a daytrip by dock attendant), but returned and their crew departed prior to a sampler being able to conduct an interview. Typically this was a result of the sampler being at another site within the cluster attempting to maximize the number of HMS interviews collected during the assignment.

The frequency of “missing” vessels was higher for some clusters, as seen in Figure 5. The Summerland-Little Torch Key (SLTK) cluster had the highest missed rate (19.6% of vessels actively fishing), due to being comprised of only two boat ramps. Unlike vessels returning to a private slip or boat lift, for-hire captains returning to boat ramps would typically leave shortly after the conclusion of the trip to wash their boat down at another site. As a result, samplers had a reduced amount of time to successfully intercept captains at these sites. Similar time constraints were also encountered at the third boat ramp included in the FIS register, located in the South Islamorada cluster which had the second highest missed rate among all site clusters (17.4%). Quantifying the number of missed for-hire vessels at these sites was determined by monitoring boat trailers in the parking lot. This approach was sufficient so long as trailers used by for-hire guides could be differentiated from those used by private vessels. Such was the case at two of the sites, as the South Islamorada cluster Lor-e-Lei boat ramp was exclusively used by for-hire guides, and one of the SLTK cluster boat ramps had a parking area designated only for guides. Identifying for-hire trailers at the other SLTK cluster boat ramp was more problematic, as they were mixed with private vessel trailers, and may have led to inaccurate counts of missed vessels.

Aside from boat ramps, higher missed rates were also associated with some clusters comprised of multiple marinas with high activity levels in which vessels returned at similar times (North Islamorada cluster=15.0%; Port Everglades cluster=14.2%). Samplers were able to interview all active vessels within these clusters during periods of low to moderate activity, suggesting the aggregation of sites within these clusters may not have been optimal. Despite the higher missed rate in these clusters, the sampling protocol that permitted samplers to freely move between sites within the cluster during an assignment did facilitate increased sampling productivity, with 58.2% of all Keys and 54.4% of all SEFL interviews being completed at secondary sites. Furthermore, clusters comprised of active marinas with vessels returning at staggered return times, such as the Jupiter Inlet cluster in SEFL, had very low missed rates (1.9%). Vessels at one site within this cluster regularly returned from morning trips between 10:30 to 11:00 hours, while vessels at another site typically returned between 11:30 to 12:30 hours. Despite the expansion of this cluster from 3 to 6 sites by the end of the study, intercepting all active vessels returning to these sites was possible due to the staggered trip return times and ability to visually observe vessels returning through the inlet throughout the assignment.

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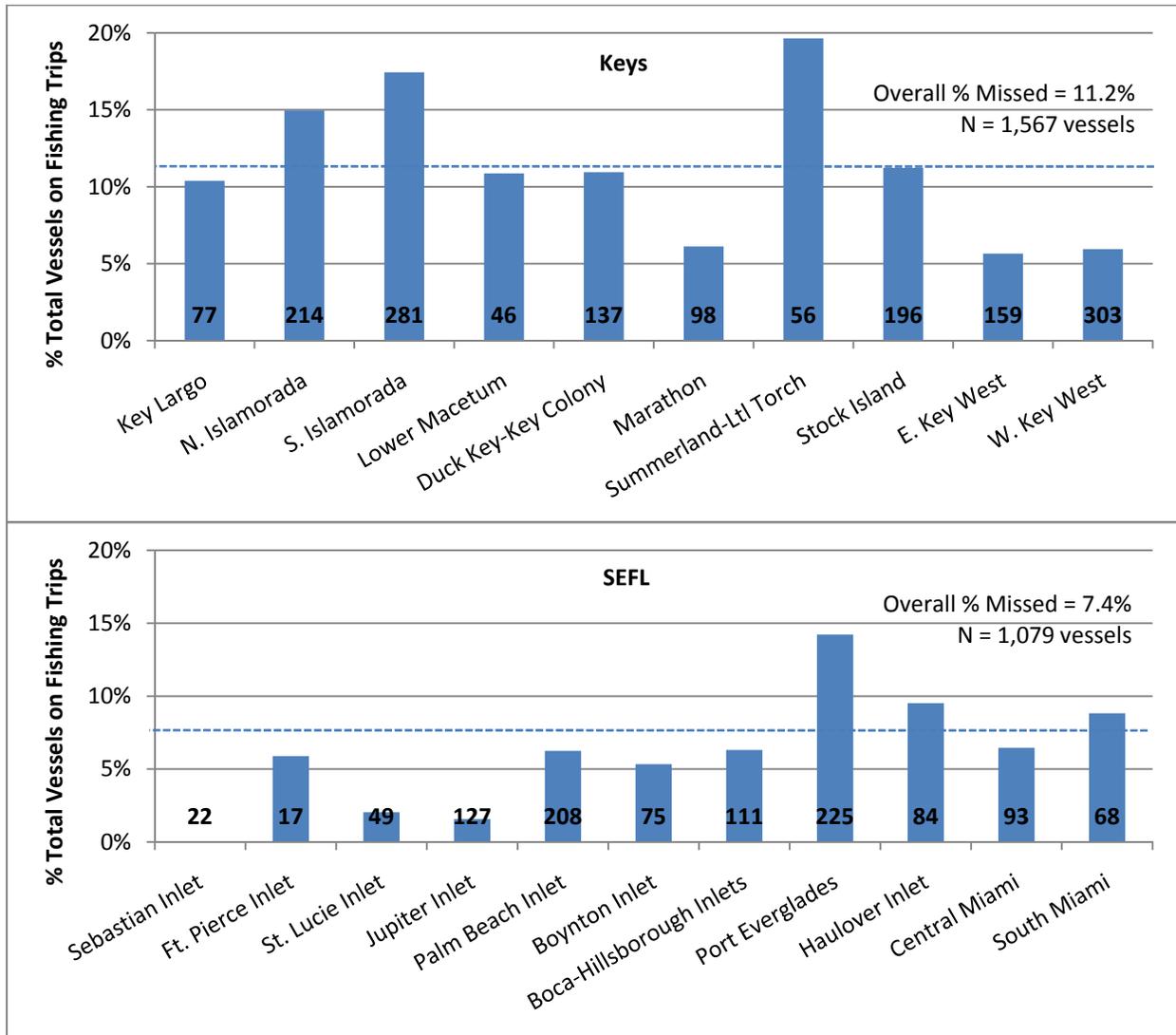


Figure 5 – Frequency of “missing” vessels by Florida subregion that were actively fishing during the FIS within each site cluster. The mean proportion of missed vessels throughout the subregion is indicated by the blue dotted line. Data labels indicate the total number of vessels believed to be actively fishing within the cluster, including those that were interviewed (HMS and non-HMS), refused to be interviewed, and missed vessels.

Independent of the FIS sampling, a separate field intercept survey was conducted for for-hire vessels returning at night from swordfish trips. Attempts to intercept vessels returning after 20:00 hours were made during the first eight months of the pilot study yet resulted in only four trips being sampled. To increase the likelihood of intercepting active vessels, the night assignment draw was expanded to randomly select counties rather than site clusters each week, as well as attempting to coordinate sampling efforts with captains that had scheduled trips. The design modifications could not overcome an unexpected lack of for-hire night fishing activity throughout the summer and fall. Despite a definitive increase in private swordfish trips that was documented by the Florida HMS Private Angler Telephone Survey during the late fall of 2008 (MRIP, 2010), for-hire night effort did not increase and the night field intercept survey was discontinued at the end of 2008.

4.2 Telephone Survey Dialing Results

The first sample period for both telephone surveys began on April 28, 2008 and continued through June 28, 2009. Telephone sampling was initiated on May 4, 2008 and concluded on July 10, 2009. Over the course of the 14-month survey, 4,242 vessel selections were drawn (787 unique vessels) for the For-Hire Telephone Survey (FHS). For the HMS Charter/Headboat Permit Telephone Survey (CHS), 1,043 vessel selections, consisting of 362 individual vessels, were drawn over 12 months from July, 2008 until June, 2009. Data collection during the first sample wave (May-June 2008) of the CHS was incomplete due to the sudden departure of a sampler, that resulted in the exclusion of this wave from the analysis.

Dialing results for the FHS are presented in Figure 6 for each sample wave in both subregions. An average of 54.3% of all selected FHS vessels were successfully contacted and completed interviews (varied 44.3-59.4% by sample wave). Vessels deemed ineligible for the survey (*i.e.*, the vessel sank, sold, no longer actively chartering, or was permanently moved out of study area) accounted for 2.4% of all vessels (varied 1.4-3.3% by wave) whereas vessels that were temporarily inactive (*i.e.*, vessel repairs, vessel temporarily outside the study area, captain out of town, family illness, etc.) accounted for 5.7% of all selected vessels (varied 2.6%-9.2% by wave). Inactivity rates were higher in the summer and fall months reflecting the seasonal movement of many vessels to northern states. Vessel representatives that refused to participate in the FHS averaged 12.4% of all vessels (varied 9.0-16.4% by wave) while the remaining 25.3% of vessel representatives could not be successfully contacted after five attempts (varied 19.6-31.9% by wave).

FHS sampling in the Keys was more difficult, with representatives from only 49.0% of all selected vessels being successfully contacted and interviewed. In comparison, successful contact rates averaged 63.5% in SEFL. Unsuccessful contact attempts were nearly double in the Keys, averaging 30.8% compared to only 15.7% in SEFL. Differences in cooperation levels were even more pronounced, with only 6.1% of SEFL vessel representatives refusing to participate, in contrast to a refusal rate of 15.9% in the Keys. The higher refusal rate in the Keys may have been attributable to recent changes in snapper-grouper regulations in the Gulf of Mexico that did not affect most SEFL for-hire vessels. Few Keys vessel representatives reported being inactive (2.0%) compared to 12.3% in SEFL, which seasonally varied from a high of 20.6% of all SEFL vessels in the summer to a low of 5.9% at the peak of tourism season in March-April 2009.

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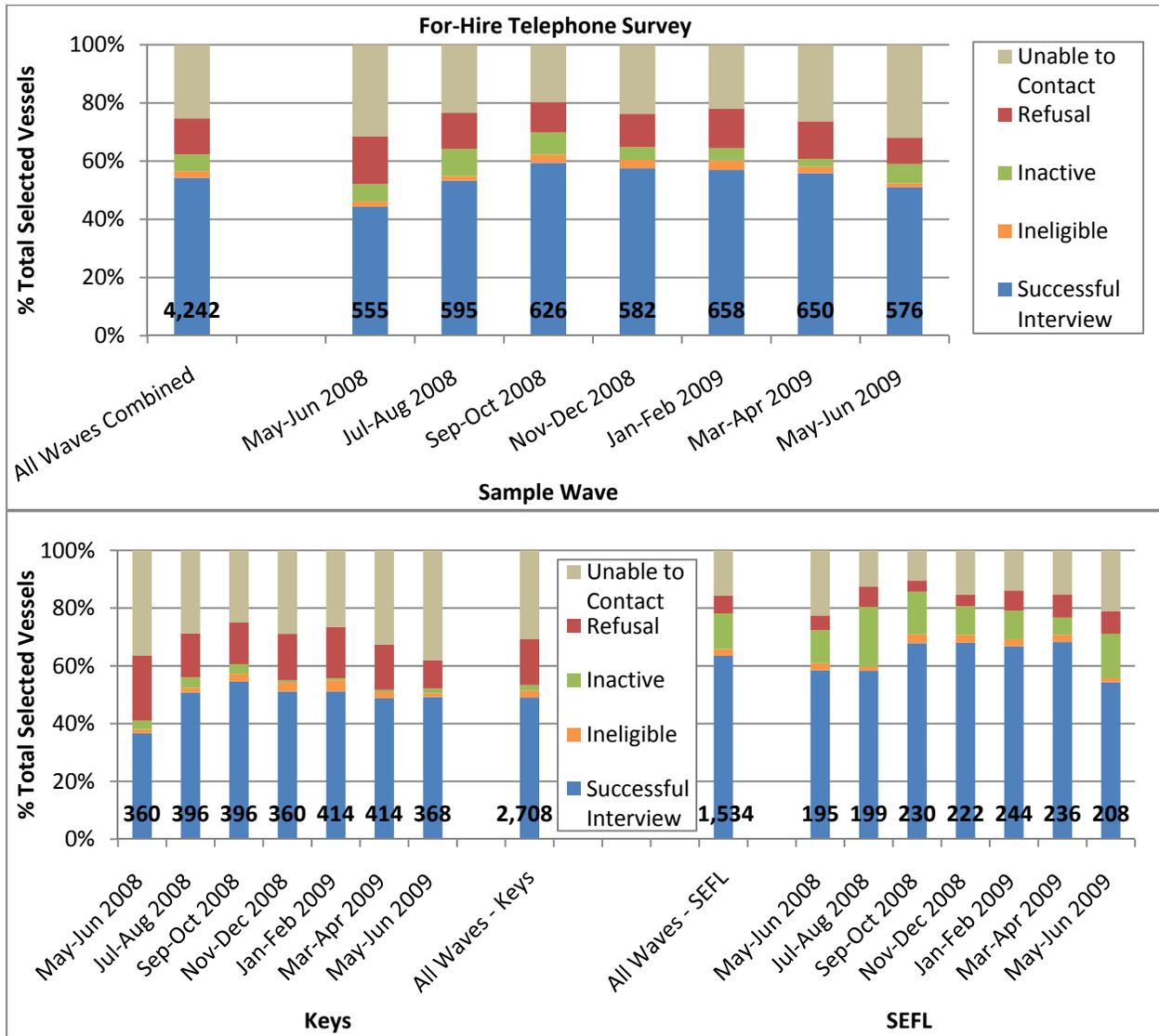


Figure 6 – Dialing results for the FHS in the Keys and SEFL subregions over the 14 months the HMS For-Hire pilot study was conducted. Upper graph shows combined results for both subregions for each 2-month sample wave. The lower graph shows results within each subregion. Data labels indicate total number of selected vessels per wave.

Dialing results for the CHS are presented in Figure 7 for each sample wave in both subregions. Successful contact rates were lower for the CHS compared to the FHS, with an average of 42.2% of all selected CHS vessel representatives providing complete interviews (varied 34.2-46.3% by sample wave). The lower contact rate was attributed to higher proportions of ineligible (10.7%, varied 7.1-16.2% by wave) and inactive (15.1%, varied 12.3-17.1% by wave) vessels. Higher proportions of ineligible and inactive vessels was expected since this was the first time most of these permit holders had been contacted in a directed HMS survey; as opposed to the FHS vessel frame which is maintained and regularly updated every two months for vessel activity. Refusal rates were lower for the CHS (7.8%, varied 5.8-13.7% by wave) whereas the proportion of unsuccessfully contacted vessels was similar between the surveys (24.2%, varied 17.5-31.8% by wave).

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As with the FHS, there were differences in dialing results between the subregions. Higher proportions of vessels selected in the Keys were attributed to both successful contacts (Keys=49.0% versus SEFL=37.6%) and unsuccessful contacts (Keys=31.3% versus SEFL=19.4%). Overall, vessels selected in SEFL comprised greater proportions of ineligible (SEFL=11.7% versus Keys=9.3%), inactive (SEFL=21.3% versus Keys=6.0%), and uncooperative (SEFL=10.1% versus Keys=4.3%) permit holders.

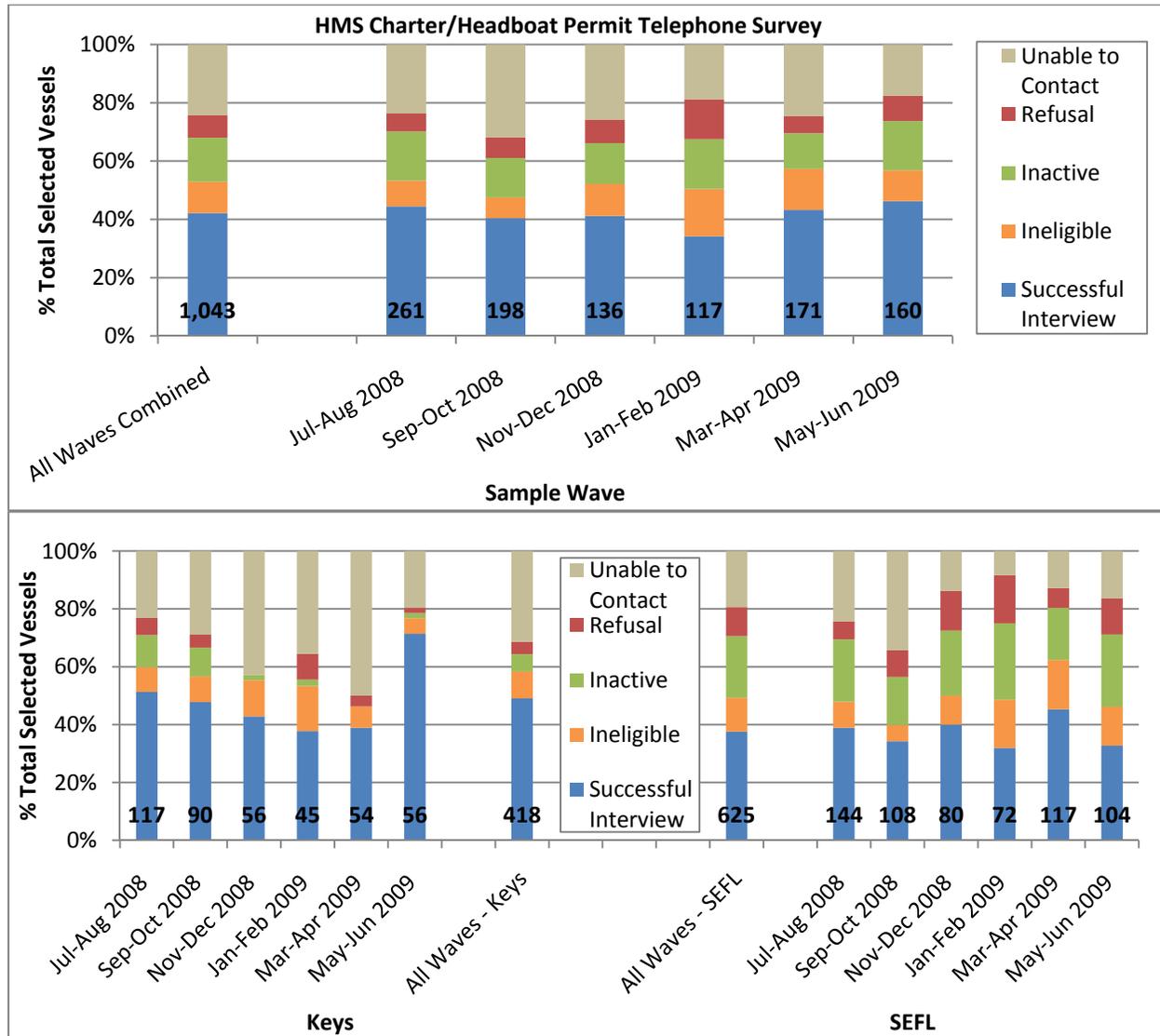


Figure 7 – Dialing results for the CHS in the Keys and SEFL subregions over the last 12 months the HMS For-Hire pilot study was conducted (data from the May-June 2008 wave is not presented due to incomplete data collection). Upper graph shows combined results for both subregions for each 2-month sample wave. The lower graph shows results within each subregion. Data labels indicate total number of selected vessels per wave.

4.3 HMS Trip Data Analysis

In this section, results from the FIS and both the FHS and CHS are presented side-by-side to describe characteristics of Florida’s for-hire HMS fishery. When results for both telephone surveys are reported, they will be consolidated and reported as the Combined Telephone Surveys (CTS), alongside the FIS results. For attributes that were not sampled by all three surveys the specific survey(s) are referenced (*i.e.*, FIS, FHS, and/or CHS). While the different sampling methodologies are not being compared in this section, important differences between the survey results are noted and discussed. Results for FIS swordfish and CTS marlin trips are shown in the figures, but are not reported in the text due to low sample sizes. A broader analysis that assesses and compares the sampling coverage (section 4.5), accuracy (section 4.6), and derived catch rates (section 4.8) for the respective sampling methodologies is presented later in the report.

Both the FIS and FHS attempted to sample all trips conducted by the for-hire vessels interviewed. Sampled trips for which HMS were targeted and/or caught were classified as HMS trips, whereas all others were considered non-HMS trips (Figure 8). As stated earlier, blackfin tuna, little tunny, Atlantic sharpnose, bonnethead, and nurse sharks were excluded from the HMS trip classification in order to focus the pilot study on the lesser known elements of the HMS fishery. During the FIS, HMS trips accounted for 39.0% of the 2,276 sampled trips. In contrast, HMS trips were reported less frequently during the FHS, accounting for only 23.7% of the 4,165 trips. Trip type could not be determined for 23 FHS trips due to the inability of respondents to recall catch. Unlike the FIS and FHS, the CHS only recorded HMS trips. Results for non-HMS trips are not presented in this report since the purpose of this pilot study was to investigate and describe the for-hire HMS fishery.

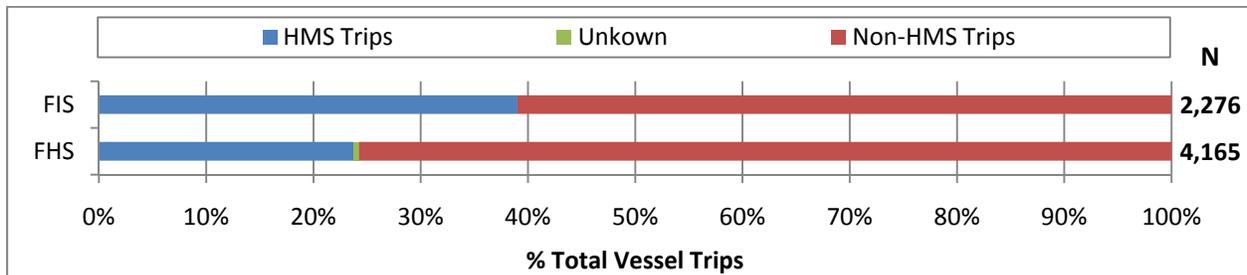


Figure 8 – Trip type classification, with an HMS trip defined as any trip during which a billfish, swordfish, tuna, or shark were targeted or caught, either intentionally or incidentally as bycatch. N indicates total number of trips for each survey. (Note, the following species were excluded from classifying a trip as “HMS”: little tunny, blackfin tuna, Atlantic sharpnose, bonnethead, and nurse shark)

Although this study was designed to exclusively sample known charter boats and HMS Charter/Headboat permitted vessels, some vessels did conduct private trips without paying customers (Figure 9). Private trips accounted for 5.6% of all FIS HMS trips and 6.1% of all HMS trips reported to the CTS. The species composition of HMS trips was further classified into five HMS groups based on what was targeted and/or caught during the trip: sailfish, marlin, swordfish, tunas, and sharks. Private trips were more common for some HMS groups, accounting for 15.8% of all CTS swordfish trips, as well as 7.4% of all FIS and 15.5% of all CTS tuna trips. Among the CTS tuna trips, nearly half of those in which yellowfin tuna (YFT) or bluefin tuna (BFT) were targeted or caught were private (43.2% of 16 trips). In contrast, sharks were targeted or caught on very few private trips (FIS=4.2%; CTS=1.2%).

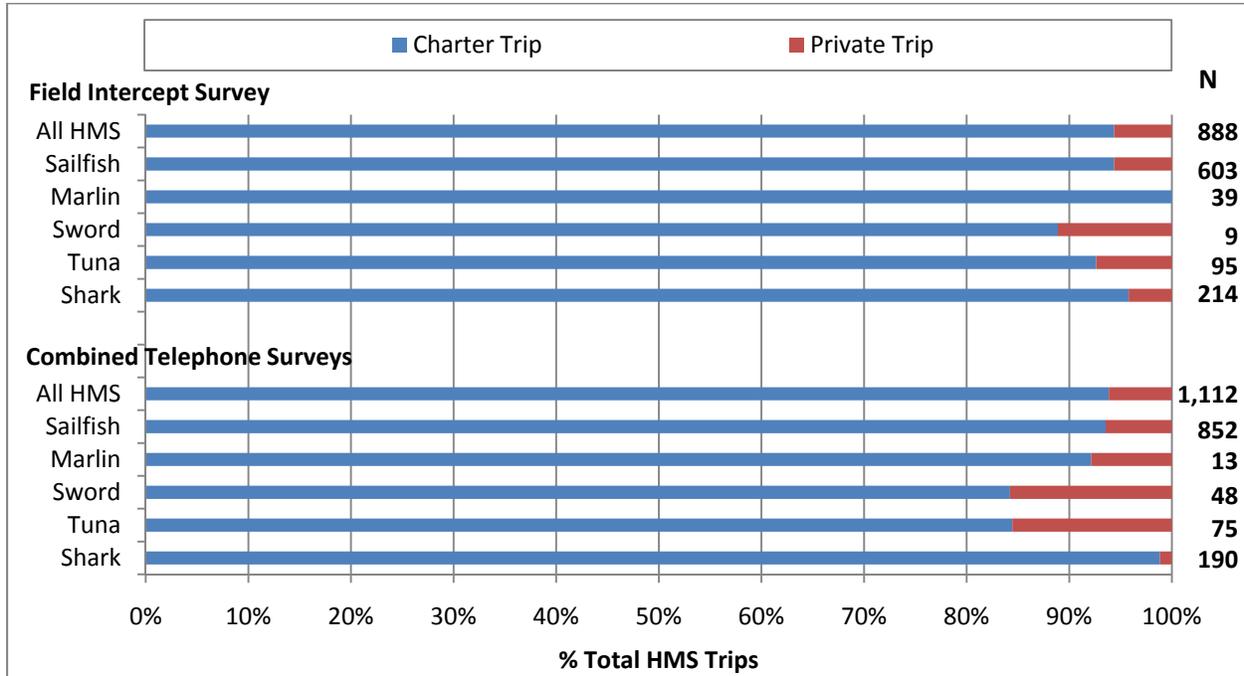


Figure 9 – Distribution of all HMS trips by fishing mode. N indicates total number of trips for each HMS group.

4.3.1 HMS Charter Trip Analysis

In keeping with the primary focus of this study on for-hire HMS fishing, trip data analysis presented in this subsection only pertains to HMS charter trips; whereas analysis of private trips is presented separately in subsection 4.3.2.

HMS charter trips were classified into the five HMS groups shown in Figure 9, based on HMS species targeted and/or caught on each trip. It should be noted that the FIS differed from the telephone surveys in that it allowed a 3rd target species to be reported. In contrast, the FHS only allows two target species. Despite the recognized inconsistency with the FHS, the target species question was expanded in the FIS to allow anglers to report a 3rd target species to aid in the characterization of the HMS fishery. The FIS results show for-hire vessel representatives reported three target species for 31.5% of all HMS charter trips, accounting for an equivalent proportion of trips in which one (31.0%) or two (32.8%) target species were reported. The similar distribution was also reported during the CTS, with vessel representatives reporting having targeted one (46.3%) or two (49.5%) target species with similar frequency. In addition, both surveys reported less than 5% of vessel representatives chose not to specify a target preference (FIS=4.7%; CTS=4.2%). Because the target species question did not ask the vessel representative to prioritize the species preference, it could not be assumed the 3rd target species was less important or accounted for the least amount of the trip’s fishing time relative to the other target species. Thus, FIS trips were classified using the 3rd target species responses when applicable. If the 3rd target species responses had not been used to classify FIS trips, 67 trips (8.0%) would have been excluded from the analysis, since neither the 1st or 2nd targets were HMS, nor were any HMS caught as bycatch.

The species composition of HMS charter trips is shown in Figure 10. Among the five groups, sailfish comprised the largest proportion of all HMS trips (FIS=60.6%; CTS=71.5%), followed by sharks (FIS=19.6%; CTS=16.0%) and tunas (FIS=7.8%; CTS=4.4%). Swordfish and marlin each accounted for less

than 3% of all HMS trips in all surveys. A sixth category in which species from two or more HMS groups were targeted and/or caught accounted for 8.5% of all FIS trips and 4.9% of all CTS trips. Exclusion of the 3rd target species responses would have minimally affected the composition of FIS trips; the proportion of multi-HMS trips would have decreased to 7.0%, while changing less than 1% for all other HMS groups. Due to the low frequency of multi-HMS trips, all results for the remainder of this report are presented for individual HMS groups only. Multi-HMS trips are reflected in each respective HMS group’s summaries. With the inclusion of these trips, the actual occurrence of each HMS group is as follows: Sailfish (FIS=67.9%; CTS=75.3%), sharks (FIS=24.5%; CTS=19.1%), tunas (FIS=10.5%; CTS=6.0%), marlin (FIS=4.7%; CTS=1.2%), and swordfish (FIS=1.0%; CTS=3.3%), as shown in the bottom graph of Figure 10. Recognizing the survey only covered a 14-month period, these results indicate that marlin and swordfish catches are a rare event even within a sample universe that is focused on HMS trips.

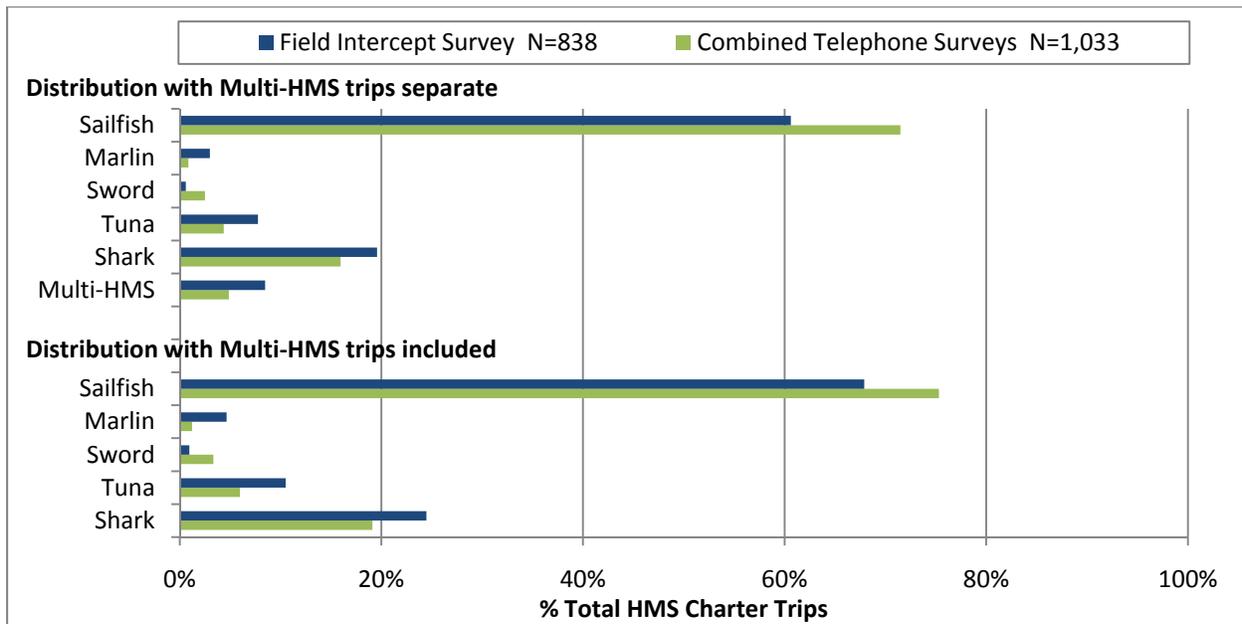


Figure 10 – HMS charter trip classification determined by the species from each HMS group that were targeted and/or caught on a trip. Upper graph shows a separate “Multi-HMS” category for trips in which species from two or more HMS groups were reported. Bottom graph redistributes Multi-HMS trips to each respective HMS group to show each group’s actual frequency of occurrence. N indicates total number of trips.

Both the FIS and CTS detected seasonal variations in the frequency of each HMS group (Figure 11). Overall, HMS trips occurred more frequently during the winter and spring months, with the Jan-Feb 2009 wave being the most active (FIS=21.5% of all HMS trips; CTS=25.3%) and the September-October wave the least active (FIS=7.0%; CTS=6.6%). Sailfish trips occurred year-round, but more than two-thirds occurred from November, 2008 – April, 2009 (FIS=68.5% of all sailfish trips; CTS=67.7%). Shark trips were more equally distributed throughout the year, but were most common during the March-April 2009 wave (FIS=22.4% of all shark trips; CTS=23.8%). Differences between the survey results were more apparent for other HMS groups, but this may be due more to smaller sample size and differences in survey designs. In general, tuna and marlin trips occurred primarily during the late spring and summer months. Swordfish trips were recorded year-round, but were most common during the summer and fall months based on the CTS results (the FIS only recorded 8 swordfish trips, compared to 40 by the CTS).

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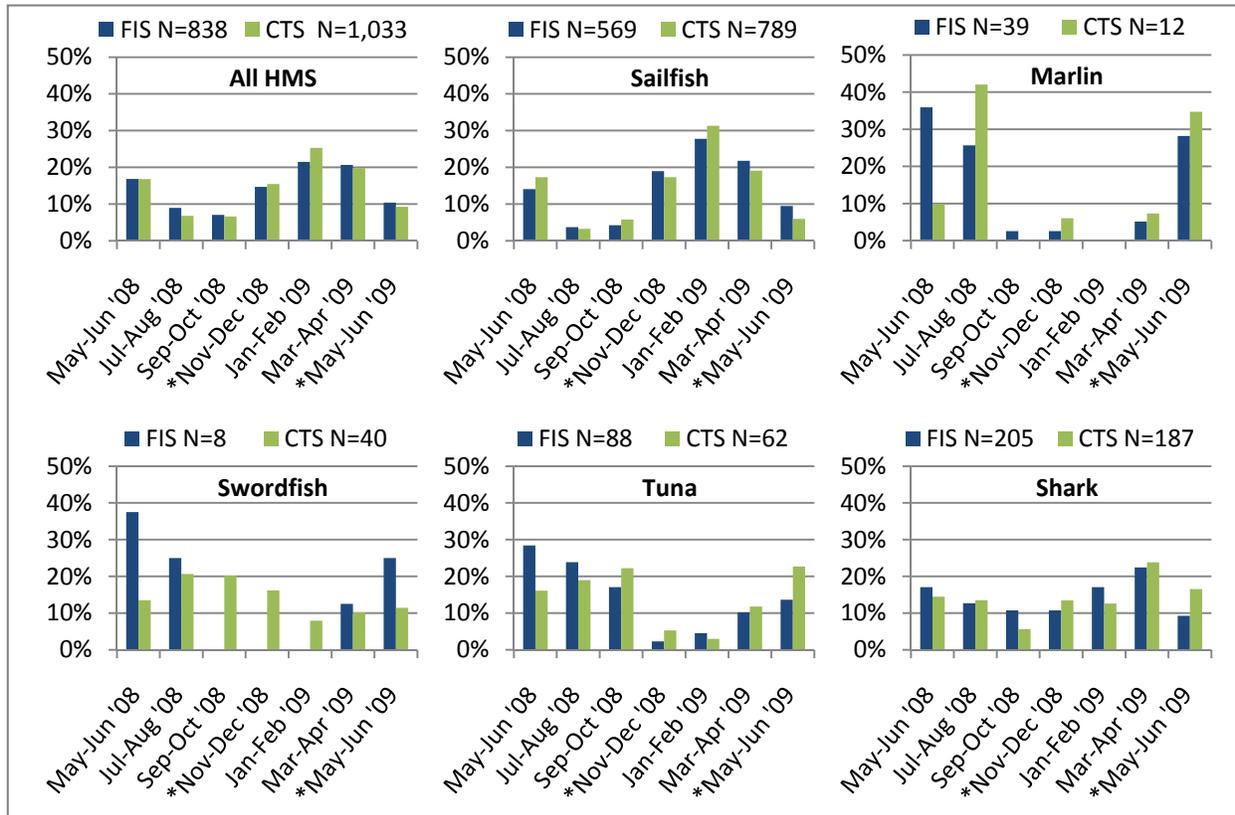


Figure 11 - Temporal distribution of trips for each HMS group. N indicates total number of trips. (Note, the Nov-Dec 2008 and May-Jun 2009 waves comprised of 8 sample weeks, while all other waves had 9)

For-Hire vessel representatives reported a broad diversity of target species during HMS charter trips. The FIS recorded 15 different HMS targets along with 30 non-HMS targets, whereas 9 HMS targets and 23 non-HMS targets were reported to the CTS (Appendix G). Analysis of trip results for each HMS group show differences in target preference and trip success (Figure 12). HMS trips were classified into three trip result categories, using the following criteria:

- **Targeted, No Catch** – trips in which a species, genus, or family from an HMS group was one of the targets, but resulted in no catches from the HMS group. Note, the FIS allowed vessel representatives to report three target species, while the CTS only allowed two target species to be reported due to the current FHS sampling protocol.
- **Targeted with catch** - trips in which a species, genus, or family from an HMS group was one of the targeted preferences, and resulted in a species from the targeted HMS group being caught.
- **Bycatch only** – trips in which none of the species, genera, or families that comprised an HMS group were targeted, but resulted in a species from the HMS group being caught.

Overall, HMS were targeted during approximately 80% of FIS and CTS HMS trips. FIS targeted HMS trips were similarly split between “targeted, no catch” trips (41.3%) and “targeted with catch” trips (38.7%), whereas the CTS results showed “targeted with catch” trips were more common (47.1%) than unsuccessful “targeted, no catch” trips (32.3%). CTS “bycatch only” (20.6%) trips were similar to the FIS results (20.0%). Among the HMS groups, sailfish were targeted during most of their trips, with “bycatch only” trips comprising just 10.0% of FIS and 13.6% of CTS sailfish trips. A greater proportion of the targeted CTS sailfish trips did result in successful catches (FIS=41.1% versus CTS=50.5% “targeted with

catch” trips). Swordfish were targeted during all but one of their trips, with targeted CTS swordfish trips split nearly equally regarding success rate (52.7% “targeted, no catch” versus 45.2% “targeted with catch”). FIS results showed greater proportions of tuna being caught as bycatch (FIS=65.9% versus CTS=44.9% “bycatch only” trips), with very few “targeted with catch” trips reported by either survey (FIS=2.3% “targeted with catch” trips; CTS=11.2%). It should be noted this success rate does not include blackfin tuna catches, even though “tuna genus” was the reported target species for all of the FIS tuna targeted trips and most CTS trips (31 of 35 tuna targeted trips). If all FIS trips in which blackfin tunas were targeted and/or caught were included with HMS tuna trips, “bycatch only” would account for 57.8% of the 244 trips, whereas “targeted with catch” trips (22.5%) would be more frequent than “targeted, no catch” trips (19.7%) (blackfin tuna catches were not recorded during the CTS). FIS results showed smaller proportions of bycatch trips for sharks than the CTS (FIS=42.4% versus CTS=56.4% “bycatch only” trips), while both surveys more frequently reported successful targeted sharks trips (FIS=32.7% “targeted with catch” versus 24.9% “targeted, no catch” trips; CTS=28.2% “targeted with catch” versus 15.4% “targeted, no catch” trips). Marlin were primarily targeted unsuccessfully (FIS=92.3% “targeted, no catch”), with all FIS marlin catches occurring as incidental bycatch.

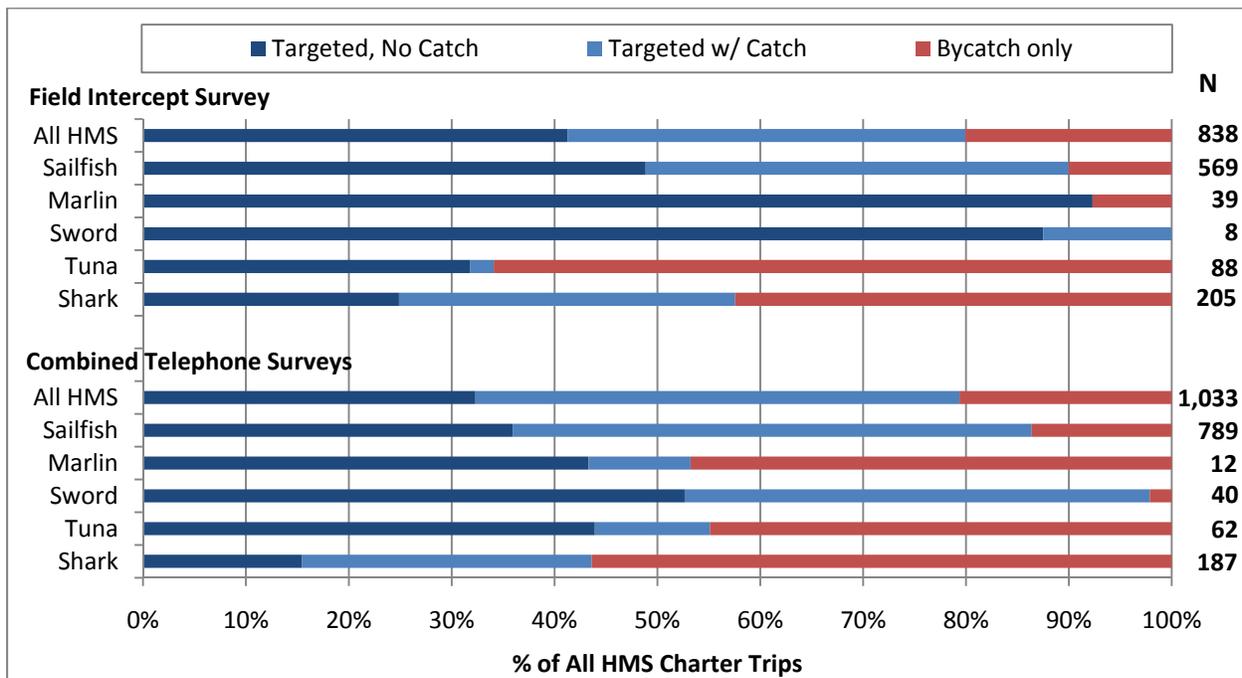


Figure 12 – Distribution of HMS charter trips by the result of the trip for each HMS group. “Targeted, No Catch” indicates trips in which species within an HMS group were targeted but not caught; “Targeted w/ Catch” indicates trips in which species within an HMS group were targeted and caught; “Bycatch Only” indicates trips in which species within an HMS group were caught incidentally while targeting other species. N indicates total number of trips for each HMS group.

Tournament fishing did not comprise a major portion of HMS charter trips, accounting for only 3.9% of all FIS HMS trips and 4.1% of CTS HMS trips (Figure 13). Marlin trips were the most frequently associated with tournament fishing (FIS= 10.3% of all marlin trips) but accounted for less than 7% for all other HMS groups (FIS=4.0% sailfish, 6.8% tuna, 1.5% shark; CTS=4.2% sailfish, 2.3% swordfish, 1.6% tuna, 3.1% shark).

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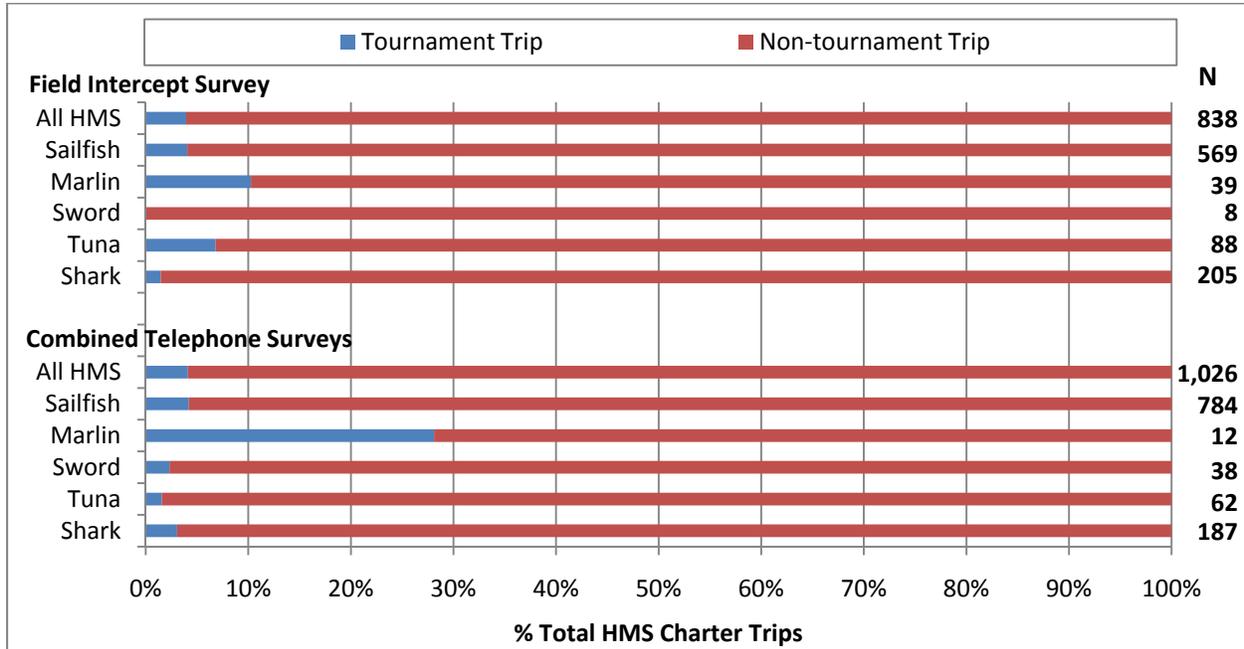


Figure 13 – Distribution of HMS charter tournament trips by HMS group for each survey. N indicates total number of trips for each HMS group.

The FIS was only conducted at access sites already covered by the MRFSS that were known to be regularly used by for-hire vessels. Other MRFSS sites that were used infrequently by for-hire vessels, including most boat ramps, were excluded from FIS sampling. The CTS facilitated the extension of sampling activities to include vessels operating out of sites not covered by the FIS (*i.e.*, other MRFSS sites, public sites not covered by the MRFSS, or private access sites). This made it possible to assess the extent of under-coverage bias concerning the FIS site list, as well as to the MRFSS in regards to private access for-hire fishing. CTS results showed most for-hire vessels operated out of sites sampled by the FIS (90.6% of all HMS trips); while a small proportion of HMS trips returned to other public (6.6%) and private (2.8%) access sites (Figure 14). While 9.1% of all swordfish trips returned to private access sites, less than 4% of all other HMS groups returned to private sites inaccessible to field samplers. For-hire vessels did operate out of other MRFSS or public sites not covered by the FIS more frequently for some HMS groups, accounting for 17.7% of all tuna trips, 11.6% of all swordfish trips, and 9.2% of all shark trips. Most of these trips returned to public boat ramps in SEFL already on the MRFSS site register.

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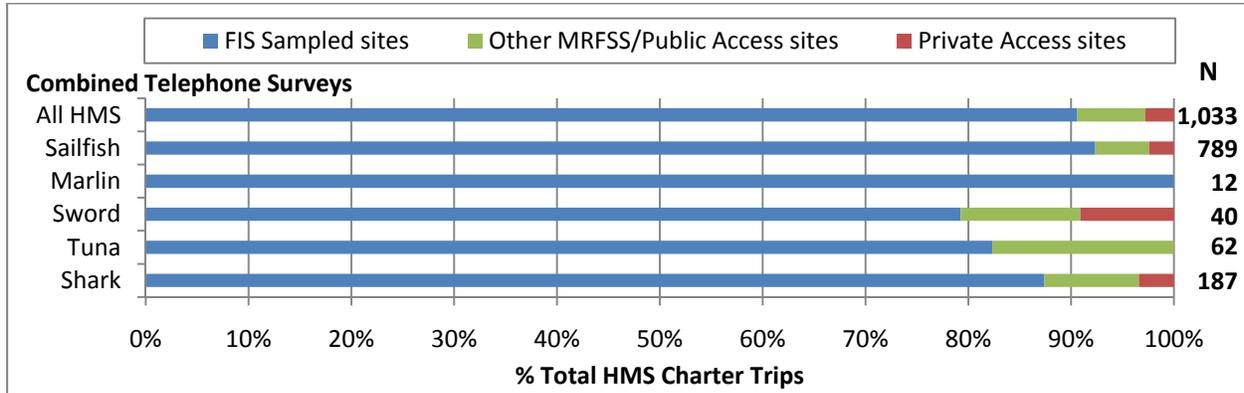


Figure 14 - Distribution of CTS HMS charter trips by the access site type used for trips within each HMS group. “FIS Sampled sites” indicate MRFSS sites that were sampled by the FIS; “Other MRFSS/Public Access sites” indicate MRFSS sites that were not sampled by the FIS, plus other public access sites that were not on the MRFSS site register; “Private Access sites” indicate sites that are not accessible to samplers conducting the FIS or MRFSS intercept surveys. N indicates total number of trips for each HMS group.

There was considerable variability in the spatial distribution of trips among HMS groups (Figure 15). Overall, HMS trips were primarily conducted in U.S. Federal waters (>3 miles from shore in the Atlantic and > 10 miles in the Gulf of Mexico), accounting for 57.4% of all FIS HMS trips and 56.7% of all CTS HMS trips. Sharks were the only HMS group whose trips primarily occurred in Florida State waters (including Florida Bay and all inland waters), with 79.0% of FIS and 70.8% of CTS shark trips. The results of both surveys showed all swordfish trips and all but one marlin trip occurred in Federal waters. Although the majority of sailfish and tuna trips also occurred in Federal waters, 38.3% of FIS and 39.7% of CTS sailfish trips occurred within State waters, as well as 10.2% of FIS and 22.1% of CTS tuna trips. One charter trip targeting yellowfin tuna in the Bahamas was also reported to the CTS.

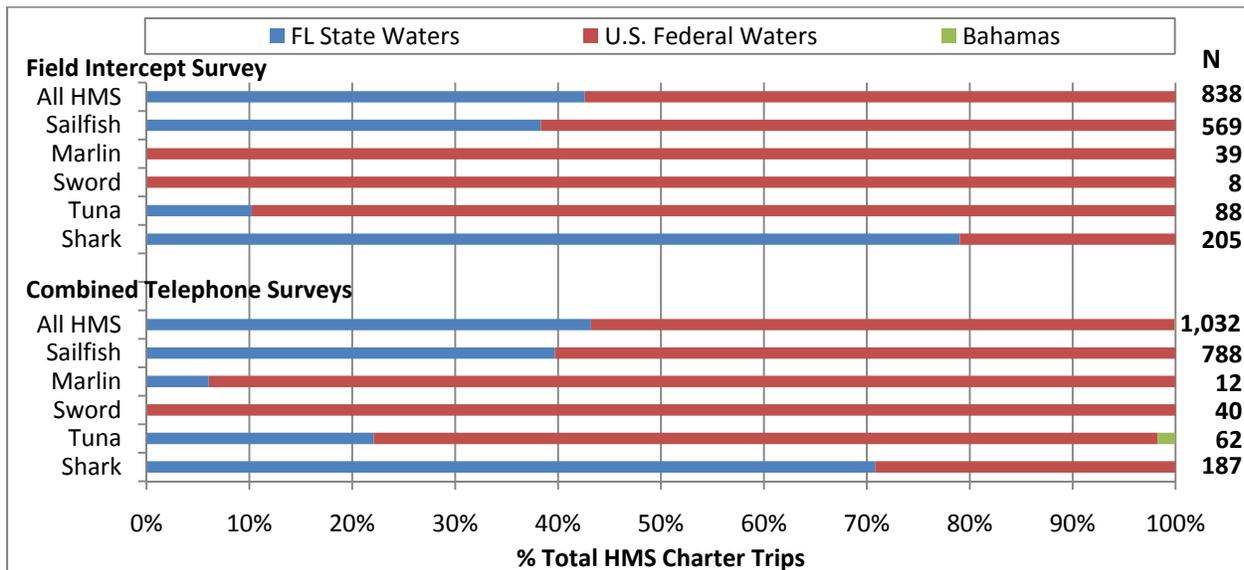


Figure 15 – Distribution of HMS charter trips by area fished for each HMS group. Florida state waters include all Atlantic waters ≤ 3mi from shore, all Gulf of Mexico waters ≤ 10mi from shore, and all inland waters; U.S. Federal waters are comprised of all other waters in the U.S. EEZ; “Bahamas” indicates territorial waters of the Bahamas. N indicates total number of trips for each HMS group.

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The CTS only asked vessel representatives what general area they primarily fished: inland, state, or Federal waters of the Atlantic Ocean (or Gulf of Mexico for vessels in the Keys). The FIS also asked vessel representatives for the specific distance from shore the vessel primarily fished. The mean distance reported for all HMS trips was 6.7 miles (Table 3), with vessels in the Keys on average fishing more than twice as far from shore than vessels in SEFL (Keys=8.9 miles, SEFL=4.1 miles). Shark trips stayed closest to shore (3.1 miles), followed by sailfish (5.9 miles), tuna (15.5 miles), marlin (16.7 miles), and swordfish (20.6); although the variability between tuna, marlin, and swordfish indicate these distances are not significantly different.

Table 3 – Mean distance from shore for HMS charter trips from each HMS group sampled during the FIS. The distance was reported by the vessel representative as the primary distance from shore where most of the trip’s fishing activity was conducted. Mean distance for HMS charter trips in the Keys and SEFL subregions are also reported. Standard Error is indicated by \pm .

	<i>All HMS Charter Trips</i>	FL Subregion		HMS Species Group				
		<i>Keys</i>	<i>SEFL</i>	<i>Sailfish</i>	<i>Marlin</i>	<i>Sword</i>	<i>Tuna</i>	<i>Shark</i>
Mean Distance from Shore (mi)	6.7 \pm 0.3	8.9 \pm 0.5	4.1 \pm 0.3	5.9 \pm 0.2	16.7 \pm 1.5	20.6 \pm 3.5	15.5 \pm 2.1	3.1 \pm 0.3
Total # Trips	836	452	384	569	39	8	88	203

As with the variability in the area and distance from shore fished, there were differences among the HMS groups regarding bottom depth of the fishing grounds. For graphical presentation, primary fishing depth for each trip was consolidated into 100-ft increments out to 500-ft, 250 ft increments from 500 to 1000 ft, 500-ft increments from 1000 to 2000 ft, and in waters deeper than 2000 ft (Figure 16). There were considerable differences between HMS groups, with sharks, sailfish, and swordfish trips conducted within a relatively narrow depth range, whereas tuna and marlin trips were distributed over a much broader range. Shark trips took place in the shallowest waters, with 53.4% of FIS and 67.3% of CTS shark trips occurring inside 100 ft. Less than 15% of all shark trips occurred in depths greater than 200 ft (FIS=14.7%; CTS=14.8%). Hammerhead trips were the one exception, where 92.3% of FIS and 64.8% of CTS trips were in 100 to 400 ft. Sailfish trips also tended to be localized in shallower waters, with the 100 to 199 ft depth range accounting for 67.1% of FIS and 65.4% of CTS sailfish trips fishing, whereas relatively few trips occurred in 300 ft or greater (FIS=11.1%; CTS=10.2%). At the other end of the depth range, all swordfish trips were conducted in at least 750 ft. While the few swordfish trips intercepted by the FIS were distributed nearly equally between 750 and +2000 ft depths, most CTS trips (71.8%) occurred between 1500 and 2000 ft. Tuna trips were primarily distributed in three depth ranges: 100 to 299 ft (FIS=30.7%; CTS=29.3%), 500 to 749 ft (FIS=37.5%; CTS=36.1%), and greater than 1000 ft (FIS=11.4%; CTS=18.6%). These deepwater trips were exclusively for yellowfin tuna. Marlin trips were also broadly distributed, but primarily occurred between 500 to 999 ft (FIS=56.4%).

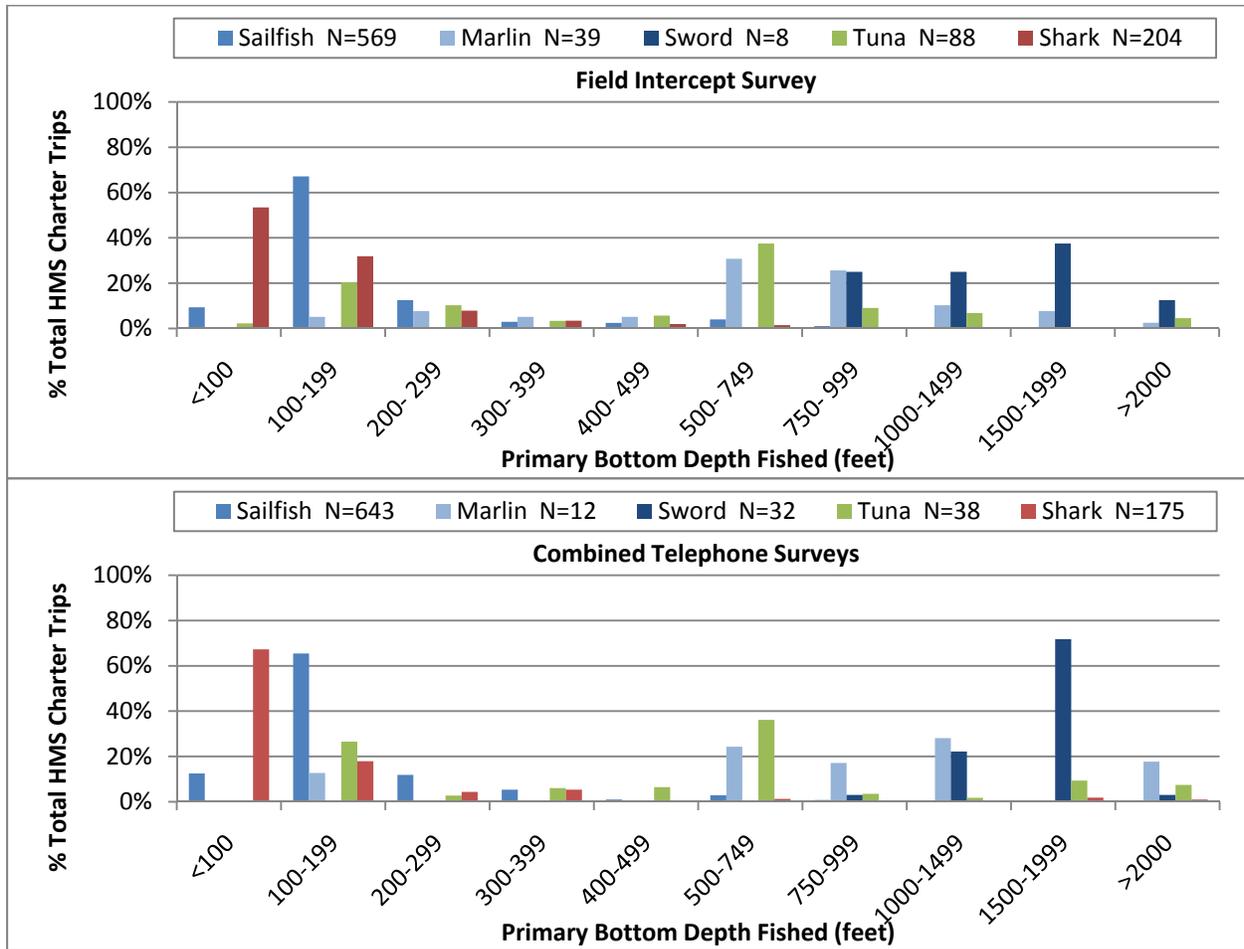


Figure 16 – Spatial distribution of trips by the primary bottom depth fished for each HMS group. Trips are classified in 100-ft depth increments up to 500 ft, 250-ft increments from 500 to 1000 ft, 500-ft increments from 1000 to 2000 ft, and trips occurring over depths greater than 2000 ft. N indicate total number of trips for each HMS group.

The temporal distribution of trips across a 7-day week is important to the design of access surveys in determining the correct proportion of weekday and weekend trips. This will determine how sampling efforts are distributed to reflect the fishery’s level of activity. Similar to the MRFSS, the eight FIS field assignments conducted each week were equally distributed between weekdays (Monday through Friday) and weekends (Saturday and Sunday). Unlike the MRFSS, though, holidays were not considered weekend days. The results of the CTS showed this even split did not reflect the actual distribution of for-hire HMS effort (Figure 17) as overall 65.0% of HMS trips were reported on weekdays. The distribution of trips on each day of the week was as follows: Monday=10.2%, Tuesday=10.6%, Wednesday=12.4%, Thursday=13.8%, Friday=18.0%, Saturday=21.2%, Sunday=13.8%. This indicates similar fishing activities between Friday/Saturday, Wednesday/Thursday/Sunday, and Monday/Tuesday.

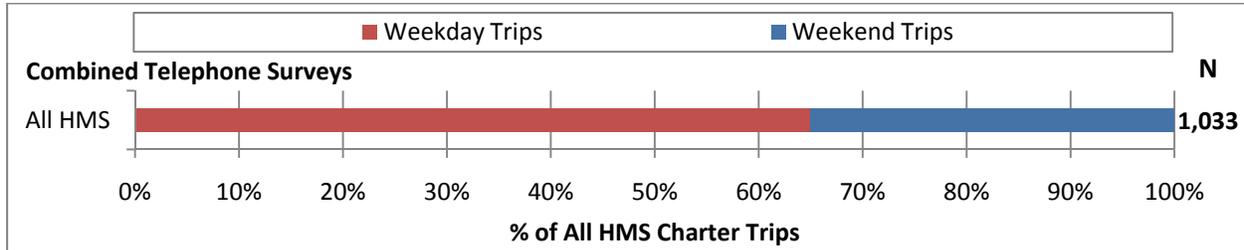


Figure 17 - Temporal distribution of trips reported to the telephone surveys between weekday (Monday – Friday) and weekends (Saturday and Sunday) for each HMS group. N indicates total number of trips for each HMS group.

The CTS collected the trip start and end times, allowing for classification of for-hire trips into trip length categories:

- **Half-day Trip** – trips lasting less than 5 hours in length.
- **Three-quarter-day Trip** – trips lasting 5 to 7 hours in length.
- **Full-day Trip** – trips lasting more than 7 hours that returned *before* 08:00 hours the next day (includes day trips and overnight trips).
- **2-day Trip** – trips lasting more than 24 hours that returned *after* 08:00 hours the next day.

The distribution of HMS charter trip lengths is shown in Figure 18. Most HMS trips were full-day trips (43.0%), followed by half-day trips (36.2%), and three-quarter-day trips (20.7%). There was only one 2-day trip that targeted yellowfin tuna and wahoo in the Bahamas. Full-day trips accounted for all marlin trips, 92.7% of swordfish trips, 60.5% of tuna trips, 43.8% of sailfish trips, and only 24.6% of shark trips. Half-day trips accounted for 51.3% of shark trips, 35.8% of sailfish trips, and only 16.9% of tuna trips. Three-quarter-day trips accounted for 24.2% of shark trips, 20.9% of tuna trips, 20.4% of sailfish trips, and 7.3% of swordfish trips. For-hire vessels in the Keys primarily conducted full-day trips (full-day trips=52.4%, half-day=24.1%, three-quarter-day=23.5%), whereas SEFL vessels primarily conducted half-day trips (half-day trips=46.5%, full-day=34.9%, three-quarter-day=18.4%).

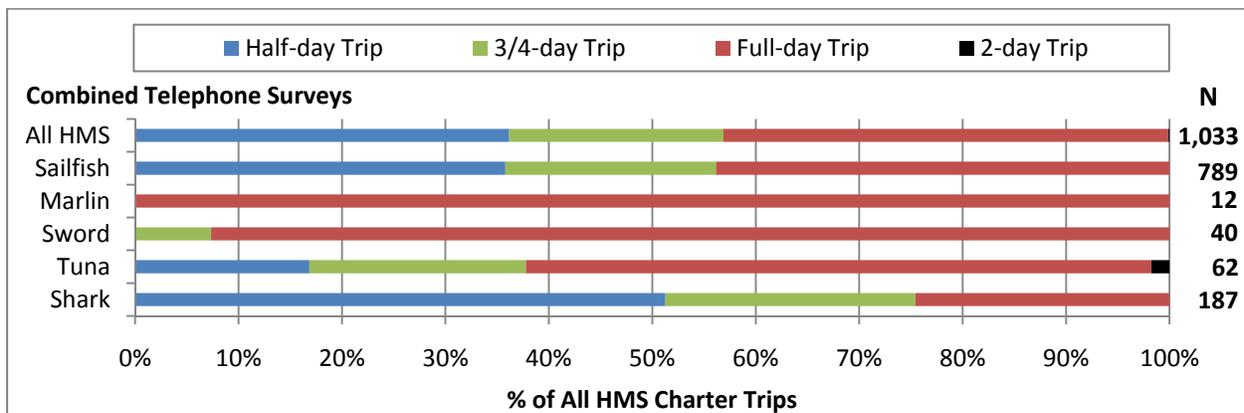


Figure 18 – Distribution of trip duration type reported to the combined telephone surveys by each HMS group. Trip duration type was defined by the trip length: “Half-day”= less than 5-hr trip length, “3/4-day”= 5 to 7-hr trip length, “Full-day”= day or night trip lasting more than 7-hr, “2-day”=trips that continued to the next day that returned after 08:00. N indicates number of trips for each HMS group.

The distribution of trip return times is shown in Figure 19A in one-hour increments during the daytime hours the FIS was conducted (08:00 to 19:59 hours). During this 12-hour time span, three 1-hr time periods stood out as peak return times for both surveys: 12:00 to 12:59, 15:00 to 15:59, and 16:00 to 16:59.

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16:59, accounting for 57.5% of all FIS HMS trips and 63.9% of all CTS HMS trips that returned during daytime hours. Overall, 50.5% of FIS and 43.3% of CTS HMS daytime trips returned before 15:00 hours, the time of day when most full-day trips would begin to return. Although 15:00 hours marked the approximate time when half of all HMS trips had returned for both surveys, swordfish (CTS=96.0%) and marlin (FIS=56.4%, CTS=100%) trips were more likely to end in the latter half of the day (Figure 19B). Earlier returns were slightly more common for shark trips (FIS=51.7%, CTS=53.3%).

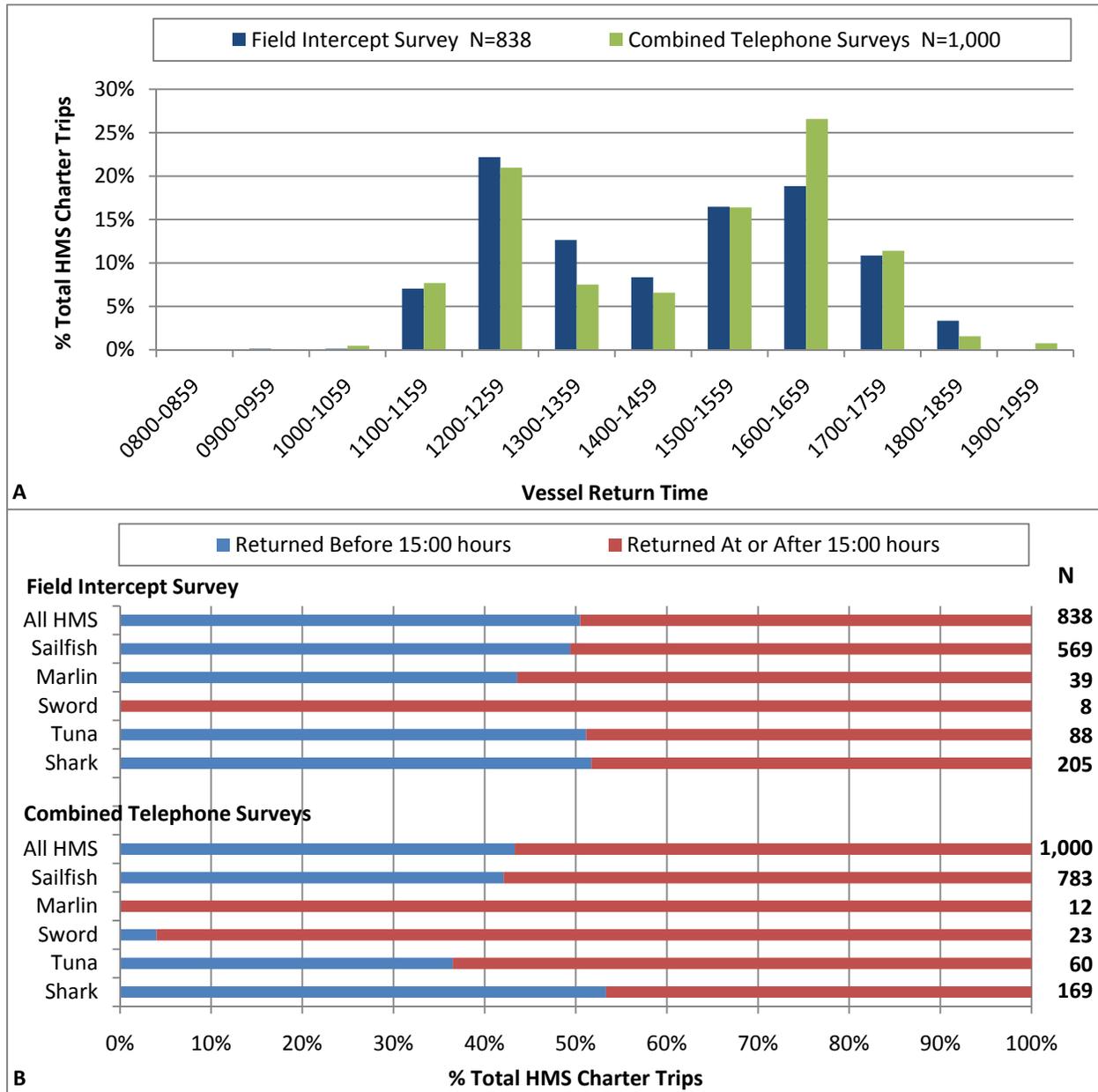


Figure 19 – Temporal distribution of trips returning to the access site during daytime hours (08:00 to 19:59 hours) for all HMS charter trips. The upper graph (A) shows vessel return times in 1-hr increments for all HMS trips. The lower graph (B) shows the proportion of trips that returned before and after 15:00 hours for each HMS group. N indicates number of trips. (Note, multiday trips that returned during daytime hours are included in the figure)

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A small number of HMS trips sampled by the CTS returned to their access sites at night between 20:00 and 07:59 hours (2.9% of all HMS trips). Trips that returned after midnight were classified as “multiday trips” under the 2005 FHS procedures manual (0.9% of all HMS trips). As shown in Figure 20, the majority of these multiday trips were targeting swordfish, accounting for 24.5% of all swordfish trips sampled by the CTS. The significance of this is that multiday trips are counted as two separate trips by the FHS during the effort estimation for the MRFSS, even if the trip ends shortly after midnight. This presents a potential bias for night fishing, which is popular for swordfish and other non-HMS species in Florida (*i.e.*, common snook and Atlantic tarpon). During this study, 39.5% of all swordfish trips returned at night between 20:00 and 07:59 hours the following morning, as well 9.1% of all shark trips. Similarly, nighttime returns accounted for 18.2% of targeted common snook and 30.5% of Atlantic tarpon charter trips reported in SEFL that were also reported to the FHS during the same time period.

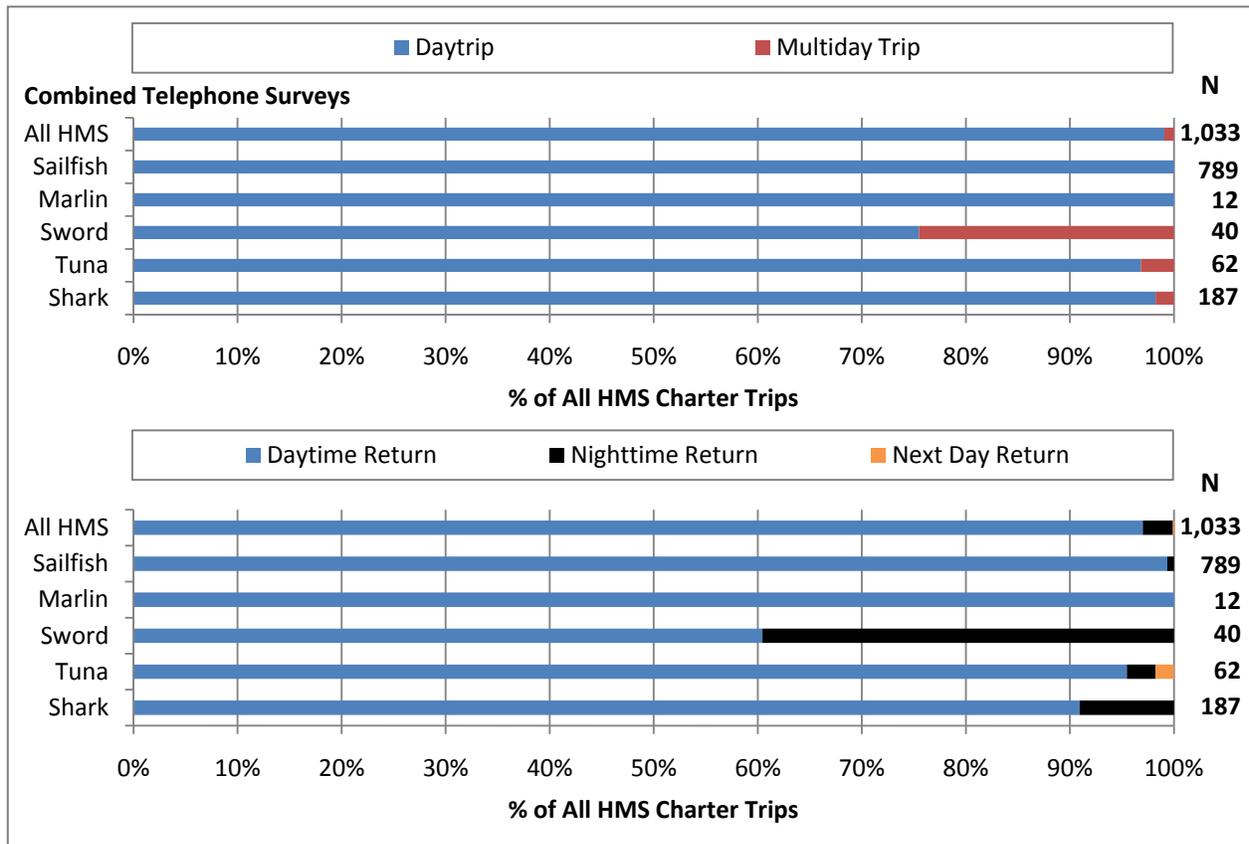


Figure 20 - Temporal distribution of trips reported to the telephone surveys by the return time for each HMS group. The upper graph shows the proportion of vessels that returned before midnight on the same day the trip began (“Daytrip”) compared to trips that extended past midnight the following day (“Multi-day trip”). The lower graph further classifies these trips by the return time into trips returning before 20:00 hours on the same day the trip originated (“Daytime Return”), trips returning at night between 20:00 and 07:59 hours the morning after the trip originated (“Nighttime Return”), and trips that returned the following day after 08:00 hours (“Next-day Return”). N indicates total number of trips for each HMS group.

Total trip fishing time (lines in the water) varied from half an hour to 10 hours (Figure 21), with a mean of 4.7 hours per FIS HMS trip and 4.9 hours per CTS HMS trip (Figure 22). Most HMS trips fished for 2.5 to 4 hours (FIS=48.1%; CTS=43.6%), whereas 28.9% of FIS HMS trips fished for 4.5 to 6 hours and 32.4% of CTS HMS trips fished for 5.5 to 7 hours per trip. Among the HMS groups, total mean fishing time per trip was reported to be longest for swordfish trips (CTS=7.1 hours), followed by marlin trips (FIS=5.6

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hours), tuna trips (FIS=5.0 hours; CTS=5.3 hours), sailfish trips (FIS=4.7 hours; CTS=5.0 hours), and shark trips (FIS=4.4 hours; CTS=4.3 hours).

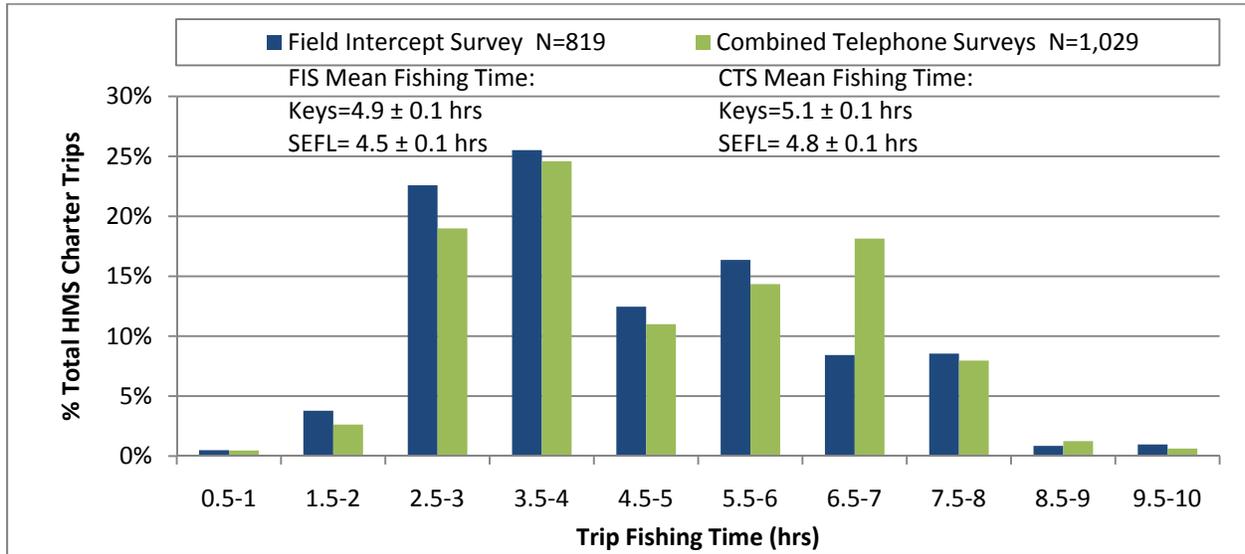


Figure 21 - Distribution of total trip fishing time by each survey for all HMS trips. The mean number of hours fished during trips within each Florida subregion is also reported. N indicates total number of trips for each survey.

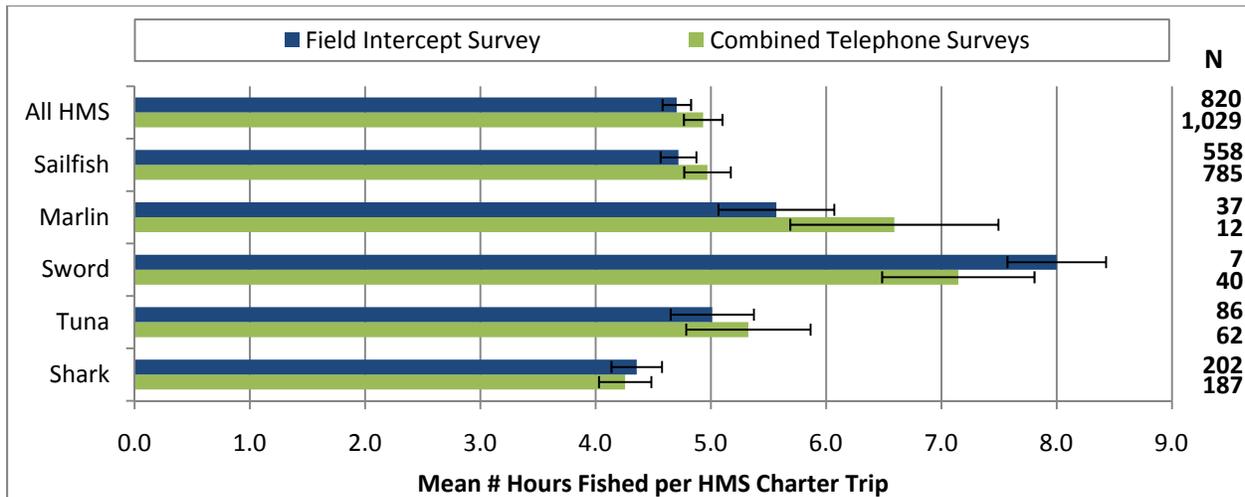


Figure 22 – Mean total trip fishing time for each HMS group with 95% confidence limits. N indicates total number of trips for each HMS group.

Several fishing methods were employed during HMS charter trips. Trolling was the most frequently reported primary fishing method and accounted for 50.5% of FIS HMS trips and 39.7% of CTS HMS trips. The FIS results showed drifting and kite-fishing were next most common methods employed (17.6% and 17.4%, respectively), followed by bottom fishing (7.8%), casting (4.5%) and other methods (2.2%) that included free-lining, live baiting, deep-drop fishing and fly fishing. The CTS results showed some differences, with kite-fishing clearly being the second most popular fishing method (29.2%), followed by drifting (14.8%), casting (7.3%), bottom fishing (5.0%), and other methods (4.0%).

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Among the HMS groups, trolling was the preferred method during sailfish trips (FIS=53.3%; CTS=46.0%), whereas kite-fishing (FIS=25.3%; CTS=37.4%) and drifting (FIS=14.1%; CTS=11.6%) were also frequently employed (Figure 23). There was a distinct difference between the two Florida subregions. SEFL vessel representatives employed kite-fishing as frequently as trolling during sailfish trips (FIS: kite=40.5% versus troll=39.2%; CTS: kite=53.8% versus troll=33.8%), whereas trolling was used more frequently in the Keys (FIS: kite=7.3% versus troll=70.0%; CTS: kite=15.1% versus troll=62.6%). Trolling was also widely employed during marlin (FIS=92.3%) and tuna (FIS=83.0%; CTS=68.9%) trips. Shark trips exhibited the broadest distribution of fishing methods. The FIS results indicated drifting was the most frequently employed method (34.3%) for shark trips, followed by trolling (20.6%), bottom fishing (18.1%), casting (14.7%), and kite-fishing (8.8%). The CTS results showed a near even distribution of casting (24.3%), drifting (23.5%) and bottom-fishing (23.5%) for shark trips, with all other methods accounting for 8.5% to 10.5%. CTS results showed drifting to be the primary method (50.8%), followed by deep-drop fishing (24.2% - “other” in Figure 23, but was specified as deep-drop by vessel representatives) and trolling (15.6%). The results of FIS swordfish trips are not reported throughout this report due to sample size concerns. Nonetheless, it should be pointed out that although trolling was the primary method reported for 6 of the 8 swordfish trips, dolphin were the primary species targeted on 5 of these trips. Trolling is not a fishing method believed to be employed to target swordfish during the day.

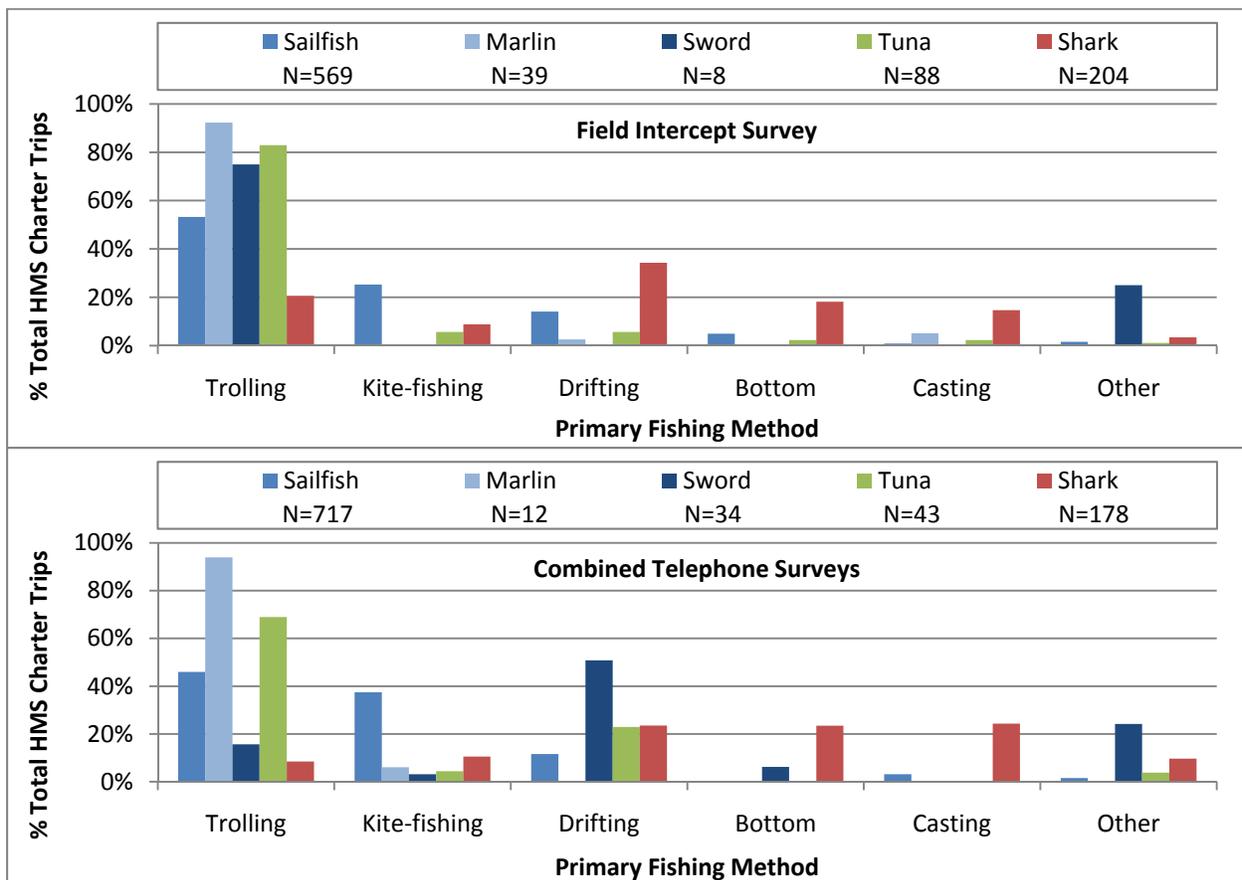


Figure 23 - Distribution of the primary fishing method employed during HMS charter trips for each HMS group. N indicates total number of trips for each HMS group.

The standard total for-hire effort estimation produced by the FHS is an angler-based estimation since the MRFSS is an angler-based access survey. In contrast, the total catch and effort estimation for this

study was vessel-based, determined using the number of vessel trips sampled by both the FHS and CHS in conjunction with the vessel-based FIS. Whereas the number of anglers per trip had no bearing on this study’s estimations, it is reported as a reference for comparison with angler-based surveys. Both the CTS and FIS reported similar results, with a mean of 3.7 customers per FIS HMS trip and 3.6 customers per CTS trip. The distribution of the number of customers per HMS trip varied from 1 to 8, with two-thirds of the trips carrying 2 to 4 customers (FIS=66.5%; CTS=67.0%).

The FIS collected additional information from vessel representatives on how many fishing lines were deployed during the trip (maximum number at one time). Overall, a mean of 4.7 lines were fished per HMS trip (Figure 24). Among the HMS groups, shark trips tended to use fewer fishing lines (3.9 lines per trip) compared to the other species (sailfish=5.0, marlin=4.9, tuna=4.6). Swordfish also reported using only 3.8 lines per trip, but the variability among these trips was very high due to the low sample size (Standard error of the mean, SEM \pm 0.7 lines per trip). Kite-fishing and trolling used the highest numbers of fishing lines per trip (5.3 and 5.0 lines per trip, respectively), followed by drifting and bottom fishing (4.2 each), other methods (3.3), and casting (2.8). These results appear to support a stronger association between number of lines fished and primary fishing method employed, rather than HMS group.

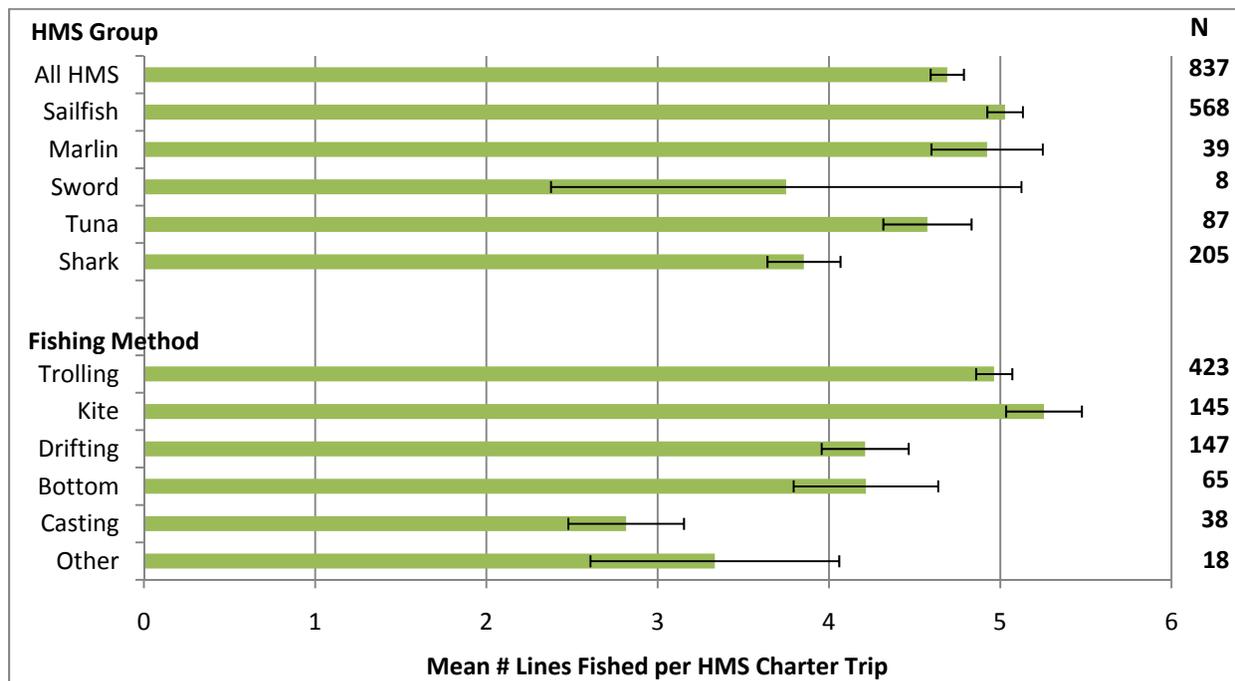


Figure 24 – Mean number of lines fished by HMS group and fishing method during HMS charter trips sampled during the FIS with 95% confidence limits. N indicates total number of trips for each group.

The FIS also collected information regarding the primary type of bait that was used during each trip. Live and dead bait were used with similar frequency (48.6% and 45.5% of all HMS trips, respectively), whereas artificial baits were only used during 5.9% of the trips (Figure 25). Live bait was used more frequently on sailfish (54.9% of all sailfish trips) and shark trips (55.7% of all shark trips). However, dead bait was preferred for all other HMS groups (marlin=82.1% and tuna=60.2%). Artificial baits accounted for 20.5% of tuna trips and 10.3% of marlin trips. Similar to the number of fishing lines employed, there did appear to be an association between the type of bait used and the fishing method employed. Live

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bait was primarily used on 98.6% of trips that kite-fished, 67.1% of trips that drifted, and 65.8% of trips that were casting. On the other hand, dead bait was primarily used on 67.8% of trips that trolled. The use of both bait types was evenly distributed on bottom fishing trips (49.2% each).

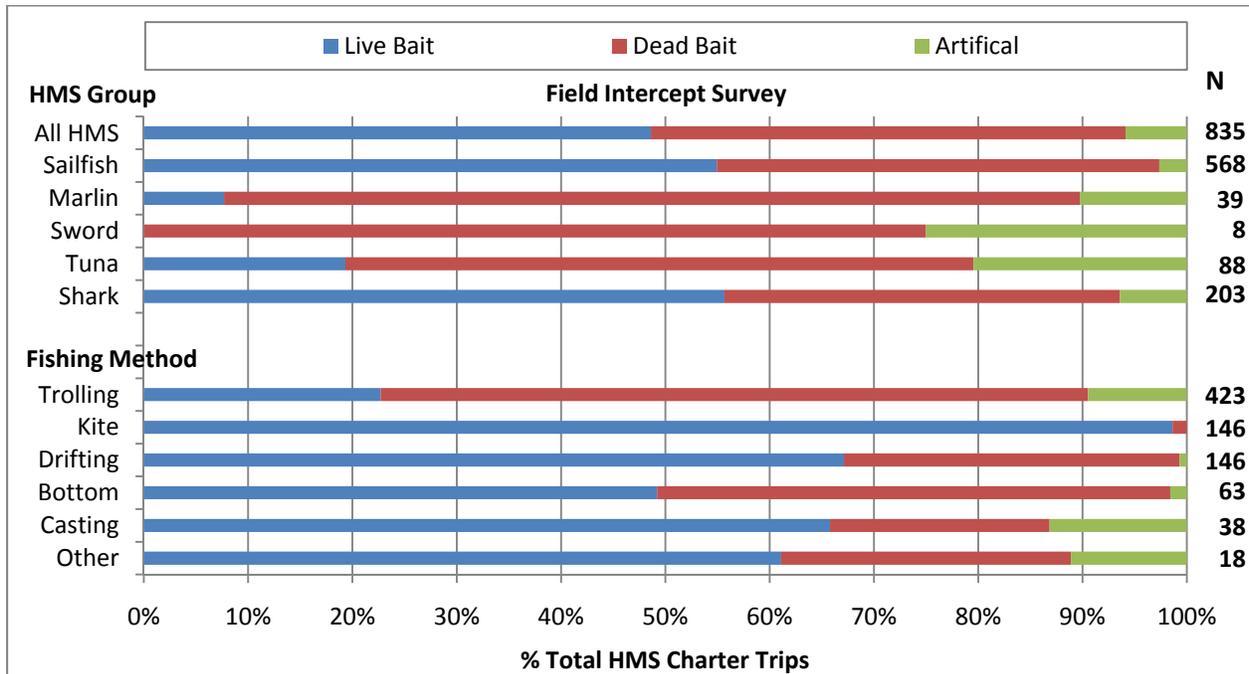


Figure 25 - Distribution of bait types used by HMS group and fishing methods during HMS charter trips sampled by the FIS. N indicates total number of trips for each group.

Vessel representatives were also asked what type of hooks they used during each FIS trip (Figure 26). J-hooks were used exclusively during 55.3% of all HMS trips, whereas circle hooks were used exclusively during 18.3% of the trips. Trips that used a combination of the both hook types accounted for 26.0% of all HMS trips. J-hooks were the dominant hook type used on trips for each HMS group, being used almost exclusively on marlin trips (89.7%), and more frequently on tuna trips (76.1%). While J-hooks remained the primary hook type for the other HMS groups, circle hooks were used exclusively with more frequency on shark trips (21.0%). In contrast, multi-hook type combinations were used more on sailfish trips (30.5%).

There was some variability in the distribution of hook types among the different fishing methods. J-hooks were primarily used exclusively during trips that were trolling (64.5%), drifting (56.6%), and casting (55.3%), while circle hooks were used exclusively during bottom fishing trips more frequently (38.5%). Both hook types were used exclusively and in multi-hook type combinations with similar frequency during kite-fishing trips (circle only=31.7%, J only=35.9%, multi=32.4%).

It should be noted these results reflect hook types employed throughout HMS trips. Reported hook types for individual catches is presented below in section 4.4 as part of the HMS catch analysis.

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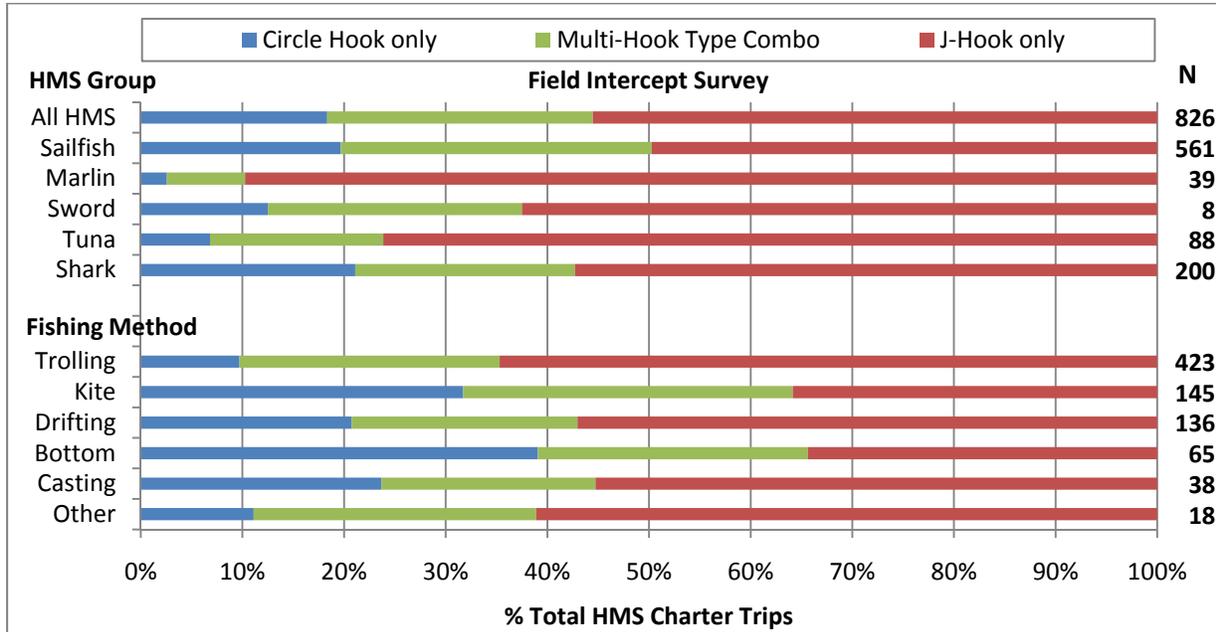


Figure 26 – Distribution of hook types fished by HMS group and fishing methods during HMS charter trips sampled by the FIS. The graph shows the proportion of trips that reported to have used “Circle Hooks only”, “J-Hooks only”, and those that used a combination of both hook types (“Multi-Hook Type Combo”). N indicates total number of trips for each group in both graphs.

4.3.2 HMS Private Trip Analysis

This section summarizes the results for the small number of private trips that occurred during the study by for-hire vessels and HMS Charter/Headboat permit holders. Private trips only accounted for 5.6% of FIS HMS trips and 6.1% of CTS trips (Figure 9). Off-frame vessels intercepted in the FIS (N=51 trip) did conduct private trips more frequently (FHS frame=5.4% of all HMS trips; CHS frame=4.6%; off-frame=9.8% - Figure 27). Within the CTS, the proportion of private trips varied significantly between the vessel frames, with the majority of HMS trips sampled in the CHS reported as private (51.9%), compared to only 3.8% of trips sampled by the FHS. In fact, during the 14 months the CHS was conducted, 80 HMS Charter/Headboat permit holders reported their vessel was only used for private recreational fishing.

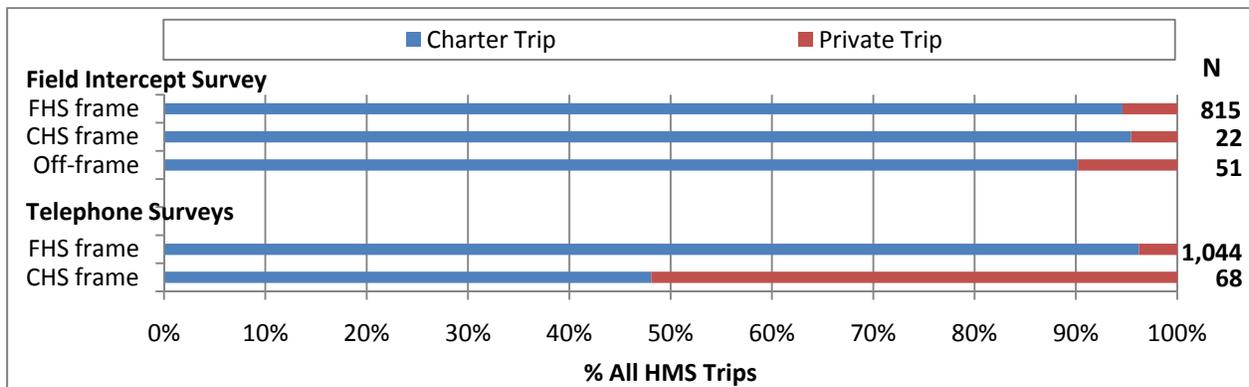


Figure 27 – Distribution of all HMS trips by fishing mode for each vessel sample frame sampled during the FIS, as well as for each telephone survey. N indicates the total number of trips for each vessel frame/telephone survey.

The species composition of HMS private trips was classified into the same five HMS groups used for the charter trips (Figure 28). Similar to the charter trips, sailfish accounted for the largest proportion of all HMS private trips during both surveys (FIS=68.0%; CTS=79.4%). Sharks were the next most common classification for FIS private trips (18.0%), although they accounted for only 3.5% of CTS trips. Tuna accounted for 14.0% of FIS trips and 16.8% of CTS trips. Swordfish accounted for 9.5% of all CTS private trips, but only 2% of FIS trips. Marlin trips were also rare for both surveys, with no trips being captured by the FIS and only 1 CTS marlin trip reported (1.6% of all CTS private trips).

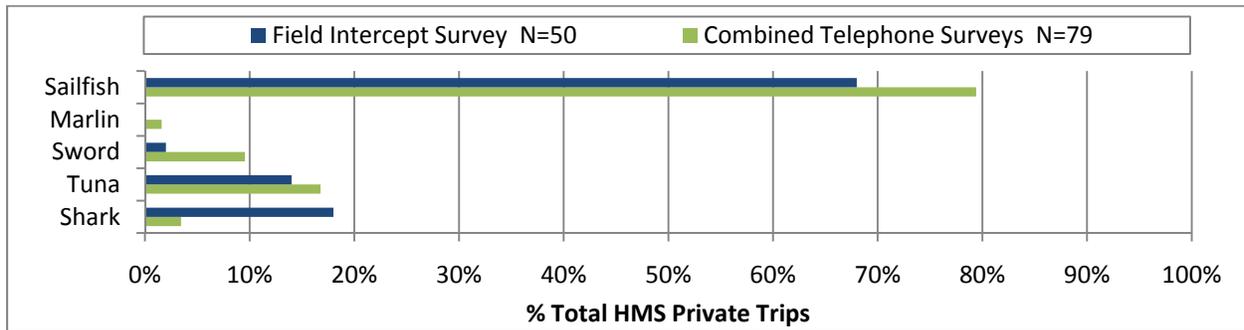


Figure 28 - HMS private trip classification determined by the species from each HMS group that were targeted and/or caught during a trip. N indicates total number of trips.

Using the same classification system to describe the result for HMS charter trips (Figure 12), 36.0% of the FIS private trips targeted HMS but did not catch any, 52.0% successfully targeted and caught HMS, and 12.0% caught HMS as bycatch while fishing for non-HMS species (Figure 29). The CTS results showed higher proportions of private trips that targeted and caught HMS (62.8% of all CTS trips) and bycatch trips (18.0%). With the exception of sailfish trips, the small sample size for each of the other HMS groups warrants caution when interpreting the results for potential differences. With that said, swordfish were targeted during all trips reported for both surveys, whereas sailfish were caught as bycatch on only 5.9% of FIS private trips and 16.5% of CTS trips. Sharks were targeted on 8 of the 9 FIS trips, but were only caught as bycatch on the 3 trips reported to the CTS. Tuna trips were split, being targeted on 4 of the 7 FIS private trips and 6 of 13 CTS trips. Marlin were caught as bycatch on the only trip reported to the CTS.

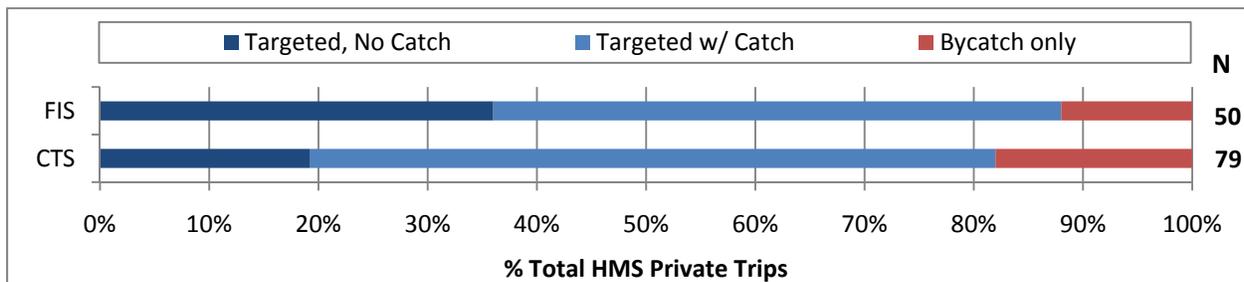


Figure 29 - Distribution of HMS private trips by the result of the trip for each survey. “Targeted, No Catch” indicates trips in which HMS were targeted but not caught; “Targeted w/ Catch” indicates trips in which HMS were targeted and caught; “Bycatch Only” indicates trips in which HMS were caught incidentally while targeting non-HMS species. N indicates total number of trips for each survey.

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Unlike charter trips, tournament fishing was more prevalent for HMS private trips (Figure 30). Tournament trips accounted for 26.0% of FIS HMS private trips and 30.9% of CTS trips, compared to only 3.9% and 4.1% of FIS and CTS HMS charter trips, respectively.

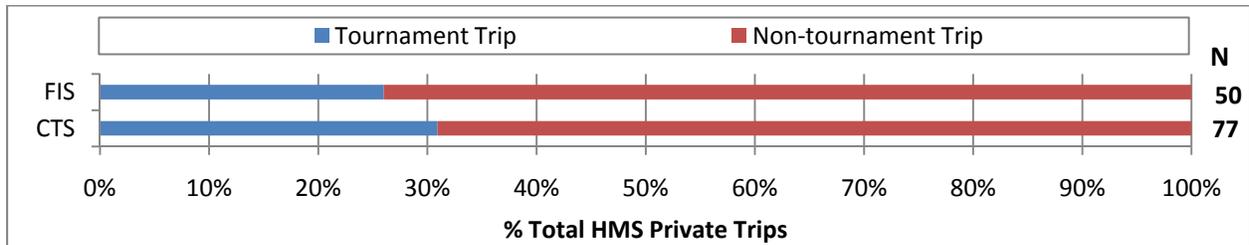


Figure 30 – Distribution of HMS private tournament trips for each survey. N indicates total number of trips for each survey.

Not surprisingly, a greater proportion of private trips returned to private access sites (Figure 31). Whereas less than 3% of charter trips returned to private access sites (Figure 14), they were used for 31.7% of HMS private trips. Public access sites not included in the FIS site list were also used in 19.1% of the private trips, indicating approximately half of all private trips could have been sampled by the FIS.

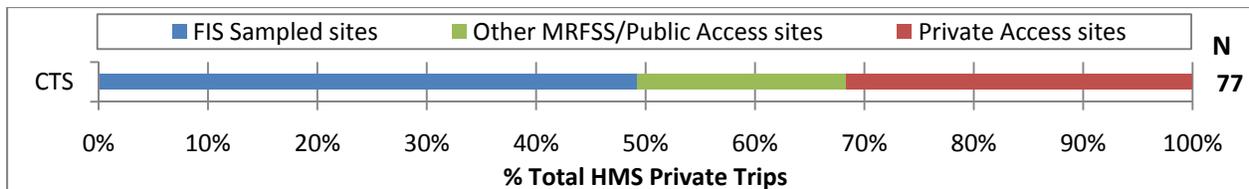


Figure 31 - Distribution of the access site type used for all HMS private trips reported to the CTS. “FIS Sampled sites” indicate MRFSS sites that were sampled by the FIS; “Other MRFSS/Public Access sites” indicate MRFSS sites that were not sampled by the FIS, plus other public access sites that were not on the MRFSS site register; “Private Access sites” indicate sites that are not accessible to samplers conducting the FIS or MRFSS intercept surveys. N indicates total number of trips that reported the access site to the CTS.

HMS private trips were also reported to have been conducted more frequently in Federal waters compared to charter trips. Although approximately 57% of HMS charter trips fished primarily in Federal waters (Figure 15), this area accounted for 80.0% of FIS and 67.4% of CTS HMS private trips (Figure 32). The distribution of sailfish trips did differ between the surveys, with only 14.7% of FIS sailfish trips primarily occurring inside State waters, compared to 37.1% of CTS sailfish trips.

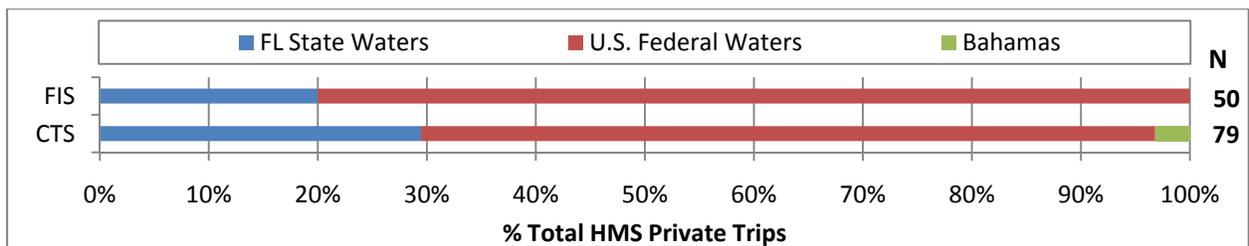


Figure 32 – Distribution of HMS private trips by the area fished for each survey. Florida state waters include all Atlantic waters ≤ 3mi from shore, all Gulf of Mexico waters ≤ 10mi from shore, and all inland waters; U.S. Federal waters are comprised of all other waters in the U.S. EEZ; “Bahamas” indicates territorial waters of the Bahamas. N indicates total number of trips for each HMS group.

4.4 Catch Analysis

During the 14 months the HMS For-Hire pilot study was conducted, 1,123 HMS fish were reported and/or observed during FIS sampling and an additional 2,065 HMS fish were reported to the telephone surveys (Table 4). Sailfish was the dominant species reported in both field and telephone sampling, with 691 and 1,395 sailfish reported to the FIS and CTS, respectively. Collectively, shark catches were the next most common HMS group, with 272 sharks sampled by the FIS and 412 reported to the CTS. Between the two surveys, shark catches were comprised of 14 species, representing 6 genera from 4 families. Among these species, blacktip, lemon, and bull sharks were the most frequently reported for both surveys. Tunas were the next most common group, with 155 recorded by the FIS and 215 reported to the CTS. Four species of tunas were reported: albacore, bluefin, skipjack, and yellowfin, but skipjacks were the only species observed dock-side. A single swordfish was recorded during FIS sampling, whereas 34 were reported to the CTS. Marlin catches were also rare, with only 3 blue marlin and 1 white marlin recorded by the FIS, and only 8 blue marlin and 1 unknown billfish (that was not a sailfish) reported to the CTS.

Overall, landed catches were encountered more frequently during FIS sampling (Table 4). The CTS recorded more than twice as many sailfish caught than the FIS, yet only 4 were reported to have been landed compared to 18 in the FIS (including 16 that were directly observed dock-side). Shark landings were also more common in the FIS, with 17 landings versus 9, even though the CTS recorded approximately 50% more total shark catches. Both survey formats recorded a similar number of landed tunas, although approximately half of all skipjacks reported to the CTS were landed while over 76% of skipjacks reported to the FIS were landed. Swordfish, bluefin, and yellowfin tuna catches were rare in the FIS, precluding a meaningful comparison with the CTS results. No marlin was reported to have been landed by either survey.

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Table 4 – Catch reports/observations for the FIS and CTS. Values indicate numbers of fish reported. Values in () under FIS “Landed” indicate number of fish directly observed. “Landed” values also indicate dead discards or fish used for bait.

Species Name	Field Intercept Survey			Combined Telephone Surveys		
	Released	Landed (Observed)	Total Caught	Released	Landed	Total Caught
ALL HMS	969	152 (115)	1,123	1,922	143	2,065
SAILFISH <i>Istiophorus platypterus</i>	673	18 (16)	691	1,391	4	1,395
MARLIN	4	0	4	9	0	9
Billfish family <i>Istiophoridae</i>	-	-	-	1	-	1
Blue Marlin <i>Makaira nigricans</i>	3	-	3	8	-	8
White Marlin <i>Tetrapturus albidus</i>	1	-	1	-	-	-
SWORDFISH <i>Xiphias gladius</i>	-	1 (1)	1	22	12	34
TUNA	37	118 (87)	155	97	118	215
Albacore <i>Thunnus alalunga</i>	-	-	-	4	-	4
Bluefin <i>T. thynnus</i>	1	-	1	14	5	19
Skipjack <i>Katsuwonus pelamis</i>	36	117 (87)	153	75	84	159
Yellowfin <i>T. albacares</i>	-	1	1	4	29	33
ALL SHARKS	255	17 (11)	272	403	9	412
Blacktip / Spinner	67	3 (2)	70	97	3	100
Blacktip <i>Carcharhinus limbatus</i>	55	3 (2)	58	93	1	94
Spinner <i>C. brevipinna</i>	12	-	12	4	2	6
Bull <i>C. leucas</i>	37	2 (2)	39	62	1	63
Hammerheads	21	6 (3)	27	8	4	12
Hammerhead genus <i>Sphyrna</i>	5	-	5	5	1	6
Great <i>S. mokarran</i>	4	-	4	2	-	2
Scalloped <i>S. lewini</i>	12	6 (3)	18	1	3	4
Lemon <i>Negaprion brevirostris</i>	54	-	54	143	-	143
Miscellaneous Sharks	76	6 (4)	82	93	1	94
Requiem Shark family <i>Carcharhinidae</i>	20	-	20	23	-	23
Requiem Shark genus <i>Carcharhinus</i>	22	1	23	26	-	26
Bigeye Thresher <i>Alopias superciliosus</i>	1	-	1	1	-	1
Blacknose <i>C. acronotus</i>	6	-	6	13	-	13
Caribbean Reef <i>C. perezii</i>	8	-	8	5	-	5
Night <i>C. signatus</i>	-	-	-	3	-	3
Sandbar <i>C. plumbeus</i>	5	1 (1)	6	10	-	10
Shortfin Mako <i>Isurus oxyrinchus</i>	-	1 (1)	1	2	1	3
Silky <i>C. falciformis</i>	6	2 (2)	8	7	-	7
Tiger <i>Galeocerdo cuvier</i>	1	1	2	-	-	-
Unidentified Shark	7	-	7	3	-	3

The disposition of catch varied among the HMS groups, with high release rates reported for billfish and sharks, whereas larger proportions of swordfish and tunas were landed (Figure 33). Overwhelmingly, sailfish were voluntarily released by for-hire vessels, with 92.2% of FIS and 94.0% of CTS sailfish being released alive, despite having been estimated to be of legal size (> 63" lower jaw fork length) by the vessel representative. An additional 5.2% of FIS and 5.8% of CTS sailfish that were released alive were reported to have been below the legal size limit. Only 2.6% of FIS and 0.2% of CTS sailfish were landed. All marlin were released alive, with all FIS marlin reported to have been of legal size, whereas 4 of the 9 marlin reported to the CTS were estimated to be undersized. Similar to sailfish, 90.4% of FIS and 94.0% of CTS sharks (including all lemon sharks) were released alive despite being legal to retain. Of the sharks that were not legal to land and were released alive, undersized sharks accounted for 2.6% of FIS and 3.5% of CTS shark catches, while prohibited species accounted for 0.7% of the total shark catch for both surveys. Both surveys indicated significantly higher landing rates for hammerheads than all other shark species (FIS=22.2%; CTS=31.1% total hammerhead catch). Whereas the only swordfish sampled by the FIS was landed, the majority of swordfish in the CTS were reported as released alive (63.8% total swordfish catch). Approximately half of the released swordfish were undersized (< 47" lower jaw fork length). The disposition of tuna catches varied by species, with 74.2% of bluefin, 45.7% of skipjack, and 12.9% of yellowfin reported to the CTS as released alive. In contrast, only 23.5% of FIS skipjack tunas were reported as released alive. All released bluefin tunas were undersized juveniles (FIS and CTS catches), with anecdotal size estimates of only 12" to 16" in total length. No fish was reported to have been released due to having reached the trip limit or due to fishing in a closed area (*i.e.*, bluefin tuna in the Gulf of Mexico).

It should be noted that the bluefin tuna catches were carefully scrutinized, with the captains providing the reports confirming key identification features unique to this species (*i.e.*, yellow ventral finlets, pectoral fin did not reach origin of 2nd dorsal fin). In addition, two bluefin tunas were directly observed on separate occasions by FWC samplers within the sample area during the same time period. One was photographed to confirm its identification while the other was collected and sent to FWC's headquarters in St. Petersburg where its identification was also confirmed. Likewise, self-reported catches of other species that are rarely encountered in this region (*i.e.*, albacore) or are easily misidentified (*i.e.*, Caribbean reef sharks) were also closely scrutinized during the data quality control phase to ensure the sampler had obtained confirmation of unique identification features during the interview. The lack of confirmation for some shark catches did result in these catches being converted to higher taxonomic levels (*i.e.*, genus or family).

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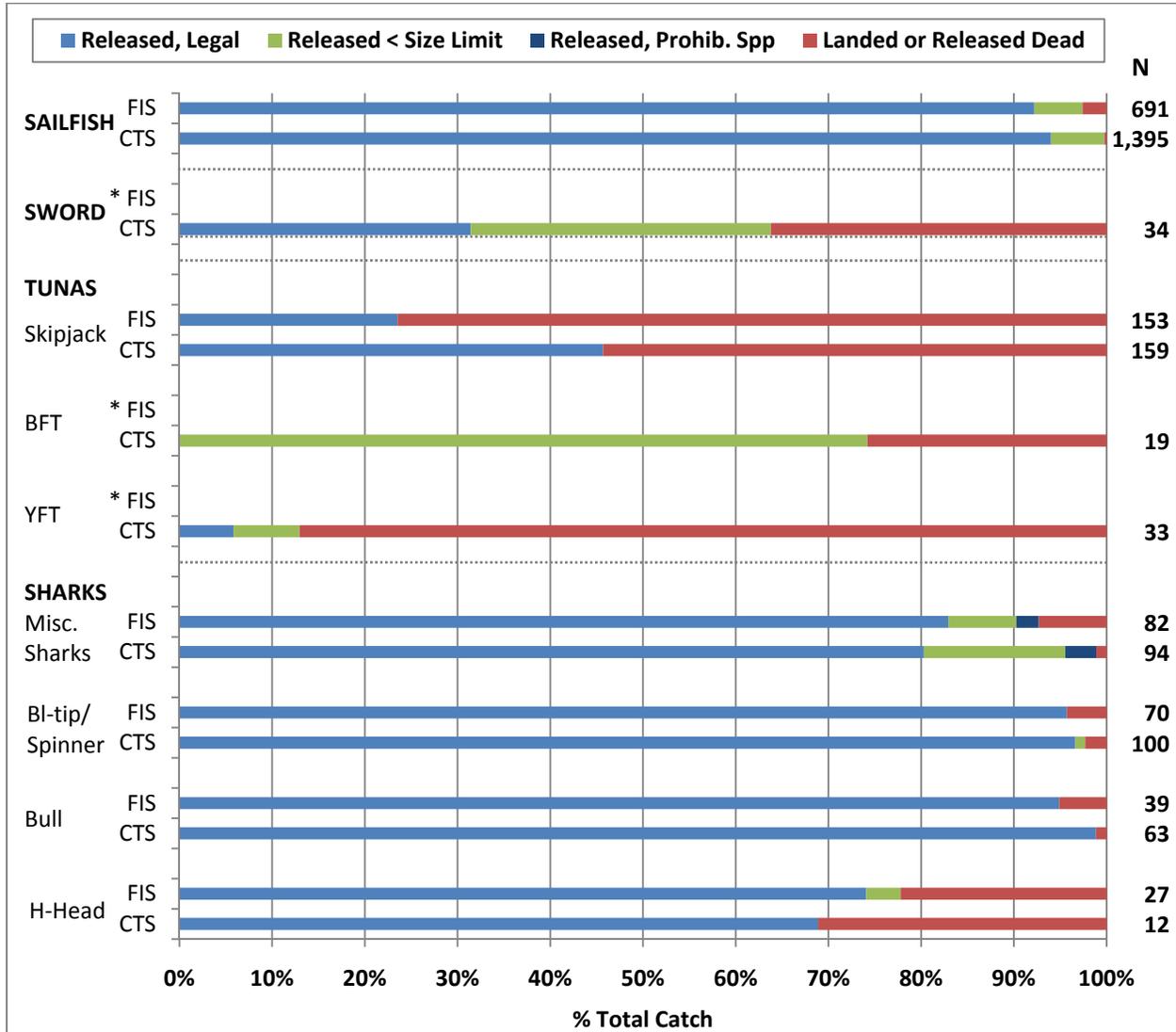


Figure 33 – Disposition of total catch reported to the FIS and CTS. Horizontal dotted lines separate HMS groups. Under the “Tunas” HMS group: “BFT”=bluefin tuna; “YFT”=yellowfin tuna. Under “Sharks” HMS group: “Bl-tip/Spinner”=blacktip & spinner shark subgroup; “H-head”=hammerhead shark subgroup. Results for marlin are not shown due to small sample sizes in both surveys. * indicates FIS results not shown due to small sample size. N indicates total number of fish caught per HMS group.

Analysis of the disposition of landed catches also revealed significant differences in the motivation of for-hire crews to retain HMS. Although the vast majority of swordfish and tunas were landed to be eaten by the customers and/or crew members, sailfish and sharks were primarily landed for taxidermy mounts (Figure 34). Taxidermy mounts accounted for 44.4% of landed sailfish and 70.6% of all landed sharks recorded by the FIS, as well as 72.5% of sailfish and 64.5% of sharks that were reported to be landed by the CTS. In addition, both surveys showed taxidermy mounts accounted for all landed bull and hammerhead sharks. In contrast, taxidermy mounts only accounted for 0.9% of landed FIS skipjack tunas and 6.6% of landed CTS swordfish. All other CTS and FIS landed swordfish were to be eaten, while 38.5% of FIS and 29.2% of CTS landed skipjacks were used for bait, in addition to a small number of FIS skipjacks that were released dead (1.7%). Dead discards accounted for all bluefin tuna mortality (N=5 fish), as well as 11.1% of FIS sailfish mortalities. During FIS sampling, samplers observed HMS being sold

at the dock after the trip’s customers had departed, including 2 sailfish and 3 skipjack tunas. No HMS catches were reported to have been sold to the CTS. While the sale of for-hire catches to the general public or to commercial buyers (*i.e.*, fish houses, restaurants) is a common practice at many marinas in southeast Florida, the sale of billfish is not believed to be common in this area, primarily due to the substantial legal penalties associated with such actions. For-hire sales typically pertain to non-HMS pelagic and reef fish (McGowan per. obs.; SAFMC, 2008), but on occasion can include HMS, as indicated by the FIS results.

It should also be noted that many for-hire captains in SEFL commented they were not landing sailfish and sharks as frequently following the onset of the economic recession in September 2008 due to fewer customers willing to pay extra taxidermy mount services. Although these anecdotal accounts could not be verified, it is plausible a decrease in discretionary spending among for-hire customers would result in fewer taxidermy mounts, thereby reducing landings for sailfish and sharks considering it was the primary disposition of landed catches for these species in this region. Further investigation may be warranted to determine what effect this may have on landings over time as the economy recovers.

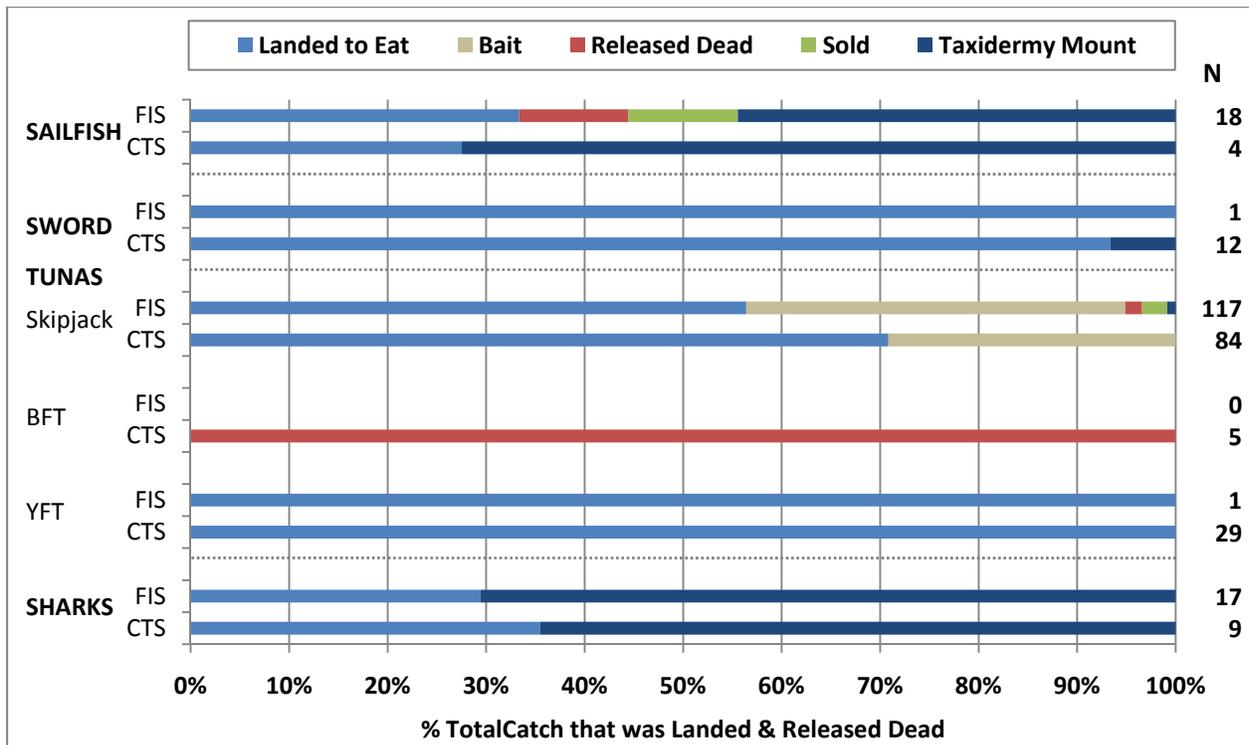


Figure 34 – Disposition of catch resulting in mortality for each HMS group that was reported to the FIS and CTS. Horizontal dotted lines separate HMS groups. Under the “Tunas” HMS group: “BFT”=bluefin tuna; “YFT”=yellowfin tuna. Catches that were reported to have been sold were based on direct observation of the sale by FIS samplers. No marlin was reported to have been landed. N indicates total number of fish landed and released dead for each HMS group.

The distribution of hook types used to catch each individual fish differed both among the HMS groups (Figure 35) and from the distribution of hook types reported to have been employed during HMS charter trips sampled by the FIS (Figure 26). Figure 35 shows that sailfish were primarily caught on circle hooks (FIS=60.5%; CTS=74.7%), despite being employed during less than half of all FIS sailfish trips (48.7%, Figure 26), either exclusively or in combination with J-hooks (in comparison, J-hooks were employed

during 80% of all FIS sailfish trips). Circle hooks were also used to catch the majority of sharks reported to the CTS (64.8%), but only accounted for 33.7% of FIS shark catches. This pronounced difference reflected a large proportion of FHS shark catches from inshore trips (37.5% of FHS shark catch compared to 2.5% of FIS), in which circle hooks were primarily used to target sharks and non-HMS species for catch and release by back-country guides in the Keys. Unlike sailfish, the FIS shark catches seems to better reflect the reported hook type distribution of FIS shark trips (Circle hook=42.0% of all charter shark trips; J-hook=78.0%). J-hooks accounted for all FIS marlin catches, as well as nearly all tuna catches (99.3%), while the CTS results showed circle hooks caught small proportions of swordfish (13.8%) and tuna (26.6%) catches). These distributions seem to show that while circle hooks were employed during some FIS charter trips (10.3% of marlin and 23.9% of tuna trips), the extensive use of J-hooks during most of these trips (87.5% to 97.4%) is undoubtedly accounting for the overwhelmingly majority of their catches.

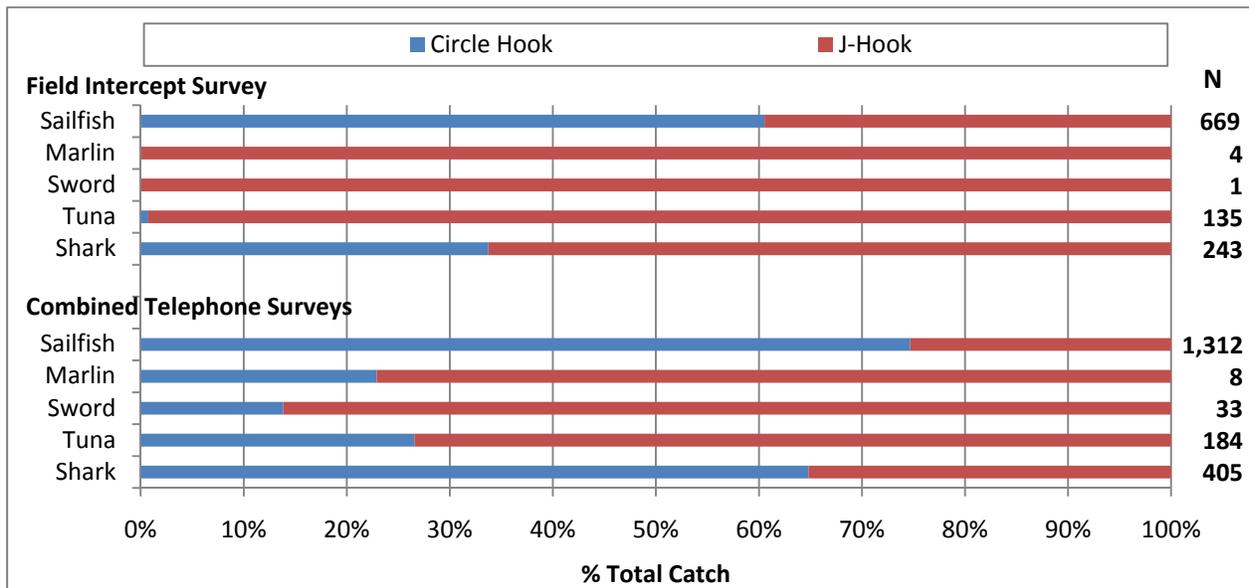


Figure 35 - Distribution of the hook type used to catch each fish by HMS group. N indicates total number of fish caught for each HMS group.

4.5 Total Effort Estimation

Florida HMS for-hire fishing effort estimates are presented in Table 5. Estimates were produced for each sample wave and Florida subregion for both the FHS and CHS. No estimates were produced for the CHS during the May-June 2008 sample wave due to the previously described incomplete data collection. The precision of the CHS estimates in all other waves is poor due to the sample frame size. To facilitate comparisons with other studies, a 12-month effort estimate of 15,439 trips (PSE 5.2%) was produced from July 2008 to June 2009. This excludes the first sample wave due to the lack of a CHS effort estimate. The January-February 2009 wave was the most active wave (4,603 trips, PSE 10.6%), with the July-August 2008 (1,174 trips, PSE 16.6%) wave being the slowest (Figure 36). This distribution is consistent with South Florida’s traditional tourism season and coincides with the peak abundance of sailfish from December through February (Jolley, 1975). Also of note, the May-June 2009 wave FHS estimate (FHS=1,578 trips, PSE 15.0%) was compared to the same 2-month period in 2008 (FHS=2,880 trips, PSE 15.0%), showing a 45.2% decline in HMS fishing effort in the 2009 period. This most likely reflects the impact of the economic recession, although corresponding FHS estimates for all for-hire

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angler trips throughout Florida during these waves do not reflect such a difference (May-June 2008=210,018 angler trips, PSE 4.8%; 2009=195,261 angler trips, PSE 5.9%). This may indicate HMS fishing was affected more profoundly by the recession than other non-HMS for-hire fisheries.

Table 5 – Effort estimates by 2-month sample wave for each telephone survey and Florida subregion. Combined estimates for both surveys are shown in the far-right column. Estimates reflect total number of HMS vessel trips. PSE=proportional standard error. *indicates sample waves that were comprised of 8 weeks, rather than 9 weeks.

For-Hire Telephone Survey					HMS Charter/Headboat Permit Telephone Survey				Combined Telephone Surveys	
FL Subregion:	Keys		SEFL		Keys		SEFL		Keys & SEFL	
Sample Wave	Trips	PSE	Trips	PSE	Trips	PSE	Trips	PSE	Trips	PSE
Jul-Aug 2008	625	25.3%	417	24.8%	67	43.4%	65	61.7%	1,174	16.6%
Sep-Oct 2008	543	24.3%	500	20.7%	20	71.1%	169	49.4%	1,232	15.3%
* Nov-Dec 2008	1,397	17.6%	1,377	16.7%	22	100%	136	38.0%	2,932	11.7%
Jan-Feb 2009	1,669	18.5%	2,854	13.2%	15	100%	64	65.0%	4,603	10.6%
Mar-Apr 2009	1,750	15.4%	1,830	16.1%	0	-	150	33.9%	3,730	10.8%
* May-Jun 2009	842	19.9%	736	22.6%	45	50.5%	146	36.6%	1,768	13.7%
12-month Total	6,827	8.0%	7,714	7.5%	169	28.2%	729	18.6%	15,439	5.2%

Figure 36 also shows seasonal changes and differences in effort between the Keys and SEFL subregions for both surveys. With exception to the January-February 2009 wave, the CTS estimates reflected a nearly equal distribution of HMS trips between the two subregions, with similar increases and decreases in the number of trips. In contrast, trips in SEFL increased substantially to 2,918 (PSE 13.0%) during the January-February 2009 wave, compared to 1,685 trips (PSE 18.3%) in the Keys, before returning to similar trip levels in the following wave. This was in spite of the significantly greater number of for-hire vessels that operated in the Keys (the Keys FHS vessel register averaged approximately 178 more vessels, or 63.5%, than the SEFL register – Table 1).

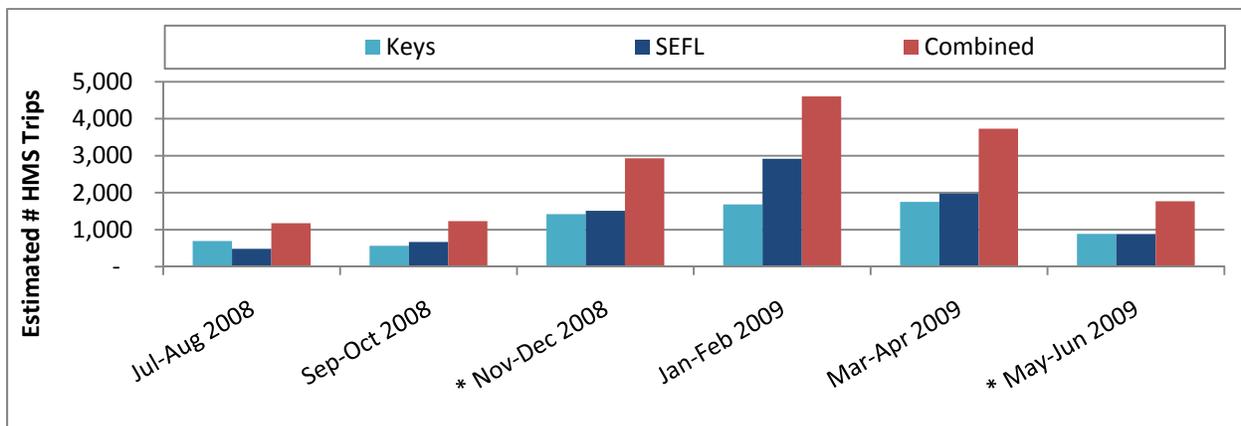


Figure 36 – Temporal distribution of CTS HMS for-hire effort estimates by 2-month sample wave for each Florida subregion and combined. *indicates sample waves that were comprised of 8 weeks, rather than 9 weeks.

4.6 Sampling Coverage

To assess the extent of sampling coverage by both survey methodologies, this section analyzes the FIS assignment selection draw, the frequency “off-frame” vessels (those that were not on either the FHS or CHS vessel frames) were intercepted by the FIS, and the distribution of trips sampled in both surveys. The randomized assignment selection draw resulted in a fairly even distribution of selected site clusters. While clusters were pre-assigned weights to account for the uneven distribution of for-hire vessels within each subregion, the selection rules of the draw ensured 8 of the 21 clusters (38.1%) would be selected each week to distribute sampling coverage and lesson reporting burden on for-hire captains and crews. Assuming a uniform distribution of selected assignments per cluster would be 10.0% in the Keys and 9.1% in SEFL, the proportion of assignments for 15 of the 21 clusters were within 2% of the uniform distribution averages (Figure 37). All but one of the 21 clusters were selected at least once a month on average (Lower Macetum=12 assignments), while 3 clusters were selected more than twice per month on average (Stock Island=35 assignments; E. Key West=36; Palm Beach Inlet=33). The weighting of the clusters did have an effect on the selection of clusters based on their activity level, with the difference between the selection frequency of a cluster and its proportional mean pressure within 2% for 9 of the 21 clusters, and within 3% for 15 clusters. Improvements to the draw may be necessary if used again, as some high pressure clusters were sampled at the same frequency as low pressure clusters. This disparity can also be corrected for through proper weighting of the intercept data to account for sampling probabilities.

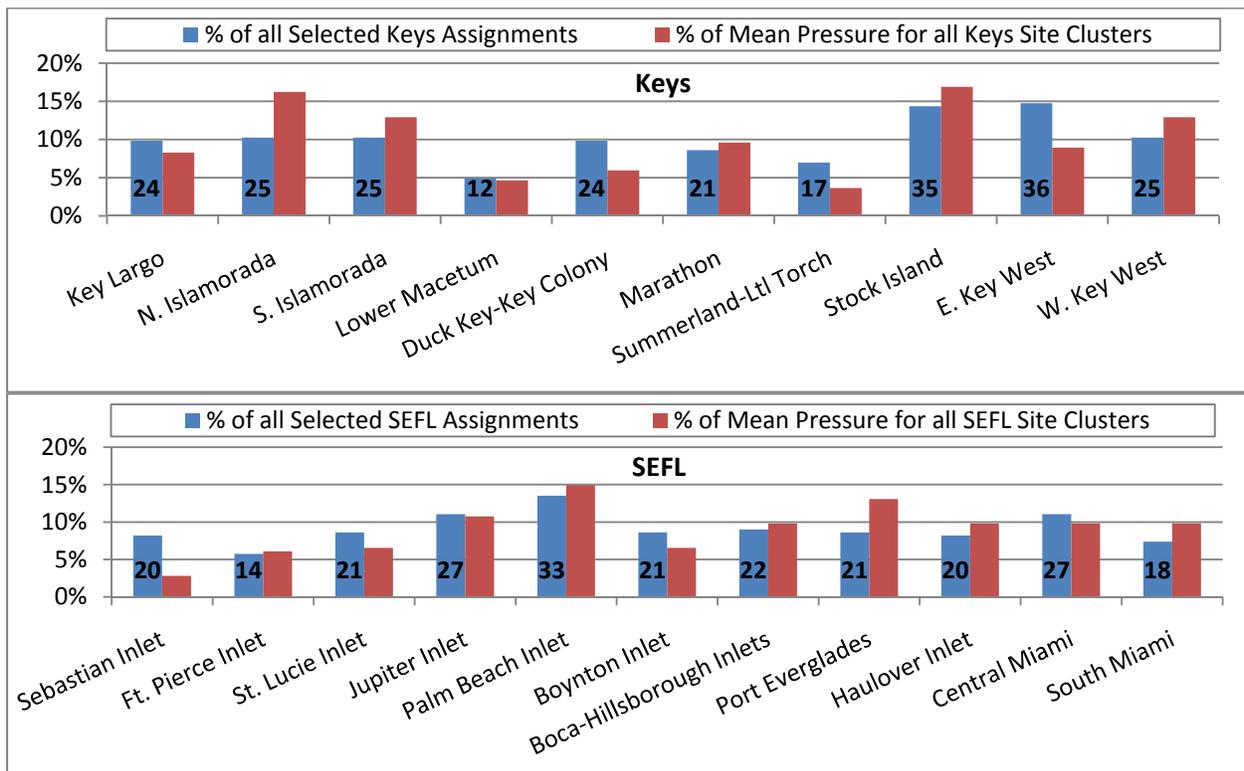


Figure 37 – Comparison of the distribution of FIS field assignments across each Florida subregion with the mean cluster pressure used to select assignments. Blue bar values indicate the proportion of assignments drawn to each site cluster within the subregion and red bar values indicate the mean cluster pressure over the course of the 14-month study. Data labels indicate the total number of assignments attempted for each site cluster.

Vessels sampled by the FIS were compared to the FHS and CHS sample frames. Vessels that were on either vessel list were classified as being “on-frame”, meaning the vessel’s fishing activity was covered by the effort estimation portion of the study. The proportion of “on-frame” vessels for HMS trip interviews is presented in Figure 38. Overall, 91.8% of the HMS interviews were collected from vessels on the FHS frame, with an additional 2.5% from the CHS frame only and the remaining 5.7% from off-frame vessels. The highest occurrence of off-frame vessels was in the first sample wave, accounting for 12.7% of the interviews. Over the next several months, updates and additions to the vessel registries resulted in the reduction of off-frame interviews to 7.2% the following wave (July-August 2008), and to 5.3% or less for all remaining waves.

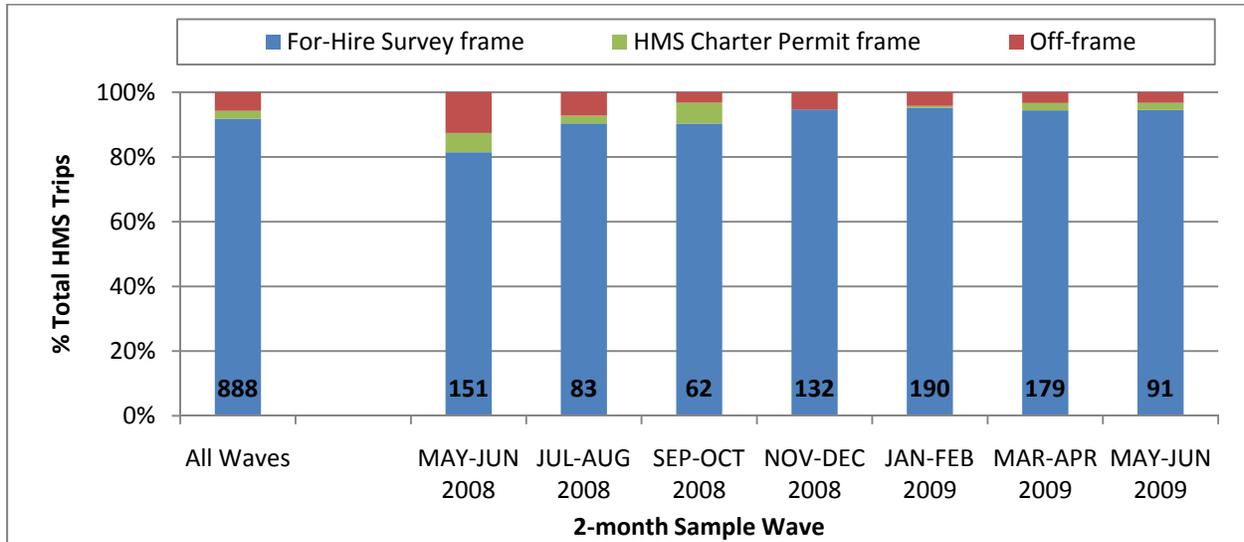


Figure 38 - Distribution of sample frames for each intercepted trip sampled during the FIS for each 2-month sample wave. Data labels indicate total number of trips for each wave.

The spatial distribution of FIS HMS trip interviews across site clusters within each Florida subregion is compared with the distribution of HMS vessel trips reported to the CTS (Figure 39). Overall, both surveys appear to have sampled similar levels of activity at most clusters. The difference in the proportion of sampled trips between surveys was within 3% for 11 of the 21 clusters, and within 5% for 16. While differences between the surveys was more apparent among some of the busier clusters (*i.e.*, N. Islamorada and Port Everglades), the results of both surveys were similar in regards to differentiating high activity from low activity clusters.

There was greater similarity between the surveys in terms of the temporal distribution of HMS trips (Figure 40). The results of both surveys reflected similar changes in HMS fishing activity, as the relative difference between the FIS intercepts and the final CTS effort estimates was within 4% for all 2-month sample waves and within 2% for 5 of the 7 waves.

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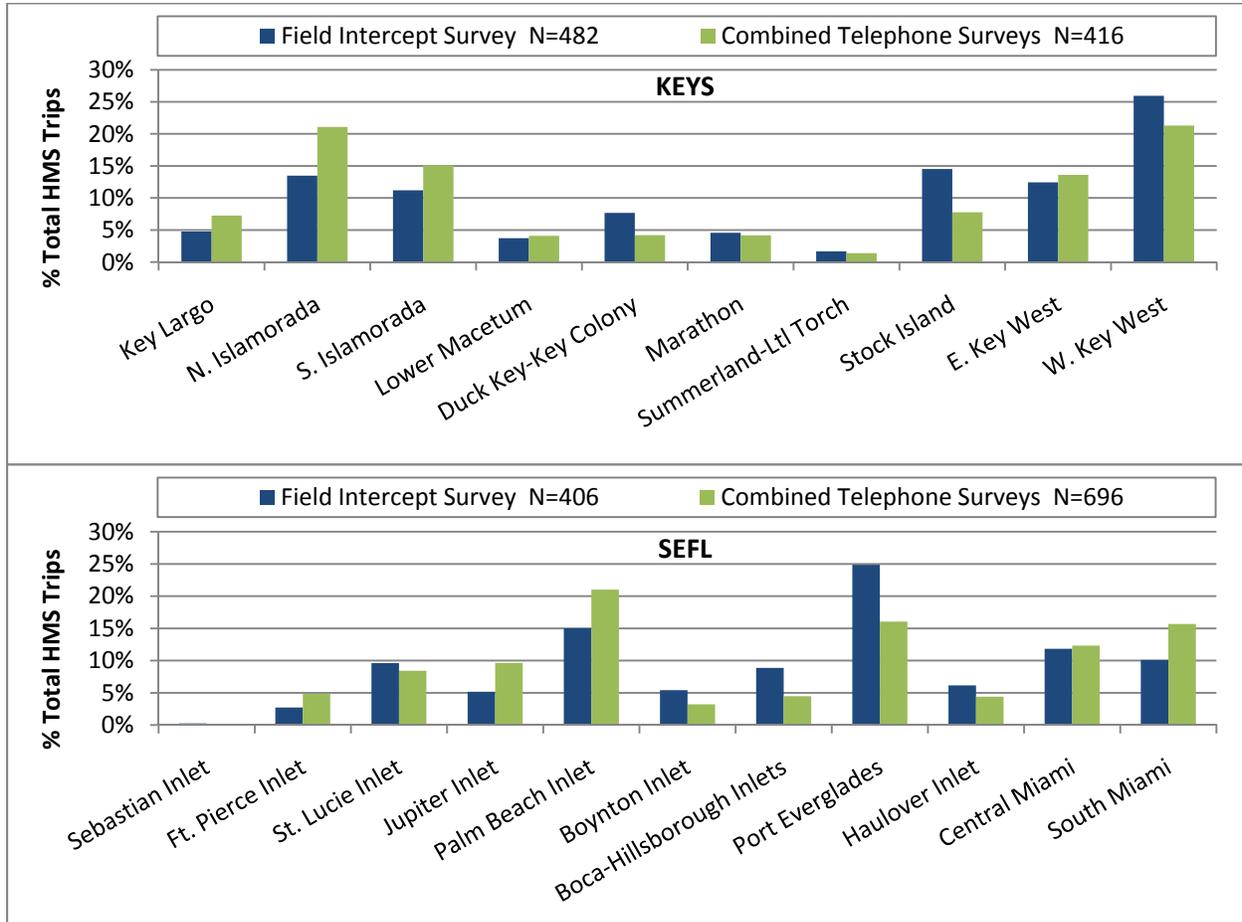


Figure 39 – Comparison of the spatial distribution of HMS trips sampled by the FIS with the CTS. The proportion of HMS trip interviews sampled by the FIS at the site clusters within each subregion is presented alongside the proportion of HMS trips reported to the CTS. N indicates the total number of sampled trips within each subregion for each survey.

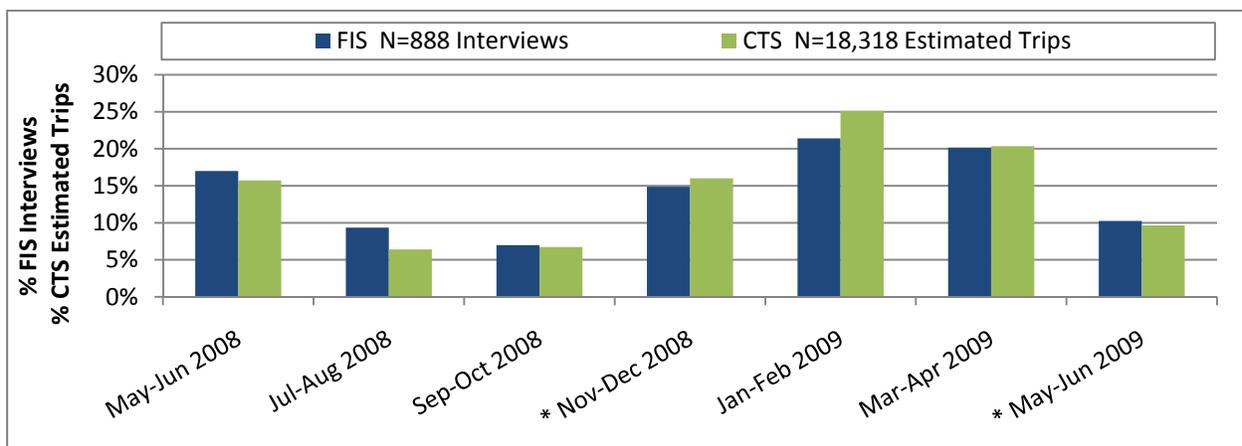


Figure 40 – Comparison of the temporal distribution of FIS vessel interviews and the estimated number of HMS trips derived from the CTS. The proportion of the FIS interviews and CTS HMS trip estimates is shown by each 2-month sample wave. * indicates waves that were comprised of 8 weeks, while all others covered 9 weeks.

4.7 Matched Trip – Recall Bias Analysis

Throughout the For-Hire pilot study, 96 vessel trips were sampled in both the FIS and FHS. Analysis of these matched trips presented an opportunity to assess the extent of recall bias in the telephone survey. HMS were reported to have been targeted or caught on 44 of the 96 matched trips to at least one of the surveys. Table 6 summarizes the matched HMS trips for the following key variables collected by both surveys: trip mode (charter or private), tournament participation, area fished (State or Federal waters), fishing time (within ± 1 hour), and target species (HMS only). The comparison showed nearly all responses (97.7%) related to the trip mode and tournament participation were in agreement for all matched HMS trips. Additionally, there were few discrepancies pertaining to area fished, with similar responses for 88.6% of the matched trips. Reported trip fishing times were also within one hour for 86.4% of the trips. Inconsistencies were more apparent with reported target species (63.6% responses in agreement, including 3 trips where HMS were reported as the 3rd target species to the FIS).

Table 6 – Summary of matched HMS trips sampled both through the FIS and FHS. Proportion of 44 matched HMS trips in which responses were in agreement for the following variables: trip mode (charter or private), tournament participation, area fished (State or Federal waters), fishing time (± 1 hour), and target species (HMS targets only).

MATCHED TRIP ANALYSIS						
Trip Variables	N	Trip Mode	Tournament	Area Fished	Fishing Time	Target Spp.
All HMS Matched Trips	44	97.7%	97.7%	88.6%	86.4%	63.6%

Catch data were also compared for both HMS and sailfish matched trips, with mean differences tested for significance using paired t-tests. Overall, none of the mean differences for catch comparisons were significantly different ($P > 0.05$, Table 7). Reported HMS catches were identical for 70.5% of the trips, including trips in which no HMS were caught, with a mean difference of 0.16 more FIS fish. When trips in which at least 1 HMS was caught were compared (“Positive Catch only” trips), catches from only 50.0% of the 26 trips were in exact agreement, but again the mean difference was not significantly different (0.27 more FIS fish, $P = 0.17$) and are likely a result of random error. Catch information from sailfish trips ($N = 36$ trips) was in exact agreement more frequently (80.6%), but was also lower among “Positive Catch only” sailfish trips (58.8%). Likewise, the mean differences were minimal and not significantly different (all sailfish trips = 0.06 more FHS fish, $P = 0.53$; positive catch sailfish trips = 0.12 more FHS fish, $P = 0.54$).

In contrast, the results indicated more pronounced differences regarding the number of customers reported per trip, with only 47.7% of the responses in exact agreement from the 44 matched HMS trips. Although the mean difference was not significant (0.32 more FHS anglers, $P = 0.09$), the lack of consistency between the surveys warranted expanding the analysis to include non-HMS trips as well. This increased the sample size to 95 matched trips in which responses were provided. The expanded comparison showed only 50.5% of the responses were in agreement and the mean difference of 0.34 more FHS anglers was statistically significant ($P < 0.01$). It should be noted the differences between the matched trips contradict the results reported for all HMS charter trips, in which the mean number of customers per trip was similar among both surveys (FIS = 3.7 customers, $N = 838$ trips; FHS = 3.6 customers, $N = 1,023$ trips). Nonetheless, considering the FHS produces angler-trip estimates for the MRFSS, these results call for further study to determine if there is a systematic bias towards over-reporting the number of anglers in the FHS. Table 7 – Comparison of matched HMS trips sampled both through the FIS and FHS. HMS and sailfish catch data were compared under two trip type scenarios: “All Trips” = all targeted and

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bycatch trips (including those in which no fish were caught); “(+) Catch”= only trips in which at least 1 fish was caught (any HMS or sailfish, respectively). A separate comparison of the number of customers reported per trip was also conducted for all HMS and non-HMS trips (“All For-Hire Trips”) and for “HMS Trips only.” The proportion of matched trips is shown across the distribution of response differences, with equivalent numbers of reported fish caught indicated by “Equal, No Diff”, higher values reported in FHS trips by “FHS > Value” (negative difference), and higher values reported in FIS trips by “FIS > Value” (positive difference). Results of paired t-tests are shown for each comparison.

Catch Comparison		Distribution of Response Differences							N	Paired T-test Results		
Catch Type	Trip Type	FHS > Value			Equal No Diff	FIS > Value				Mean Diff.	T- value	P- value
		-3	-2	-1		1	2	3				
HMS	All Trips	-	2.3%	6.8%	70.5%	13.6%	6.8%	-	44	0.16	1.42	0.16
	(+) Catch	-	3.8%	11.5%	50.0%	23.1%	11.5%	-	26	0.27	1.43	0.17
Sailfish	All Trips	-	2.8%	8.3%	80.6%	8.3%	-	-	36	-0.06	-0.63	0.53
	(+) Catch	-	5.9%	17.6%	58.8%	17.6%	-	-	17	-0.12	-0.62	0.54
# Customers per Trip Comparison												
All For-Hire Trips		6.3%	14.7%	10.5%	50.5%	12.6%	5.3%	-	95	-0.34	-2.68	<0.01
HMS Trips only		6.8%	11.4%	13.6%	47.7%	15.9%	4.5%	-	44	-0.32	-1.74	0.09

4.8 Catch Rate Analysis

A primary objective of this pilot study was to compare catch rates obtained from a traditional field access survey to catch rates collected through a telephone survey. Whereas access surveys are typically limited in regards to sampling vessels that return at night or to private access sites, a telephone survey provides better coverage to address these biases, so long as its sample frame is representative of the population. Moreover, telephone surveys are more cost effective in terms of sample size to capture more trips involving rare event species, a common problem associated with recreational HMS fisheries. The advantages of telephone surveys can be negated, though, if catch information is not reliable; either due to recall bias, misidentification of species, the unwillingness of vessel representatives to fully participate, or their deliberate concealment of certain fishing activities.

Sailfish catch rates were compared for this analysis because the species is easy to identify for most anglers, are typically caught in low numbers per trip (reducing the likelihood of rounding errors), and their capture is widely perceived as a positive experience by for-hire operators and their customers. Equally as important, at least 100 sailfish trips were recorded by both surveys within each Florida subregion, providing a robust sample size. No other HMS met these criteria, primarily due to low catch sample sizes. Three types of catch rate, or average catch per trip (CPUE), comparisons were conducted:

- **All Sailfish Trips** – trips in which sailfish were targeted and/or caught (including bycatch).
- **Targeted Sailfish Trips** – trips in which sailfish were targeted (includes responses for the 3rd target species collected by the FIS)
- **Positive Catch Sailfish Trips** – trips in which at least one sailfish was caught, either intentionally or as bycatch.

Due to the significant proportion of vessels sampled by the CHS that operated as private vessels (Figure 27), only trips conducted by vessels on the FHS vessel frame were included in the CPUE analysis. As a purpose of the analysis was to test for differences between the two data collection methodologies, only FHS reported trips that returned to access sites sampled by the FIS were included. This facilitated a more direct comparison and served to minimize other factors that affected sailfish catch rates.

The results of the CPUE analysis are shown in Figure 41. During all comparisons, average catch rates derived from the telephone survey data were greater for sailfish. Using a weighted least squares regression analysis, FHS sailfish CPUEs were significantly greater ($P < 0.01$) for both “all trips” and “targeted trips” categories. In contrast, CPUEs for “positive catch trips” were not significantly different ($P = 0.18$). This suggests vessel representatives may not have been reporting sailfish as a targeted species as frequently to the telephone survey when no sailfish were caught. To test this hypothesis, the pool of analyzed trips was expanded to also include all non-HMS trips in which other pelagic species were reported to have been targeted. These included dolphin, wahoo, king mackerel, cero mackerel, blackfin tuna, little tunny, cobia, and tripletail. Similar fishing methods used to target sailfish are typically employed during these trips (*i.e.*, trolling and kite-fishing), and they were conducted over the same fishing grounds. The inclusion of these non-HMS trips with zero sailfish catches did reduce the mean catch rate by approximately two-thirds for both surveys, as the number of FIS trips for the “all trips” comparison increased from 511 to 1,125 trips and FHS trips increased from 689 to 1,687 trips (comparison only included non-tournament charter trips since the FHS does not record trip data for tournament and private non-HMS trips). Nonetheless, the regression analysis determined FHS CPUEs (0.59 sailfish per trip \pm 0.05 SEM) were still significantly greater ($P < 0.01$) than FIS sailfish CPUEs (0.39 \pm 0.03). Similar results were produced when “Targeted Trips” were also compared ($P < 0.01$).

These results indicate a prestige bias towards positive sailfish catches during the recall survey, despite the short, 1-week sample period to minimize respondent recall bias. The actual number of sailfish reported to have been caught on positive catch trips did not appear to be inflated; rather the frequency of successful trips appears to have been over-reported in the FHS. Consequently, recall of catches for less frequently encountered species (*i.e.*, swordfish or marlin) may not be similarly affected by this form of bias.

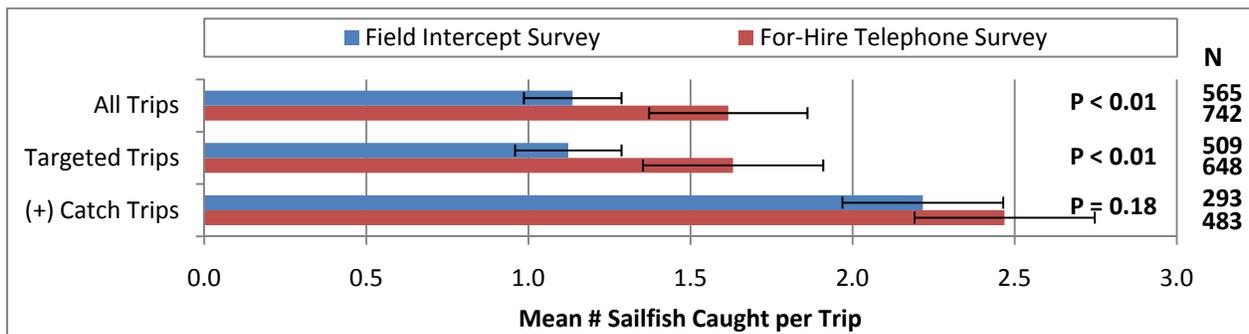


Figure 41 – Comparison of sailfish catch rates derived from the FIS with the FHS. Three types of trip analyses were completed for sailfish trips: “All Trips”= all trips in which sailfish were targeted or caught as bycatch, “Targeted Trips”= only trips in which sailfish were targeted, “(+) Catch Trips”= only trips in which at least 1 sailfish was caught. P values indicate the result of the regression analysis. N indicates total number of trips for each group.

An additional CPUE comparison was conducted to explore differences in catch rates between daytime trips that returned before and after 15:00 hours, the time of day when approximately half of all HMS

trips had returned (Figure 19). Such a comparison would test the assumption that catch rates are similar for vessels that targeted the same species but returned at different times of the day. Catch rates were compared within each survey because differences between the survey results were previously reported (Figure 41). Tournament trips were also excluded from the analysis since they typically would not end until after 15:00 hours in this region (potentially inflating CPUEs for the late day group). The results of the comparison in Table 8 clearly show catch rates were significantly lower among trips that ended prior to 15:00 hours in both surveys ($P < 0.01$).

Table 8 – Comparison of sailfish catch rates between trips that ended before or after 15:00 hours for each survey. Only non-tournament trips conducted by FHS frame vessels that returned to FIS sampled access sites that caught and/or targeted sailfish were included in this comparison. N indicates total number of trips per group.

Sailfish CPUE Comparison	Field Intercept Survey				For-Hire Telephone Survey			
	# Sailfish	SE	95% CL	N	# Sailfish	SE	95% CL	N
Ended Before 15:00	0.77	0.07	0.14	275	1.02	0.07	0.13	312
Ended at 15:00 or Later	1.19	0.13	0.25	260	1.85	0.16	0.31	383
P-Value	< 0.01				< 0.01			

4.9 Total Catch Estimation

Using the CPUEs from the telephone surveys, catch estimates for each species are presented in Table 9. Catch estimates were produced for released alive, landed (*i.e.*, to be eaten or mounted for taxidermy), and dead discard (including fish used for bait) catches. Catch estimates were consolidated into released alive, landed and dead discard, and total catches (released alive + landed/dead discard). Species-level estimates were also consolidated for each of the five HMS groups, as well as into five shark sub-groups to summarize the estimates produced for the 13 species, 2 genus-level, 1 family-level, and an unidentified shark level reported by the vessel representatives. Catch estimates for each species are listed in Appendix I. The five shark sub-groups were created due to the inherent difficulty with the accurate identification of sharks, even by experienced anglers. The shark sub-group classifications are listed below, along with a brief explanation for each grouping:

- Blacktip/Spinner = blacktip and spinner sharks - two common species that are frequently misidentified as the other.
- Bull = bull shark - frequently targeted and caught by for-hire vessels and are more easily identifiable to for-hire crew members.
- Hammerheads = Hammerhead genus *Sphyrna*, great hammerhead, and scalloped hammerhead – easily distinguishable from other sharks, but frequently misidentified as the other or generally reported as “hammerhead.”
- Lemon = lemon shark – frequently caught by back-country guides in the Keys and more easily identified by for-hire crew members.
- Misc. sharks = unidentified shark, bigeye thresher, shortfin mako, requiem shark family, requiem shark genus *Carcharhinus*, Blacknose, Caribbean reef, night, sandbar, silky – contains remaining species that are frequently misidentified, are prohibited, or are rarely encountered.

The combined results of the FHS and CHS resulted in a total catch estimate of 20,631 sailfish (PSE 9.7%) being caught over a 12-month period from July 2008 to June 2009. Of these, only 56 sailfish (PSE 50.1%) were estimated to have been landed. The combined total catch estimate for blue marlin was 131 fish

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(PSE 40.0%), all of which were reported to have been released alive. The combined swordfish total catch estimate was 421 fish (PSE 29.8%), with 123 swordfish (PSE 41.4%) estimated to have been landed. A combined total of 3,308 tunas (PSE 20.3%) were estimated to have been caught by the two surveys, of which 1,826 (PSE 22.3%) were landed. Among the four species of tuna reported to have been caught, skipjacks were by far the most common, accounting for 75% of the total combined tuna catch estimate (2,479 fish, PSE 25.1%), more than half of which were landed (1,323 fish, PSE 26.7%). Yellowfin tuna were the next most common tuna species reported, with a total catch estimate of 502 fish (PSE 38.9%), of which 437 were landed (PSE 43.4%). Catch estimates for other tuna species are reported in Appendix I. The combined total shark catch was estimated to be 5,562 sharks (PSE 15.8%). Only 122 sharks were estimated to have been landed, but the precision of the estimate was fairly low (PSE 35.5%). Among the shark sub-groups, lemons accounted for largest portion of the total shark catch estimate with 2,144 sharks (PSE 33.1%), all of whom were released. The total catch estimate for bull sharks had the highest precision among the shark groups, with a PSE of 23.8% (757 sharks). A total of 1,269 blacktip and spinner sharks (PSE 30.1%) were estimated to have been caught, along with 1,270 of the miscellaneous sharks (PSE 23.9%) and 122 hammerheads (PSE 35.6%). Catch estimates produced from the FHS during the May-June 2008 wave are not reported here, but can be reviewed in Appendix J.

Table 9 – Catch estimates derived from both telephone surveys from July 2008 to June 2009 for each HMS group and the shark subgroups. Total catch estimates in right column are the combined estimates of both surveys. Estimates reflect total number of fish. PSE=proportional standard error. Expanded estimates for shark species are listed in Appendix I.

July '08 – June '09 Survey	Released Alive				Landed/Dead Discard				Total Catch	
	FHS		CHS		FHS		CHS		FHS & CHS	
Species	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE
Sailfish	19,505	10.1%	1,069	32.7%	56	50.1%	-	-	20,631	9.7%
Blue Marlin	107	46.2%	24	73.0%	-	-	-	-	131	40.0%
Swordfish	249	44.3%	49	65.0%	108	44.9%	14	100%	421	29.8%
Tuna	1,467	36.5%	15	100%	1,701	22.9%	126	90.3%	3,308	20.3%
Skipjack	1,156	44.2%	-	-	1,197	27.9%	126	90.3%	2,479	25.1%
Yellowfin	65	71.1%	-	-	437	43.4%	-	-	502	38.9%
All Sharks	5,319	16.4%	120	83.9%	122	35.5%	-	-	5,562	15.8%
Blacktip/Spinner	1,222	31.1%	-	-	47	57.8%	-	-	1,269	30.1%
Bull	734	24.4%	11	100%	13	100%	-	-	757	23.8%
Hammerheads	78	45.1%	-	-	44	57.9%	-	-	122	35.6%
Lemon	2,134	33.2%	10	100%	-	-	-	-	2,144	33.1%
Misc. Sharks	1,152	24.8%	100	100%	18	100%	-	-	1,270	23.9%

4.10 Compliance with Federal HMS Regulations

NOAA Fisheries requires all recreational vessels that target or land HMS from federal waters of the Atlantic, Gulf of Mexico, and Caribbean Sea to obtain a vessel-based HMS or Atlantic Tunas General permit on an annual basis. The permit type is determined by the fishing activity in which the vessel is engaged during that year. Vessels that operate exclusively within State waters are not required to obtain the permit, unless they are fishing for tunas managed under the Consolidated HMS Fishery Management Plan. Table 1 shows the proportion of HMS-permitted vessels within each sample frame by wave. To determine the level of compliance with the permit requirement and the extent of HMS fishing that is not covered by the State waters exemption, the survey results pertaining to the trip type (targeted or bycatch – Figure 12) and the area fished (Figure 15) for each HMS group was analyzed to determine what proportion of the trips were conducted by HMS-permitted vessels (Figure 42).

The results were classified into six categories:

- **Bycatch w/ Permit: FL & U.S. waters** – trips in which any HMS was caught incidentally in State territorial seas (STS) of Florida or adjacent Federal waters by vessels possessing an active HMS or Atlantic Tunas General category permit.
- **Target w/ Permit: FL & U.S. waters** – trips in which any HMS was targeted and/or caught in Florida STS or adjacent Federal waters by vessels possessing an active HMS or Atlantic Tunas General category permit.
- **Bycatch w/ No Permit: FL waters** – trips in which any HMS was caught incidentally in Florida STS by vessels that do not possess an active HMS or Atlantic Tunas General category permit.
- **Target w/ No Permit: FL waters** – trips in which any HMS was targeted and/or caught in Florida STS by vessels that do not possess an active HMS or Atlantic Tunas General category permit.
- **Bycatch w/ No Permit: U.S. waters** – trips in which any HMS was caught incidentally in Federal waters by vessels that do not possess an active HMS or Atlantic Tunas General category permit.
- **Target w/ No Permit: U.S. waters** – trips in which any HMS was targeted and/or caught in Federal waters by vessels that do not possess an active HMS or Atlantic Tunas General category permit.

Overall, 55.5% and 59.6% of HMS charter trips sampled in the FIS and CTS respectively were conducted by HMS-permitted vessels (first two categories listed above). An additional 18.6% of FIS and 15.8% of CTS HMS trips were conducted in State waters by vessels that did not possess HMS permits (third and fourth categories listed above), which did not violate the permit requirements. A small proportion of vessels without permits did catch HMS in Federal waters while targeting non-HMS species (fifth category listed above: FIS=4.4%; CTS=5.3%). Finally, a significant number of HMS trips in which HMS were targeted in Federal waters were conducted by vessels without active permits (sixth category listed above: FIS=21.4%; CTS=19.3%).

Among the HMS groups, vessels fishing for swordfish had the highest compliance rate with the HMS permit requirement, as 79.3% of CTS trips targeting swordfish were conducted by HMS-permitted vessels. When the State waters exemption is also taken into consideration, 88.3% of FIS and 84.8% CTS shark trips were in compliance with the permit requirement (either fishing with a permit or exclusively inside State waters). Similarly, this would also cover 73.3% of FIS and 72.6% of CTS sailfish trips. Since the State waters exemption does not apply to tunas, 60.3% of FIS and 75.3% of CTS tuna trips were conducted by HMS-permitted vessels. Vessels that targeted marlin had the lowest rate of compliance, with only 43.6% of FIS marlin trips being conducted by permitted vessels. Trips in which HMS were

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targeted by vessels without permits in Federal waters accounted for 24.3% of FIS and 23.2% of CTS sailfish trips, 53.8% of FIS marlin trips, 18.5% of CTS swordfish trips, 18.2% of FIS and 14.7% of CTS tuna trips, and only 5.9% of FIS and 2.3% of CTS shark trips.

Although all marlin and swordfish trips were conducted in Federal waters, sailfish, tunas, and sharks were regularly targeted and/or caught in State waters (Figure 15). During this study, the State waters exemption resulted in more than half of all shark trips being conducted by vessels without HMS permits while fishing in Florida waters. The proportion of sailfish trips that occurred in State waters by vessels without permits was much smaller, accounting for only 10.1% of FIS and 9.0% of CTS sailfish trips. For tunas, the proportion was even smaller, accounting for only 2.2% of FIS and 1.6% of CTS tuna trips.

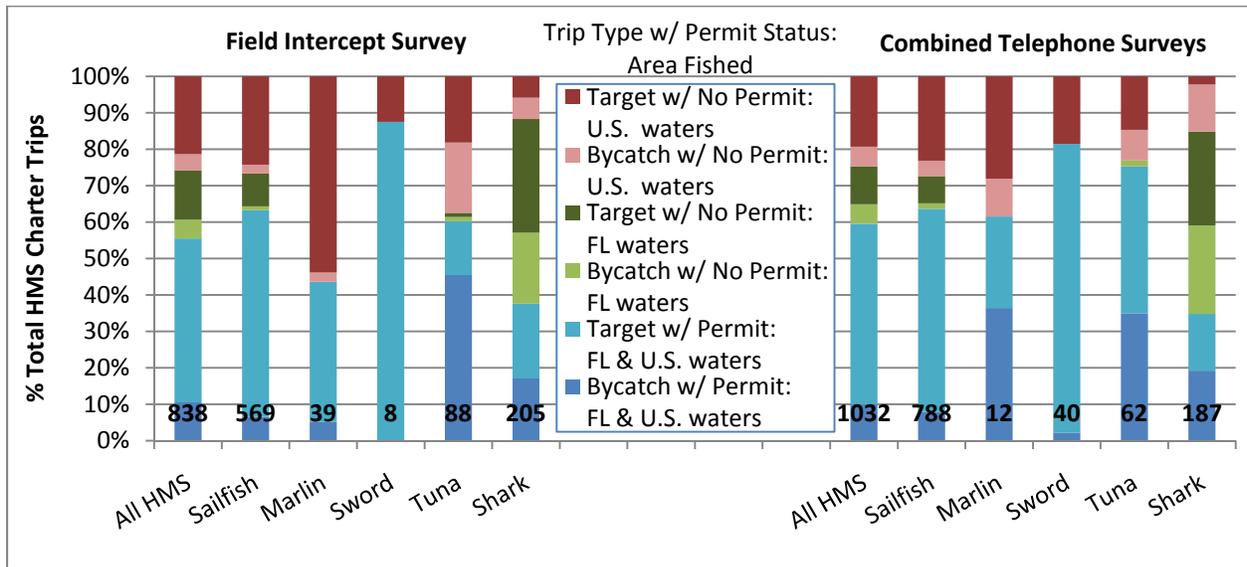


Figure 42 - Distribution HMS-permitted and non-permitted vessels by the trip type and area fished for HMS charter trips among each HMS group. Data labels indicate total number of trips for each HMS group.

NOAA Fisheries requires that all tournaments in which a prize or award is offered for catching or landing Atlantic HMS must register with the NMFS' HMS Management Division at least four weeks prior to its start. Registered tournaments are then selected to submit catch reports to the Recreational Billfish Survey (RBS). All tournaments targeting billfish or swordfish are required to report catches to the RBS, while other HMS tournaments are randomly selected to report. The accuracy of this census of billfish and swordfish tournament landings is dependent upon the tournament organizers complying with the Federal registration and reporting requirements. The FIS intercepted 46 HMS trips participating in tournaments; from which 20 individual tournaments were identified by vessel representatives (neither telephone survey recorded the names of tournaments). Non-HMS species were exclusively targeted during two of these tournaments (HMS were caught as bycatch). Compliance with the registration requirement was found to be poor; with only 10 of 18 tournaments in which HMS were targeted (55.6%) being matched to the HMS Management Division registration list (Table 10).

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Table 10 – Target species and NOAA Fisheries-registration status for HMS tournaments reported to the FIS. (Note, does not include 2 non-HMS targeted tournaments that were not required to register with NOAA Fisheries)

Tournament Target Species	# Registered Tournaments	# Unregistered Tournaments	All Tournaments	
			#	% Registered
Sailfish	9	3	12	75.0%
Sailfish/Shark	-	1	1	0%
Blue Marlin	-	2	2	0%
Blue Marlin/Tuna	1	-	1	100%
Tuna	-	2	2	0%
TOTAL	10	8	18	55.6%

HMS permit holders are also required to report all billfish and swordfish landed during non-tournament recreational trips to NOAA Fisheries within 24 hours of landing via the non-tournament reporting (NTR) telephone hotline or website. Likewise, the State of Florida also requires catches landed in state waters be reported to NOAA Fisheries. During the course of FIS and CTS sampling, a total of 22 sailfish and 13 swordfish were either observed or reported to have been landed. These landings were cross-referenced with the NTR landings reported from the same time period. The comparison revealed that only 31.8% of the sailfish and 61.5% of the swordfish were reported as required to NOAA Fisheries (Table 11).

Table 11 – Comparison of sailfish and swordfish landings that were observed or reported in the FIS or CTS with the NOAA Fisheries non-tournament reporting (NTR) database. The proportion of landed catches that were matched to fish in the NTR database is shown for each species and survey. N indicates the number of fish and % indicates the proportion of the total number of fish per species.

	Reported to NTR	Sailfish N=22				Swordfish N=13			
		Yes		No		Yes		No	
		#	%	#	%	#	%	#	%
FIS & CTS	FIS	7	38.9%	11	61.1%	1	100%	0	-
Observed/Reported Landings	CTS	0	-	4	100%	7	58.3%	5	41.7%
	Total	7	31.8%	15	68.2%	8	61.5%	5	38.5%

4.11 Characterization Survey Analysis

Characterization sampling was initiated on May 28, 2008. At the completion of the May-June 2009 wave sampling, all vessels not characterized on both sample frames were contacted directly, following the same dialing procedures as the FHS. In addition, all FHS vessels located in the other three Florida subregions (Florida Panhandle=PanH, southwest Florida =SWFL, and northeast Florida=NEFL; Figure 1) were also characterized for the one-time survey. All characterizations were completed by September 5, 2009. Due to the movement of some vessels from the CHS vessel frame to the FHS frame, all 2,337 vessels were divided into three groups for the characterization analysis:

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- **FHS-Only** – for-hire vessels on the FHS frame that did *not* possess any HMS or Atlantic Tunas General category permit during the study period.
- **FHS-HMS** - for-hire vessels on the FHS frame that did possess an HMS or Atlantic Tunas General category permit for at least one sample wave. These vessels may have started on the CHS frame, but were moved to the FHS frame once identified as for-hire vessels operating in Florida.
- **HMS-Only** - vessels possessing an HMS Charter/Headboat permit that remained on the CHS frame for the duration of the study

There were 592 HMS Charter/Headboat permitted vessels in SEFL and the Keys, of which 260 remained on the CHS frame throughout the study and comprised the HMS-Only group. An additional 13 for-hire vessels in this area possessed HMS Angling permits, along with 4 possessing Atlantic Tunas General permits. In combination with another 172 HMS-permitted for-hire vessels in other Florida subregions, 520 FHS vessels comprised the FHS-HMS group. The remaining 1,557 vessels on the FHS frame without HMS permits comprised the FHS-Only group.

Most HMS Charter/Headboat permitted vessels in SEFL and the Keys operated as for-hire vessels (64.7% of 592 vessels – Table 12). Permit holders that used their vessels only for private trips accounted for 15.0% of the HMS Charter/Headboat permits in the region, whereas 2.4% reported to be inactive, and 7.4% were deemed to be ineligible for the study. Only 10.0% of permit holders could not be contacted, along with a very small number of vessel representatives that refused to participate (2.5%).

Table 12 – Vessel status of HMS Charter/Headboat permitted vessels in SEFL and the Keys. For-hire vessels are identified by the sample frame they were on during the May-June 2009 sample wave. (Note, for-hire vessels on the CHS frame would have been moved to the FHS frame had the study continued)

Vessel Status of HMS Charter/Headboat Permitted Vessels in SEFL and the Keys, N=592 vessels							
For-Hire Vessels		Private Vessels	Inactive Vessels	Ineligible Vessels	Unable to Contact		Non-Cooperative
FHS Frame	CHS Frame				Bad Contact Info	Non-Responsive	
55.9%	8.8%	15.0%	2.4%	7.4%	4.6%	3.4%	2.5%

Since most for-hire vessels were already on the FHS vessel list, private boats accounted for 34.2% of the 260 HMS-Only vessels that remained on the CHS frame throughout the study. As such, the characterization results for these vessels will be reported separately in subsection 4.12.2.

4.11.1 For-Hire Vessel Characterization Survey Analysis

The complete dialing results for the characterization survey of for-hire vessels are summarized in Figure 43 and presented by Florida subregion in Table 13. Overall, 57.8% of all vessels were successfully characterized and provided some information regarding their HMS fishing activity. Complete interviews were provided by 58.0% of FHS-Only and 54.2% of FHS-HMS vessels. In addition to vessels that were successfully interviewed, those that were ineligible (vessel had not fished in Florida past 12 months from the interview date and would not fish in Florida in the future) accounted for 1.5% of FHS-Only and 2.1% of FHS-HMS vessels. Likewise, inactive vessels (vessel had not fished in Florida past 12 months from the interview date, but did anticipate fishing in Florida in the future) accounted for a small proportion of for-hire vessels (FHS-Only=3.9%; FHS-HMS=4.0%). These proportions are consistent with the dialing results of the FHS weekly sampling (Figure 6).

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Vessel representatives could not be successfully contacted for 31.1% of FHS-Only and 31.0% of FHS-HMS vessels; either due to bad contact information or the vessel representative was unresponsive to the five contact attempts. Uncooperative vessel representatives accounted for 4.8% of FHS-Only and 6.0% of FHS-HMS vessels; substantially lower than the refusal rates experienced during the FHS (12.4%) weekly sampling. A few interviews resulted in mid-interview refusals (11 vessels), in which the vessel representative refused to answer one or more questions. Primarily, these were refusals to disclose the total number of HMS trips the vessel had been used for, either because it was perceived as an economic question or the representative could not provide an accurate estimate (despite being cooperative for all other questions). Information from mid-interview refusals was still used in the analysis when possible.

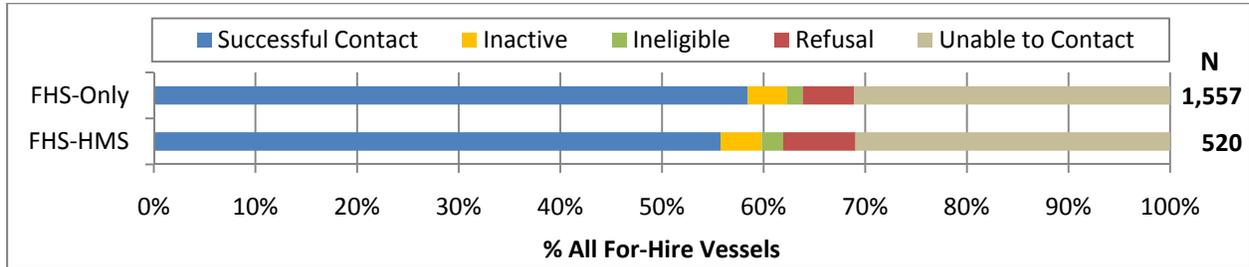


Figure 43 - Summarized characterization dialing results for all for-hire vessels in Florida by HMS permit status. Interview status values have been combined as follows: “Successful Contact” = Complete Interview + Incomplete Interview, “Refusal” = Initial Refusal + Mid-Interview Refusal. N indicates total number of vessels for each group.

Table 13 – Dialing results for one-time HMS characterization survey of all FHS vessels in Florida by each subregion. The values for the Florida subregions combined are a derived average of all vessels combined for each dialing result. “FHS only” = for-hire vessels on the FHS vessel list that did not have an HMS permit; “FHS-HMS” = for-hire vessels on the FHS vessel list that did have HMS permits.

FL Subregion		Interview Status							# Vessels
		Complete Interview	Incomplete Interview	Ineligible	Inactive	Initial Refusal	Mid-Interview Refusal	Unable to Contact	
FHS-Only	Panhandle	76.7%	-	3.8%	1.7%	3.1%	-	14.6%	287
	SWFL	58.3%	0.2%	2.5%	1.7%	2.7%	-	34.6%	641
	Keys	39.5%	1.9%	3.6%	-	6.1%	0.3%	48.5%	309
	SEFL	57.0%	-	7.4%	3.3%	7.4%	2.5%	22.3%	121
	NEFL	59.3%	-	6.5%	2.0%	10.1%	0.5%	21.6%	199
	All Subregions	58.0%	0.4%	3.9%	1.5%	4.8%	0.3%	31.1%	1,557
FHS-HMS	Panhandle	83.8%	-	1.0%	-	1.0%	-	14.3%	105
	SWFL	75.9%	-	3.4%	-	-	-	20.7%	29
	Keys	43.6%	0.6%	5.2%	-	5.8%	0.6%	44.2%	172
	SEFL	41.2%	4.0%	5.6%	6.2%	9.6%	2.3%	31.1%	177
	NEFL	64.9%	-	-	-	8.1%	2.7%	24.3%	37
	All Subregions	54.2%	1.5%	4.0%	2.1%	6.0%	1.2%	31.0%	520

Of the 1,211 characterized for-hire vessels, 34.6% of the vessel representatives reported targeting HMS at least once within 12 months of the interview date. As expected, vessels possessing an HMS permit were more likely to have recently targeted HMS (Figure 44). Among the FHS-Only vessels, only 23.9% targeted HMS, compared to 67.6% of FHS-HMS vessels. Of the five Florida subregions, the Keys and SEFL accounted for higher proportions of vessels targeting HMS; with 65.9% (Keys) and 45.8% (SEFL) of FHS-Only vessels compared to less than 16.8% in the other subregions, and 87.0% (Keys) and 81.0% (SEFL) of FHS-HMS vessels compared to less than 52.0% in the other subregions.

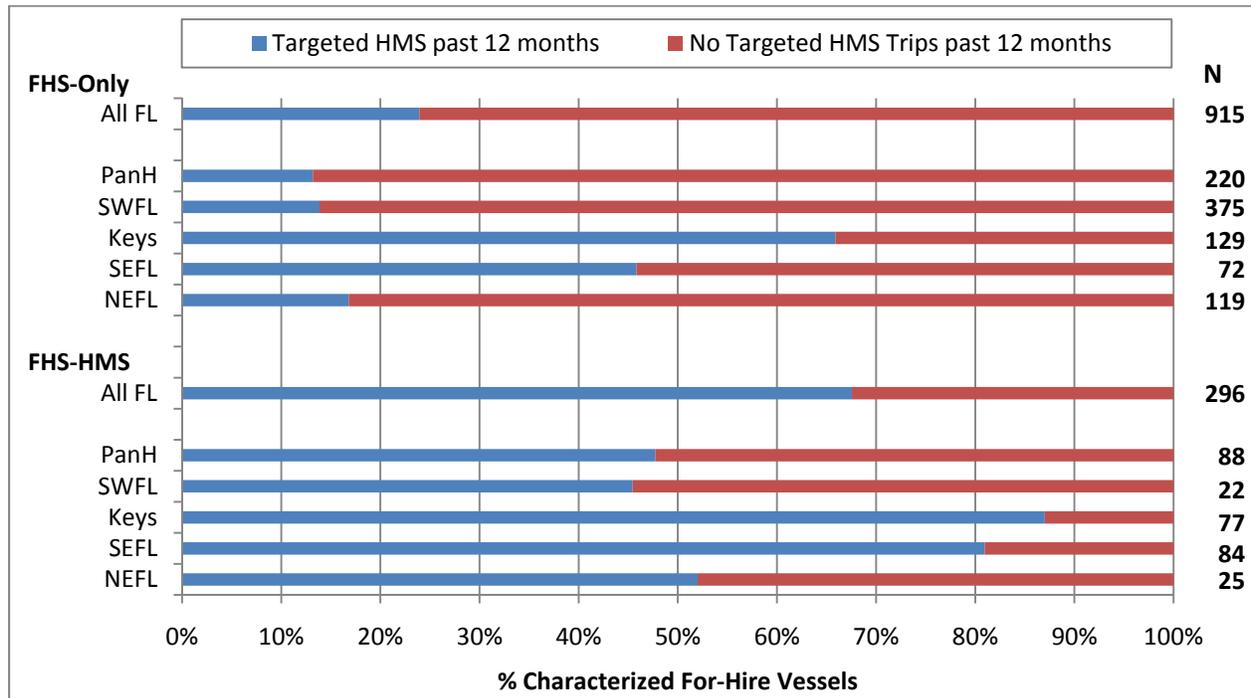


Figure 44 – Proportion of for-hire vessels that reported at least one HMS targeted trip within the past 12 months of the characterization interview. N indicates total number of characterized vessels for each vessel group by Florida subregion.

There were clear differences among the for-hire vessels that reported targeting HMS at least once within the past year in regards to the specific HMS group they had targeted (Figure 45A). FHS-Only vessels primarily targeted sharks (77.6%), followed by billfish (44.4%), swordfish (10.7%), and tunas (5.6%). In contrast, billfish were targeted by most FHS-HMS vessels (78.2%), while more than a third of the FHS-HMS vessels also targeted sharks (39.9%) and swordfish (37.8%) at least once, while only 24.9% targeted tunas.

As expected, FHS-HMS vessels conducted more targeted HMS trips, averaging 54.3 trips/year, compared to 37.4 trips/year by FHS-Only vessels (Figure 45B). The frequency of trips conducted by vessels to target specific HMS groups also varied considerably among the groups. Billfish trips were the most frequent, with FHS-HMS vessels conducting an average of 52.6 billfish trips/year and FHS-Only vessels averaging 40.9 trips/year. Of the vessels that reported targeting sharks at least once, FHS-Only and FHS-HMS vessels conducted an average of 22.4 and 18.7 shark trips/year, respectively. In contrast, vessels targeting swordfish (FHS-Only=13.3 swordfish trips/year; FHS-HMS=10.7 trips/year) and tuna (FHS-HMS=16.7 tuna trips/year; FHS-Only=8.8 trips/year) conducted trips less frequently.

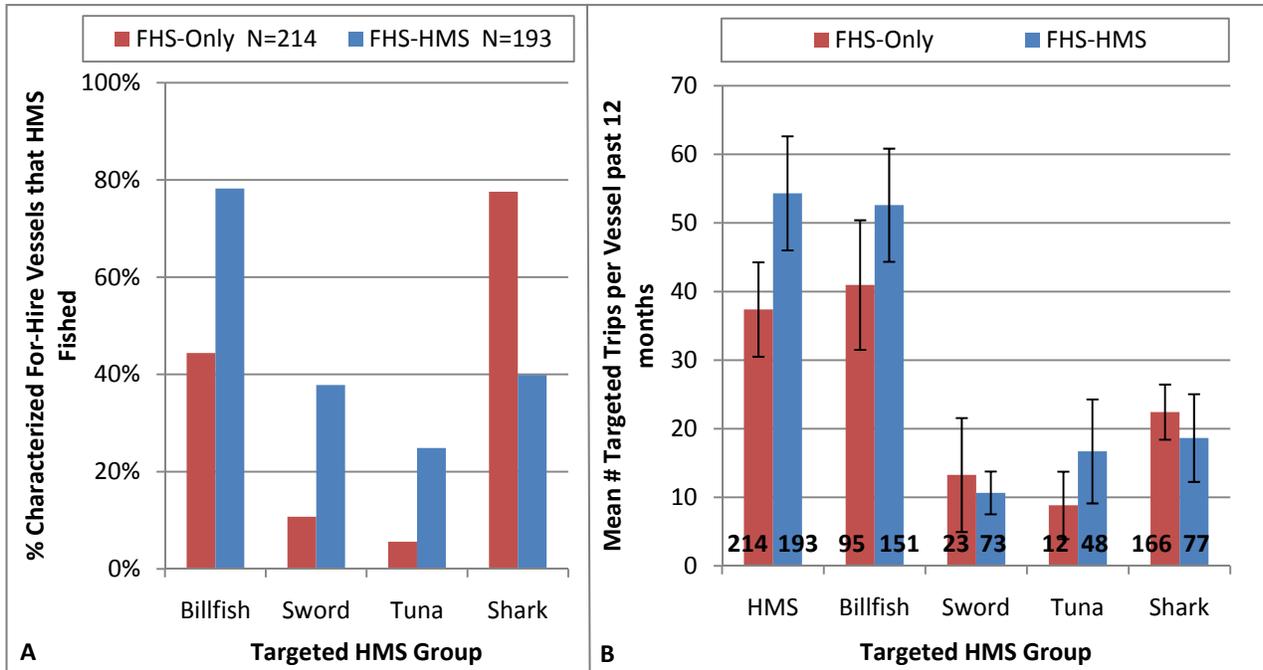


Figure 45 – The left graph (A) shows the proportion of for-hire vessels by HMS permit status that targeted each HMS group. The sum of the proportions exceeds 100% because many vessels reported targeting multiple HMS groups throughout the past year. The right graph (B) shows the mean number of HMS trips per vessel within the past 12 months for each HMS group. Mean values were derived for vessels that were reported to have conducted at least one targeted trip for the respective HMS group within each vessel group. Error bars represent 95% confidence limits and N indicates total number of characterized for-hire vessels that fished for each HMS group within past 12 months by each vessel group.

Vessel representatives that reported to have fished for HMS within the past 12 months of the characterization interview were asked how many years they had fished for HMS. The mean HMS fishing experience for the for-hire vessel representatives was greater than 20 years for both vessel groups (FHS-HMS=24.1 years; FHS-Only=20.6 years).

Directed HMS trips were primarily conducted out of the primary access site by more than 90% of all characterized for-hire vessels (Figure 46). Vessels that used a secondary access site within Florida for HMS fishing accounted for 8.7% of FHS-Only and 2.5% of FHS-HMS vessels. No vessel representative reporting using a secondary access site outside of Florida for most of their HMS fishing with their vessel.

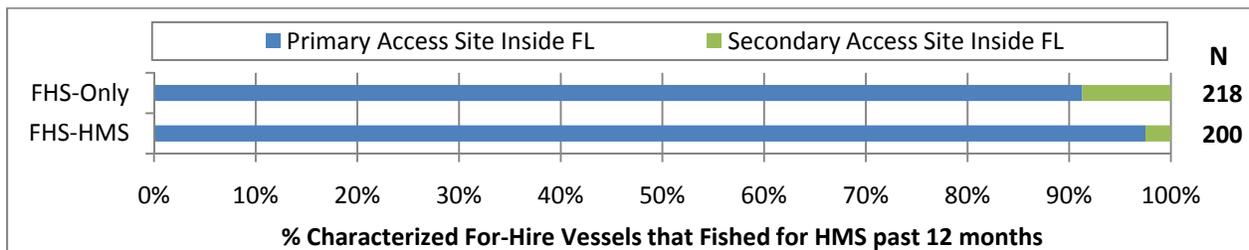


Figure 46 – Proportion of for-hire vessels that primarily used their principle port for HMS fishing compared to those vessels that instead used a secondary site elsewhere within Florida. N indicates total number of characterized for-hire vessels that fished for HMS within past 12 months for each vessel group.

The different types of access sites primarily used for HMS fishing are shown in Figure 47. For-hire vessels primarily used marinas, accounting for 88.9% of FHS-HMS and 75.8% of FHS-Only vessels (82.1% all for-hire vessels). Only 7.5% of FHS-HMS and 2.8% of FHS-Only vessels primarily used private docks (5.1% all for-hire vessels). Boat ramps were primarily used by 21.4% of FHS-Only and 3.5% of FHS-HMS vessels, although it should be noted that boat ramp use within the FIS study area was less than half of the state-wide average for all for-hire vessels (6.4% of for-hire vessels in the Keys and SEFL, 12.8% all Florida subregions). More importantly to assessing the extent of coverage by an access survey, 88.4% of FHS-Only and 87.4% of FHS-HMS vessels operated out of access sites that were covered by the MRFSS. An additional 6.0% of FHS-Only and 3.0% of FHS-Only vessels reported using access sites that were accessible to the public, but were not on the MRFSS site register (or the vessel representative did not provide sufficient information to match the site to a known MRFSS site). The remaining 5.6% of FHS-Only and 9.5% of FHS-HMS vessels used private access sites that are not accessible to samplers conducting a field intercept survey.

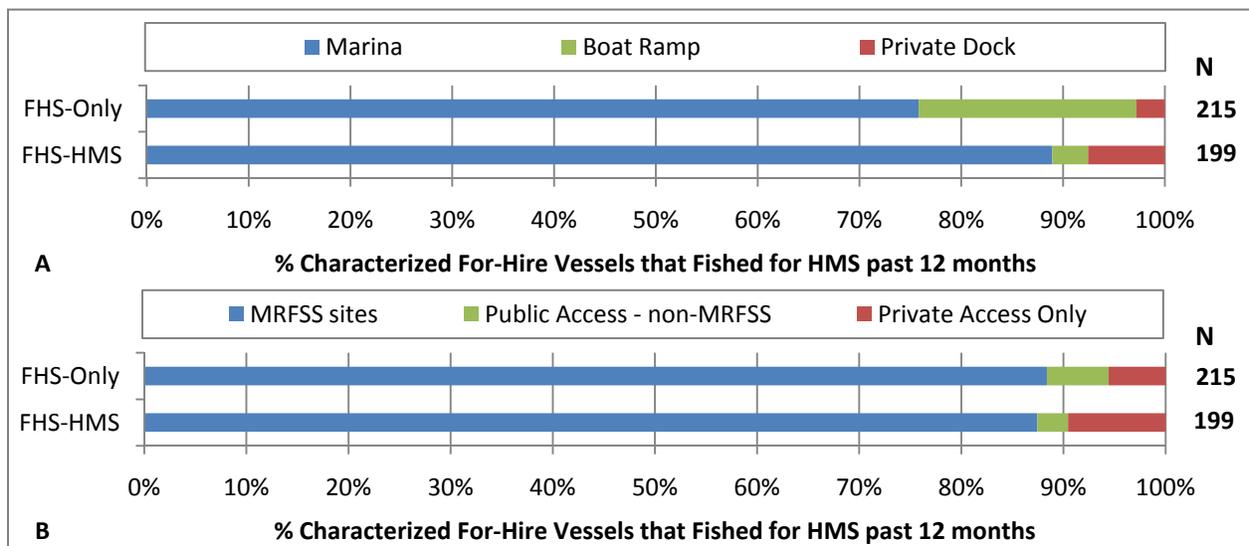


Figure 47 - Proportion of access site types primarily used by for-hire vessels for HMS fishing in Florida. “MRFSS sites” = sites that have been matched up with known sites on the MRFSS register, “Public Access – unknown MRFSS sites” = sites that were reported to be public access by the vessel representative but could not be matched to the MRFSS site register, and “Private Access” = sites that are not sampled by the MRFSS. N indicates total number of characterized for-hire vessels that fished for HMS within the past 12 months for each vessel group.

Vessel representatives were asked if they ever stopped at another public access site (*i.e.*, public marina, fuel dock, water-front hotel or restaurant, etc.) while returning from a directed HMS trip within the past 12 months from the interview date. Among the small proportion of for-hire vessels operating out of private access sites (Figure 47), the large majority (FHS Only=80.0%, FHS-HMS=72.0%) indicated that they never stopped at a public access site while returning from HMS trips (Figure 48). Therefore, while private access sites are only used by less than 10% of the Florida for-hire fishery, it will be difficult to collect information from this segment using a traditional access point intercept survey.

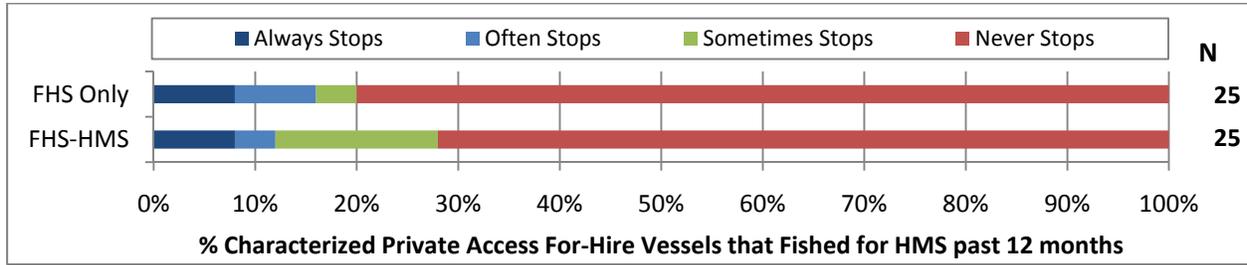


Figure 48 - Frequency for-hire vessels in Florida that primarily operated out of private access sites stopped at another marina, fuel dock, or other public access site while returning from an HMS trip within the past 12 months. N indicates total number of characterized for-hire vessels that fished for HMS within the past 12 months for each vessel group.

For-hire vessel representatives were also asked if they had used alternate sites for some HMS fishing within the past 12 months. Small proportions of vessels reported to have operated out of alternate sites (including sites outside Florida, either in other states or outside the United States altogether), including 20.2% of FHS-HMS and 15.7% of FHS-Only vessels (Figure 49). Vessels primarily operating out of private access sites responded similarly, with 24.0% of FHS-Only, and 12.0% of FHS-FHS vessels using an alternate site.

Taking into account the principle port or secondary access site used primarily for HMS (Figure 46), along with the use of alternate sites (Figure 49), the use of access sites outside of Florida for HMS fishing by for-hire vessels was extremely limited within the past 12 months. No FHS-Only vessels reported fishing for HMS outside of Florida, while only 3.5% of FHS-HMS vessels reported using an alternate site outside of Florida in addition to their Florida-based HMS fishing trips. Some vessel representatives anecdotally reported having used their vessels for HMS fishing in mid-Atlantic and northeastern states, as well as in the Bahamas and Mexico, to target billfish and tunas in prior years. These trips were not conducted during the Characterization survey’s time period, though, due to high fuel prices and the onset of the economic recession.

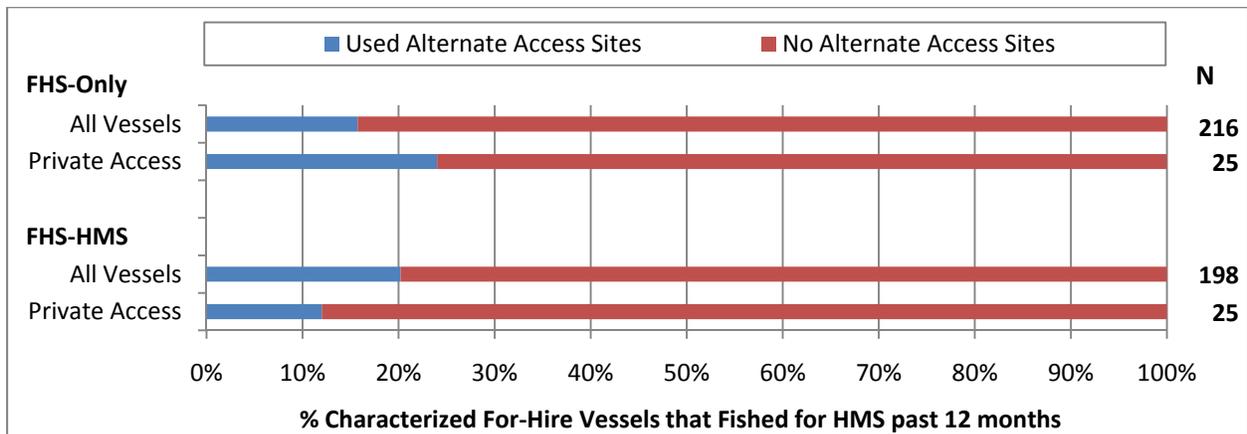


Figure 49 – Proportion of for-hire vessels in Florida that used an alternate access site for HMS fishing within the past 12 months. The upper bar for each vessel group shows all characterized vessels while the lower bar only shows vessels that primarily used a private access site for HMS fishing. N indicates total number of characterized for-hire vessels that fished for HMS within the past 12 months for each vessel group.

4.11.2 HMS Charter/Headboat Permit Only Vessel Characterization Survey Analysis

The following characterization survey results are for vessels on the CHS frame (those possessing the HMS Charter/Headboat permit) that were not moved to the FHS frame because they only operated as private vessels. This vessel group is referred to as HMS-Only vessels. Unlike the for-hire vessels, only vessels located in the Keys and SEFL were characterized.

Summarized dialing results for the one-time characterization survey of HMS-Only vessels are presented in Figure 50. Successfully characterized vessels that provided some information regarding their HMS fishing activity accounted for 40.0% of the permit holders. Those that were deemed ineligible (vessel had not fished in Florida past 12 months and would not fish in Florida in the future) accounted for only 4.6% of the HMS-Only vessels, slightly higher than the proportion of all characterized for-hire vessels (1.7% FHS-only and FHS-HMS combined). In contrast, HMS-Only vessels that were inactive (vessel had not fished in Florida past 12 months, but did anticipate fishing in Florida in the future) accounted for a much larger percentage (16.5%) compared to the proportion of inactive for-hire vessels (3.9%). This was most likely a result of this pilot study being the first time these permit holders were contacted regarding their HMS fishing activity, whereas most for-hire vessels have been regularly sampled by the FHS and MRFSS for a number of years. Refusal rates (5.4%) and the proportion of HMS-Only vessels that could not be contacted (33.5%) were similar to the for-hire vessel characterization results. There were no mid-interview refusals encountered with this vessel group.

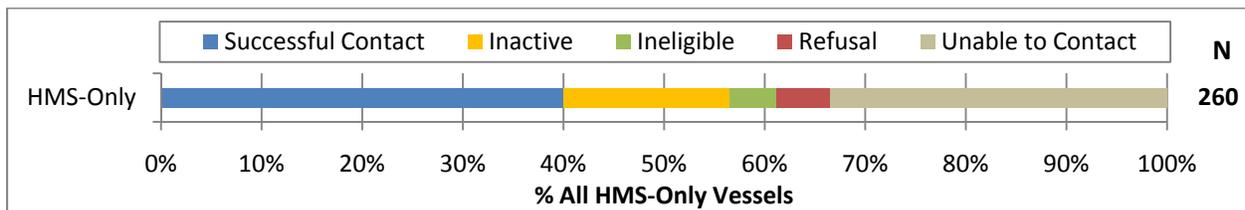


Figure 50 - Summarized characterization dialing results for all HMS-Only vessels in the Keys and SEFL. Interview status values have been combined as follows: “Successful Contact” = Complete Interview + Incomplete Interview, “Refusal” = Initial Refusal + Mid-Interview Refusal. N indicates total number of HMS-Only vessels.

Of the 104 characterized HMS-Only vessels, 93.3% of the permit holders reported targeting HMS at least once within 12 months of the interview date (Figure 51), conducting an average of 27.8 targeted trips during that time period (Figure 52). The Keys and SEFL accounted for similar proportions of vessels conducting HMS targeted trips (91.9% Keys and 94.0% SEFL). Among the permit holders that reported having recently fished for HMS, 91.3% had targeted billfish at least once during that time, averaging 22.7 billfish trips/year. Moreover, 53.3% fished for swordfish, but only averaged 6.3 trips/year, whereas 32.6% targeted tunas, with an average of 12.1 trips/year. The small percent of permit holders that reported having targeted sharks within the past year (13.0%) averaged 8.4 trips per year. By comparison, for-hire vessel representatives averaged more than twice as many targeted billfish and shark trips, as would be expected by a full-time business (Figure 45). On the other hand, the frequency of swordfish and tuna trips conducted by HMS-Only vessels was more similar to for-hire vessels.

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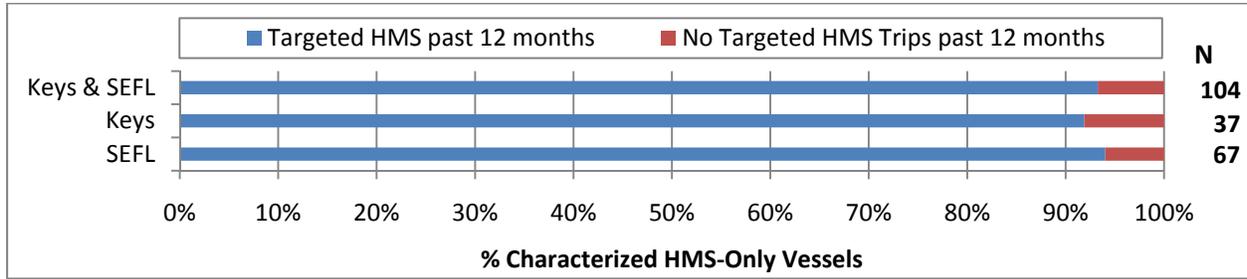


Figure 51 – Proportion of HMS-Only vessels that reported having conducted at least one HMS targeted trip within the past 12 months of the characterization interview. N indicates total number of characterized vessels for each Florida subregion.

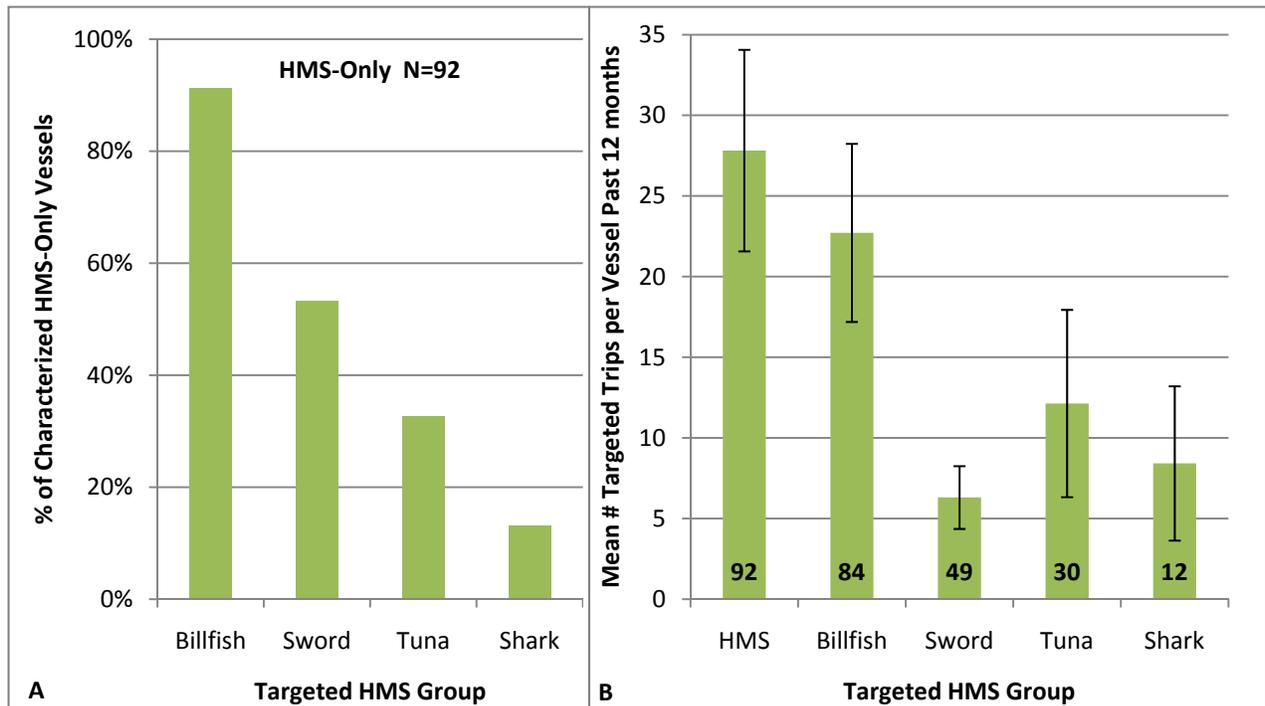


Figure 52 – The left graph (A) shows the proportion of HMS-Only vessels that targeted each HMS group. The right graph (B) shows the mean number of HMS trips per vessel within the past 12 months for each HMS group. Mean values were derived for vessels that were used to conduct at least one targeted trip for the respective HMS group. Error bars represent 95% confidence limits and N indicates total number of characterized vessels that fished for HMS within past 12 months for each HMS group.

Similar to for-hire vessel representatives, HMS-Only permit holders reported having an average of 24.5 years of experience fishing for HMS.

Directed HMS trips were primarily conducted from primary access sites by 90.7% of all characterized HMS-Only vessels (Figure 53). Unlike the for-hire vessels, though, a few permit holders reported using secondary access sites located outside the United States for most of their HMS fishing (5.2%), in addition to some that primarily used secondary sites located in other states (4.1%).

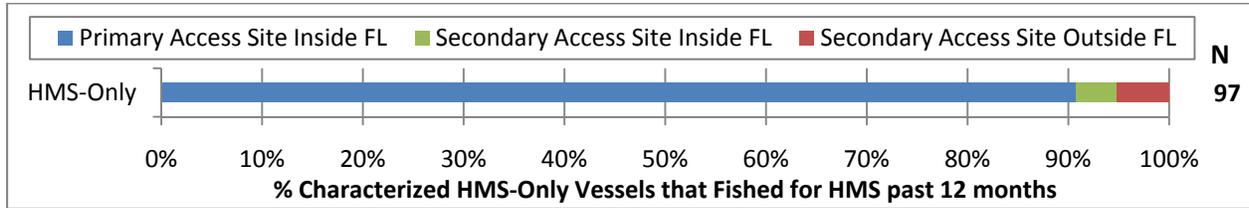


Figure 53 – Proportion of HMS-Only vessels that primarily used their principle port for HMS fishing compared to vessels that instead used a secondary site elsewhere within Florida. N indicates total number of characterized vessels that fished for HMS within past 12 months.

The use of private docks and private access sites was more common among HMS-Only permit holders (Figure 54). Nearly half of all HMS-Only vessels primarily operated out of private access sites (47.8%), whereas these inaccessible sites only accounted for 9.6% of for-hire vessels within the Keys and SEFL. An additional 12.0% of HMS-Only vessels fished out of public sites that were not on the MRFSS site register. Altogether, this would indicate a potential under-coverage bias of nearly 60% of HMS-Only vessels in a traditional access point intercept survey, compared to only 11.2% of all for-hire vessels operating within the same area of Florida. Marinas and boat ramps were only used by 51.1% and 12.0% of HMS-Only vessels, respectively, compared to 86.8% and 6.4% of the for-hire vessels operating in the Keys and SEFL.

Stopping at other public access sites while returning from HMS fishing was not a common occurrence among HMS-Only permit holders, as 87.0% never stopped, 9.8% stopped sometimes, and only 3.3% stopped often or after all HMS trips (Figure 55). Vessels that operated primarily out of private access sites responded similarly, with less than 16.5% reported having stopped at least sometimes, including only 3.6% that stopped often or after all HMS trips.

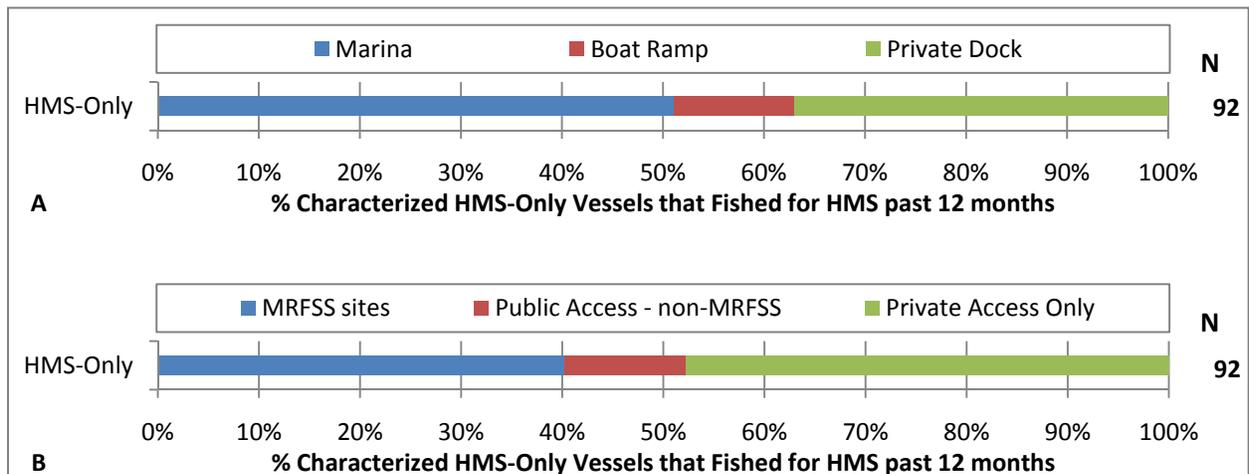


Figure 54 - Proportion of access site types primarily used by HMS-Only vessels for HMS fishing in Florida. “MRFSS sites” = sites that have been matched up with known sites on the MRFSS register, “Public Access – unknown MRFSS sites” = sites that were reported to be public access by the vessel representative but could not be matched to the MRFSS site register, and “Private Access” = sites that are not sampled by the MRFSS. N indicates total number of characterized vessels that fished for HMS within the past 12 months.

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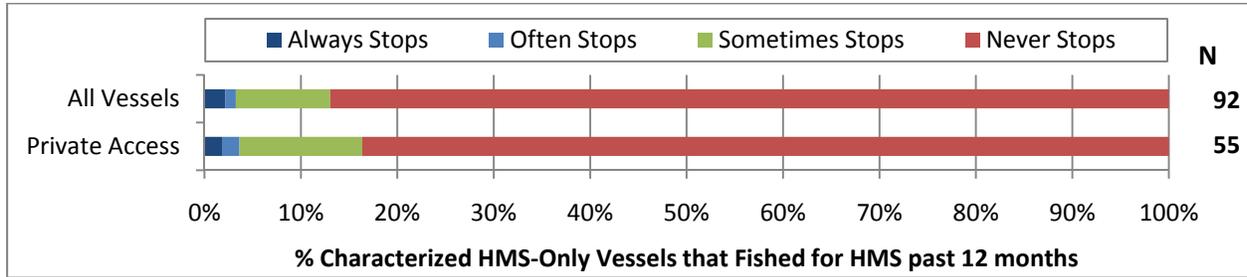


Figure 55 - Frequency HMS-Only vessels in Florida stopped at another marina, fuel dock, or other public access site while returning from an HMS trip within the past 12 months. The upper bar for each vessel group shows all vessels while the lower bar only shows vessels that primarily used a private access site for HMS fishing. N indicates total number of characterized vessels that fished for HMS within the past 12 months.

Permit holders that reported using an alternate site in addition to their vessel’s principle port for HMS fishing accounted for 27.3% of HMS-Only vessels (Figure 56). This was more common than what was reported by for-hire vessels (17.9%). A similar fraction of HMS-Only vessels that primarily used private access sites reported using alternate sites (27.2%). In combination with the permit holders that used secondary access sites outside Florida for most of their directed HMS fishing, 21.6% of HMS-Only vessels fished for HMS outside Florida in addition to trips within their home state (Figure 57). Specifically, 16.5% fished outside the United States, 4.1% in other states, and one vessel fished for HMS in Florida, other states, and outside the United States within the past 12 months. In comparison, only 3.5% of FHS-HMS and no FHS-Only vessels fished outside Florida for HMS.

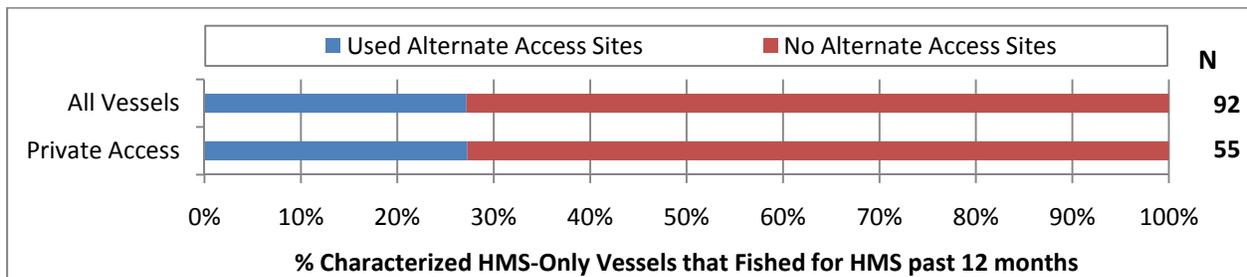


Figure 56 – Proportion of HMS-Only vessels in Florida that used an alternate access site for HMS fishing within the past 12 months. The upper bar reflects the proportion of all characterized HMS-Only vessels while the lower bar only shows vessels that primarily used a private access site for HMS fishing. N indicates total number of characterized vessels that fished for HMS within the past 12 months.

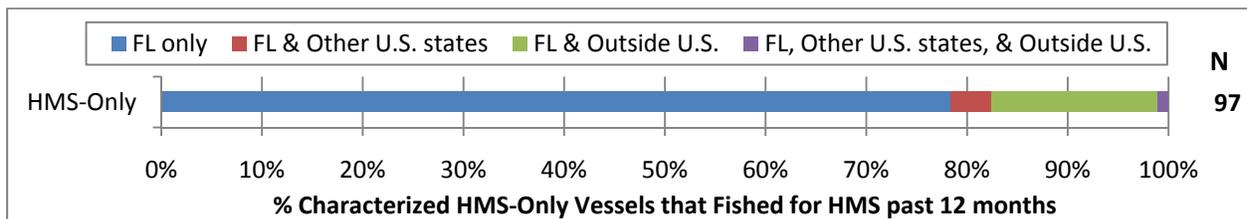


Figure 57 – Distribution of the geographic areas fished for HMS by HMS-Only vessels. Includes principle port, secondary access site for HMS fishing, and other access sites vessel representatives reported to have been used by the vessel in the past 12 months. N indicates total number of characterized HMS-Only vessels that fished for HMS within the past 12 months.

4.11.3 Characterization Survey Results Regarding the Use of E-mail for Future HMS Survey

Vessel representatives were asked if they would be willing to participate in a future survey that would use E-mail as the primary communication method as an alternative to the traditional telephone survey. As shown in Figure 58, HMS-Only vessel representatives were more willing to participate in an E-mail survey (75.2%), whereas only 48.4% of all for-hire vessels were willing to try the new format (50.9% FHS-HMS and 47.6% FHS-Only).

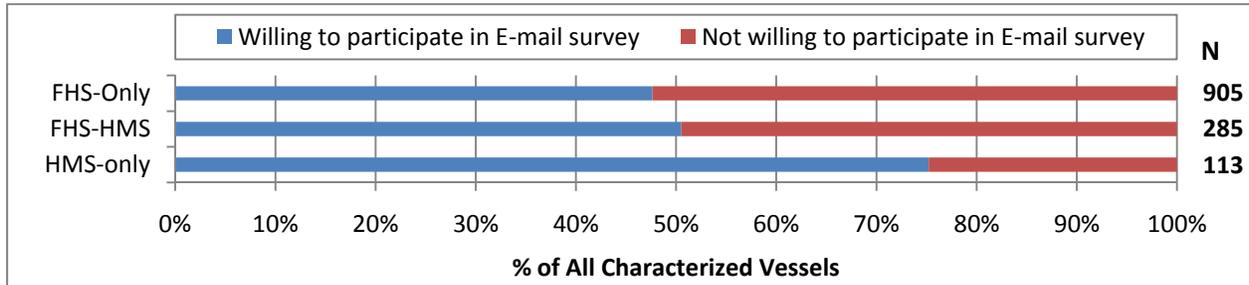


Figure 58 - Proportion of vessel representatives of for-hire and HMS-Only vessels willing to participate in a future survey in which e-mail would be the primary method of contacting them. N indicates total number of characterized vessels for each vessel group.

5. DISCUSSION

5.1 Florida HMS For-Hire Fishery: General Characteristics

The results of this study lead to the following characterizations of the for-hire HMS fishery in Florida:

- HMS fishing accounts for 24% of all for-hire trips conducted in South Florida. HMS fishing accounts for a larger proportion of trips in southeast Florida (32.7%) than in the Keys (17.9%).
- Sailfish is the most common and widely targeted HMS in South Florida, accounting for 72% of all HMS charter trips and more than two thirds of the estimated HMS total catch.
- More than 40% of HMS charter trips are conducted by for-hire vessels that do not possess HMS permits; approximately half of which target HMS in Federal waters, violating Federal regulations. Non-permitted vessels targeting HMS in Federal waters account for approximately 54% of marlin trips, 24% of sailfish trips, 18% of swordfish trips, 17% of tuna trips, and 4% of shark trips.
- For-hire vessels possessing HMS permits primarily target billfish when fishing for HMS, whereas vessels that do not possess HMS permits primarily target sharks.
- Directed HMS fishing occurs year-round in South Florida. More than two thirds of sailfish trips occur from November to April, tuna and marlin trips occur primarily during the late spring to summer months, and swordfish trips are more common during the summer and fall. Shark trips are more evenly distributed throughout the year, but are more frequent during the winter-spring tourism season.
- For-hire trip return times are broadly distributed throughout the day, with approximately 60% of HMS charter trips returning between either 12:00 to 13:00 hours or 15:00 to 17:00 hours.
- Nighttime returns between 20:00 and 08:00 hours account for 40% of for-hire swordfish trips, but less than 3% of all HMS charter trips in general.
- Approximately 93% of for-hire vessels in Florida return to public access sites, of which 88% of those are sampled through the MRFSS. The remaining 7% of for-hire vessels return to private access sites. Less than 3% of all HMS charter trips in South Florida returned to private sites.
- Tournament fishing accounts for only 4% of HMS charter trips, but more than 26% of private HMS trips conducted by for-hire vessels.
- Approximately 57% of all HMS charter trips occur primarily in Federal waters, including all swordfish, most marlin (>95%), and more than 76% of tuna trips. More than 38% of sailfish and 70% of shark trips occur in Florida State waters.
- A comparison of 95 matched trips sampled both by the Field Intercept Survey (FIS) and later during the For-Hire Telephone Survey (FHS) revealed vessel representatives exhibited poor recall regarding the number of customers they carried, as a significantly greater number of customers per trip were reported in the telephone survey during all matched for-hire trips.
- Sailfish catch rates reported to the FHS were significantly greater than those recorded by the FIS. The actual numbers of fish caught during positive catch trips did not differ significantly between the survey formats. Possible prestige bias towards positive catch trips (reported more frequently in the telephone survey) should be further investigated.
- Sailfish catch rates from for-hire trips that return at 15:00 hours or later are significantly greater than trips that return earlier in the day.
- Most for-hire vessels practice catch and release fishing for billfish and sharks.
- Compliance with mandatory reporting requirement to NOAA Fisheries of landed sailfish and swordfish catches is poor among for-hire vessels. Only 32% of sailfish and 62% of swordfish reported or observed to have been landed during this study were reported to NOAA Fisheries.

5.2 Evaluation of Survey Design

5.2.1 *Sample Frame Coverage*

Supplementing existing data collection activities is necessary to accommodate the “rare event” nature of recreational HMS fisheries. This includes narrowing the sample population to likely HMS anglers and the utilization of non-traditional sampling methodologies to further increase the likelihood of capturing trips in which HMS are targeted and/or caught. Used as the primary sample frame by the Large Pelagic Survey (LPS) in the mid-Atlantic and New England states, the HMS permit list is a useful tool in regards to identifying the relatively small percent of anglers that anticipate using their vessels for directed HMS fishing from a much larger population of recreational anglers. Unfortunately, the results of this study clearly show a significant proportion of HMS are targeted by non-permitted vessels (Figures 42 and 45), whereas species such as sharks and skipjack tuna are frequently caught as bycatch (Figure 12). Likewise, the Florida HMS Private Angler Telephone Survey (PATS), a biweekly survey of HMS Angling permitted vessels conducted throughout Florida from May 2008 to April 2009, also indicated several HMS are frequently caught as bycatch during private recreational trips in this region. Consequently, the PATS identified significant coverage gaps regarding the use of the HMS permit as the sole sample frame to monitor HMS fishing in Florida (MRIP, 2010). These gaps include 1) the lack of a permit requirement in State waters for all HMS (with the exception of tunas), and 2) the unknown proportion of non-HMS permitted vessels fishing in Federal waters. The latter group may potentially account for a significant proportion of HMS catches, as indicated by considerable differences between the PATS and MRFSS total catch estimates for sailfish and skipjack tunas, despite having relatively good levels of precision.

Unlike the PATS, this study employed a dual sample frame approach to address potential HMS permit list coverage gaps (Currivan and Roe, 2004). By pairing the HMS Charter/Headboat permit list with the FHS vessel list, the study results demonstrated that the dual-frame approach significantly improved coverage of HMS fishing activities in South Florida. Vessels without HMS permits accounted for approximately 45% of all HMS charter trips sampled in the FIS HMS, including approximately 37% of sailfish, 56% of marlin, and 62% of shark trips (Figure 42). Consistent with the FIS, 41% of the Combined Telephone Surveys (CTS) HMS charter trips were conducted by non-permitted vessels. The State-wide characterization survey results also showed approximately 24% of non-permitted for-hire vessels (FHS-Only) targeted HMS at least once during the past 12 months, including 46% of southeast Florida (SEFL) and 64% of Florida Keys (Keys) vessels (Figure 44). These non-permitted vessels primarily targeted billfish and sharks (44% and 78% of all characterized FHS-only vessels, respectively – Figure 45).

The results of this study demonstrate that identification and monitoring of for-hire vessels participating in HMS fisheries clearly is best achieved by using the FHS vessel list as the primary sample frame. The added value of the HMS Charter/Headboat permit list serving as a secondary sample frame should not be overlooked, though. Coverage of the fishery clearly improved under the dual-frame design approach, as indicated by the FIS results. The proportion of FIS intercepted vessels on the FHS frame steadily increased from 82% during the first sample wave to over 94% by the end of the study (Figure 38). This was primarily accomplished by HMS Charter/Headboat permit Telephone Survey (CHS) sampling which facilitated more timely vessel updates to the FHS frame; both by identifying previously unknown vessels operating on a part-time basis or out of private access sites, while also providing updates regarding the replacement of older FHS vessels with new ones by vessel owners (these replacements often go unnoticed if the new vessel is assigned the same name as the older vessel). In addition, both the

proportion of CHS and off-frame vessel intercepts in the FIS similarly declined as hoped, from 6% to 2% for CHS intercepts and 13% to 3% for off-frame intercepts.

On the other hand, the study did draw attention to a large proportion of HMS Charter/Headboat permitted vessels that were being operated exclusively as private vessels (15% - Table 12). Vessels that reported not to be actively participating in the for-hire fishery (either for HMS or non-HMS fisheries) were not moved to the FHS vessel frame. After each sample wave update in which more HMS permitted vessels were moved to the FHS frame, the CHS frame was comprised primarily of private vessels (34.2% of 260 CHS vessels) or vessels that were inactive (5.4%), ineligible (16.5%), uncooperative (5.8%), or unable to be contacted (18.1%). The small size of the CHS frame (Table 1) and the tendency of private vessels to fish less frequently than for-hire vessels (Figure 52) resulted in few HMS trips being reported to the CHS (only 68 trips throughout the pilot study). Consequently, catch and effort estimates produced by the CHS were of low precision and the limited amount of information collected precluded a detailed analysis of the characteristics of this segment of the HMS fishery.

5.2.2 Sampling Efficiency of the Field Intercept Survey

The primary objective of the FIS was to intercept for-hire HMS trips and landed catches in as efficient a manner as possible. Several design features were adopted from the access point intercept survey employed by the LPS, including cluster sampling and vessel-trip interviews, to expand coverage and increase the likelihood of intercepting all for-hire trips conducted on a given day around a central ocean access point (*i.e.*, an inlet or pass).

The cluster sampling approach was highly effective at intercepting most for-hire trips (HMS and non-HMS trips) that occurred within a cluster; with more than half of all vessel interviews being collected at secondary sites. Overall, samplers missed less than 10% of all for-hire vessels actively fishing (Figure 5), and only 7% of vessels at the primary site. Some clusters did experience higher rates of missed vessels, primarily due to the inclusion of boat ramps, as well as the logistical difficulty of intercepting vessels that returned to different sites at the same time. Furthermore, samplers in the Keys reported many of the missed vessels they recorded were guides operating small flats boats on back-country trips. The window of time vessel representatives with these smaller craft were available for interviews was much shorter than with those working on off-shore vessels, simply because less time was needed to clean the smaller boat. Although sharks were frequently caught during back-country trips, these vessels primarily conducted non-HMS directed trips. This latter point may have also contributed to the significantly higher proportion of HMS trips encountered by the FIS compared to the FHS (HMS were targeted or caught during 39% of all FIS trips compared to only 24% of FHS trips - Figure 8).

The expanded coverage and high sampling efficiency achieved by the cluster sampling approach would not have been possible had vessel interviews been collected at the angler-trip level. The frequent departure of for-hire customers immediately after the conclusion of a trip limits the ability of samplers to interview all vessels at an access site that return at similar times, let alone at different sites. Conducting a complete trip interview with each customer also requires more time than a single interview with an experienced vessel representative accustomed with the purpose and content of the survey questionnaire. Additionally, refusals by customers who were dissatisfied with their trip experience, disinterested in being surveyed, unsupportive of fisheries research, or unable to be interviewed due to illness or intoxication (a common occurrence in tourist areas) did not result in the

loss of data from otherwise cooperative for-hire vessels under the vessel-trip interview design. Cooperation rates among for-hire representatives throughout the FIS exceeded 94% (Appendix H).

It should also be noted an added benefit to this approach was for-hire captains overwhelmingly expressed their preference that they or their crew were being interviewed during the FIS, and not their customers as in the MRFSS Access Point Angler Intercept Survey (APAIS - the survey to which they have long been accustomed). This was especially prevalent at marinas where tourists comprise most of their clientele. While captains were not formally surveyed, the most common reasons addressed captains' concerns that their customers not be burdened with being surveyed (including being delayed if they were trying to leave), as well as their perception that vessel representatives would provide more accurate trip and catch data than their customers could. The consistent preference for vessel level interviews expressed during these informal conversations should at least warrant a follow-up survey question regarding the industry's preference as to who should be interviewed during field intercept surveys – crew or customers.

The FIS design requirement that all assignments be conducted until all for-hire vessels had returned to their dock for the day or until 20:00 hours did result in a more representative sample. The differences in trip durations (Figure 18) and of vessel return times (Figure 19) among the HMS groups in both surveys indicate the extended coverage was necessary to account for the diversity of trip types that occur within this region. More importantly, the CPUE analysis comparing sailfish trip end times (before or after 15:00 hours) confirmed there are significant differences in catch rates collected from for-hire vessels that return at different times of the day (Table 8). Discontinuing field assignments prematurely would have biased the sample towards trips that fished less time, closer to shore, or returned earlier in the day.

The CTS results did show an additional 7% of HMS charter trips returned to other public access sites not on the FIS site list, most of which were boat ramps already on the MRFSS site register. With exception to the three boat ramps in the Keys, the exclusion of most boat ramps from the FIS site clusters was based on the infrequency for-hire vessels were encountered at these sites during the course of earlier MRFSS sampling. The lack of historical productivity and uncertainty of how many for-hire vessels would be operating out of these sites on a given day suggested sampling efficiency would be reduced by the inclusion of these sites. Although the coverage gap resulting from the exclusion of these low activity sites was relatively small, future field surveys should attempt to include boat ramps in some capacity.

Overall, the FIS design effectively achieved the objective of intercepting most HMS trips returning to multiple access sites clustered around a central geographic ocean access point. It also demonstrated a total count of for-hire effort within the cluster could be quantified for each assignment to derive the proportion of missed vessel trips, a necessary component to conducting a roving creel survey (Essig and Holliday, 1991). In regards to the second objective of intercepting landed HMS catches, the FIS was less successful. During 14 months of directed sampling in one of the most active HMS fishing areas within the United States, billfish, swordfish, and shark landings were rare events; with a combined total of only 28 fish observed at the dock. To a large degree, this is a reflection of the growing conservation trend to release these species alive. It is also believed landings were reduced during the study period as a result of the economic recession, providing an opportunity to rigorously test methods for sampling rare HMS events. Anecdotal accounts by for-hire captains indicated fewer sailfish and sharks were landed for taxidermy mounts during this time due to fewer customers willing to pay for the additional service. Considering over 60% of the landed sailfish and sharks reported to both the FIS and CTS were landed for taxidermy mounts (Figure 34), this would account for a significant portion of HMS landings. Analysis of

MRFSS Type 3 catch records from 1990 to 2009 support these accounts, as fewer landed sailfish were recorded in Florida during 2008 and 2009 than in any other year within the 20-year time period (observations were adjusted by the total number of party-charter mode interviews collected each year).

The great expenditure of effort by the FIS to intercept so few fish clearly demonstrates surveys are not a cost-effective method for accurately monitoring HMS *landings* by the for-hire industry in this region. A census of harvest is needed for these species.

5.2.3 Evaluation of Self-Reported Catch

HMS catch information was recorded during both telephone surveys to increase and improve HMS catch data. Overall, this alternative data collection approach did accomplish a primary study objective of increasing HMS catch sample sizes, especially for less common species as swordfish and blue marlin (Table 4). The CTS recorded 34 swordfish caught on 48 trips, compared to only 1 swordfish caught on 9 trips intercepted by the FIS. This included 20 swordfish caught on trips that returned during daytime hours when the FIS was conducted. Blue marlin catches were rare, but the 8 recorded in the CTS matched the most recorded by the MRFSS in any of the past 20 years for all fishing modes combined throughout Florida. Likewise, the CTS recorded twice as many sailfish catches as the FIS, as well as 2.5 times more tuna and 58% more shark catches. The self-reported records were sufficient to produce estimates for the southern region of Florida with equal precision to annual statewide MRFSS estimates; however, whether the estimates in this study are reasonably accurate and sufficient to meet the needs for management and assessment of stocks is what should determine the utility of this alternative sampling methodology.

It should be noted that the collection of catch data through a recall survey has traditionally been discouraged due to reliability concerns for self-reported information. Possible sources of error include recall bias (inaccurate recollection of events); species misidentification; prestige bias (over-reporting good events/catches); the unwillingness of vessel representatives to fully participate; or concealment of certain fishing activities (Pollock, 2002; Lyle et al, 2002). Reporting errors such as these have typically resulted in over-estimation of catch (Pollock *et al.*, 1994). Despite these recognized potential biases, recall may be more accurate for rare or important events (Fisher *et al.*, 1991), for which HMS fishing could be categorized as for many species (*i.e.*, billfish, swordfish, and some shark species). This study utilized a relatively short recall period (1-week) to minimize recall bias and employed a complementary on-site intercept survey for catch rate comparison. The accuracy of self-reported HMS catches was also evaluated from a small group of matched trips that were sampled in both the field and telephone surveys.

Analysis of 36 matched sailfish trips sampled by both the FIS and FHS did show identical sailfish catch information for 81% of the trips and an overall mean difference of less than 1/10th of one fish between the two records that was not significant (Table 7). When the comparison was limited to only trips reporting at least one sailfish caught, similar catches were reported for only 59% of the matched trips; however, the mean difference again was small and not statistically significant. Although the matched trip sample size is low (N=36), the results indicate differences in sailfish catches reflect random variability and not systematic recall error.

A separate comparison of catch rates between field and telephone survey methods clearly showed sailfish catches reported to the FHS were significantly greater than those collected during the FIS (Figure

41). The apparent difference in catch rates between the surveys could be attributed to vessel representatives over-reporting trips in which at least one sailfish was caught in the FHS, rather than inflating the number of sailfish caught on these successful trips. In spite of short recall periods, vessel representatives may have confused trips, especially during weeks when they fished more frequently (or even multiple times a day), often targeting similar species. This would be consistent with other studies that have noted more active participants being more susceptible to recall errors (Fisher *et al.*, 1991; Tarrant *et al.*, 1993; Connelly and Brown, 1995). It should be noted that while vessel representatives were sent pre-notification letters each time they were selected for the FHS, the letter did not state HMS catch information would be requested, nor was the enclosed datasheet modified for them to record catch information.

In contrast to over-reporting successful trips, some vessel representatives may have been less inclined to report landed sailfish during the FHS, and to a lesser extent landed sharks, as indicated by the more frequent dock-side observations during the FIS (Table 4). Despite the collection of catch reports by the FHS for twice as many sailfish and 58% more sharks, the FIS recorded 4.5 times as many landed sailfish and almost twice as many landed sharks (FIS samplers directly observed 4 times as many sailfish and 22% more sharks). It is plausible that vessel representatives were hesitant to report landed sailfish to the FHS if they had not previously reported the fish to NOAA Fisheries as required via the non-tournament reporting (NTR) telephone hotline or website. In fact, nearly 70% of the landed sailfish recorded by both surveys were not reported to NOAA Fisheries via the NTR (Table 11).

Another explanation may involve sensitivities and concerns expressed by some for-hire vessel representatives in SEFL regarding the disposition of catch question. Specifically, a small minority of captains expressed displeasure with the expanded list of catch disposition responses used in this study that included “taxidermy mount / trophy souvenir” (whereas in the MRFSS APAIS, mounted catches would have been recorded as “other”). Their displeasure was mostly directed towards recent Law Enforcement actions unrelated to the pilot study. Nonetheless, it resulted in a few vessel representatives refusing to cooperate with the study, and may have fostered misperceptions among other for-hire captains that the information on billfish and shark dispositions was being collected for Law Enforcement (despite samplers reading Privacy Act disclosures at the beginning of field and telephone interviews). Considering that taxidermy mounts accounted for more than 60% of sailfish and shark landings in this region (Figure 34), mistrust of data collection programs among some in the for-hire industry could potentially affect the accuracy of landings estimates derived from self-reported catches.

Despite the identified shortcomings of the self-reported HMS catch, the potential benefits of this alternative data collection approach are encouraging. Increasing sample sizes for rare species such as swordfish and marlin would be a significant improvement over existing programs in which these species are infrequently documented. The current mandatory non-tournament reporting requirement only pertains to landed catches, with no reliable sources of released recreational catch information for swordfish and marlin currently available in this region (released billfish and swordfish catches from HMS tournament trips are reported to the Recreational Billfish Survey - RBS, but compliance with the tournament registration requirement is poor and tournament trips only account for 4% of for-hire and less than 10% of private HMS trips – MRIP, 2010). Increased awareness of post-release mortality in recreational fisheries makes accurate estimation of released catches of greater importance for stock assessments; collecting HMS catch information via the FHS would be a cost-effective data source that can be quickly implemented.

The reliability of FHS collected catch information still needs to be more thoroughly investigated. With exception to sailfish, the small sample sizes in this study did not allow for an assessment of the accuracy of self-reported catches. If larger sample sizes were collected by expanding data collection over a larger area, more robust testing could be conducted to assess the accuracy of FHS CPUEs. Ultimately, if self-reported catches are deemed reliable for species that continue to be poorly covered by field surveys, estimates of released and landed catches could be produced to supplement data gaps. At the same time, FHS vessel sample sizes could be evaluated to determine what sample level is necessary to produce estimates with high precision, or if a census method is more appropriate to monitor released catches.

5.2.4 Review of Potential Under-Coverage Bias

The National Research Council's (NRC) 2006 review of the MRFSS identified potential under-coverage bias associated with access point surveys with regards to nighttime fishing, trips returning to private access sites, and tournament fishing. This study was designed to ascertain the extent of each factor and determine if bias exists in coverage.

Nighttime fishing

With the exception of swordfish, the for-hire HMS fishery in South Florida is conducted almost exclusively during daylight hours (Figure 20). For-hire vessels that returned at night comprised less than 3% of all HMS charter trips reported to the CTS. Whereas 40% of CTS swordfish trips returned after 20:00 hours, the lack of productivity during the night field intercept survey can most likely be attributed to an unexpected decline in directed for-hire swordfish trips during this time period. Anecdotal reports from for-hire captains in SEFL suggested unanticipated record high diesel fuel prices during the spring and summer of 2008 had made the cost of swordfish trips prohibitive (USEIA, 2011). Whereas numerous captains in Ft. Lauderdale and Miami had reported running weekly night trips in prior years, the lack of customers willing to pay high fuel surcharges reduced the frequency of swordfish trips to less than once a month for most vessels. The onset of the national economic crisis in September 2008 most likely reduced interest in the fishery among potential customers even further, in spite of sharply declining fuel prices throughout the latter half of the study (USEIA, 2011). Verifying these anecdotal reports is difficult considering the FHS only began collecting trip-level target species data in 2007. The limited FHS data from 2007 to 2010, consisting of 16 targeted swordfish trips in 2007, 11 in 2008, 21 in 2009, and 6 in 2010 (raw number of reported trips that returned at night), does not indicate that there was a decline in overall fishing effort, rather that the trip itself was rare among the for-hire fishery.

Night field sampling may be essential to improving monitoring efforts for non-HMS fisheries that target common snook, Atlantic tarpon, and reef fish, but the lack of night activity by the for-hire HMS fishery does not warrant directed field sampling at this time. Standard FHS sampling will continue to monitor the frequency of directed swordfish trips (daytime and nighttime), so long as vessel representatives are asked the targeted species for each trip. The FHS is likely to detect an increase in directed effort if for-hire swordfish trips become more common. To further improve coverage of the nighttime fishery in the absence of 24-hr field sampling, the FHS should be modified to collect swordfish catch information; either as a standard question or as a follow up for vessel representatives who indicate swordfish as one of the trip's target species. The cost of such a modification would be minimal, to both the conduct of the survey and vessel representative reporting burden, while significantly improving upon the lack of swordfish catch information for both daytime and nighttime fishing under current monitoring programs.

Use of private access sites

Private access site use was limited among for-hire vessels returning from HMS trips in Florida. The characterization survey indicated less than 10% of all for-hire vessels within the Keys and SEFL study area used private access sites as their primary site for directed HMS fishing (state-wide it was less than 8% - Figure 47). More importantly, the CTS determined private access fishing accounted for less than 3% of all HMS charter trips (Figure 14).

Tournament participation

For-hire vessels in South Florida participated in HMS tournaments on a limited basis, accounting for approximately 4% of all charter trips sampled in both survey formats. The small sample size did not facilitate comparisons of catch rates for any HMS group. The limited results did indicate a potentially significant under-coverage of HMS tournament fishing, though, as only 56% of the reported HMS-targeted tournaments had registered with the NOAA Fisheries HMS Management Division (Table 11). Education and enforcement of the registration and RBS reporting requirements need to address this gap. In addition, tournament trips could be fully included in the FHS, yet while still being excluded from for-hire non-tournament effort estimates. The primary benefit of collecting the additional tournament info via the FHS would be to help determine registration status of active HMS tournaments and subsequently provide NOAA Fisheries with timely information related to unregistered events. This would help direct outreach efforts more efficiently to improve registration rates and RBS reporting. Moreover, the addition of a small percentage of trips to the FHS would entail minimal cost considering some information for these trips is already collected (*i.e.*, trip date, trip type, access site, departure and return time) for comparison with vessel pre-validation visits to verify vessel representative responses.

5.3 Data Collection & Management Recommendations

The for-hire HMS fishery in Florida is comprised of several fisheries, each with distinct characteristics that present different sampling requirements and challenges. Catch and release fisheries for sailfish and sharks are quite extensive in South Florida, with hundreds of for-hire vessels conducting thousands of directed trips each year. Landed catches are rare in both fisheries, typically occurring in small, infrequent pulses that make it particularly challenging for surveys to accurately estimate annual landings. In contrast, smaller segments of the for-hire fleet conduct directed trips for swordfish, marlin, and tunas, primarily in waters further offshore that return later in the afternoon, or at night in the case of many swordfish trips. The non-tournament marlin fishery is also primarily a catch and release fishery, whereas a significantly greater proportion of swordfish and tuna catches are landed. Capturing these longer range trips in a general survey is more difficult compared to the more common sailfish, shark, and non-HMS for-hire trips due to the low levels of participation.

The characteristics and management needs for these different HMS groups will require different monitoring approaches to ensure the sustainability of these fisheries. The NRC (2006) stated that the for-hire sector of marine recreational fisheries should be considered a commercial sector, and survey methods and reporting requirements for that sector therefore should be different from those of private anglers. Specifically, the NRC recommended that charterboat, headboat, and other for-hire recreational fishing operations should be required to maintain logbooks of fish landed and kept, as well as fish caught and released, provided that reporting is mandatory for continued operation in for-hire fisheries

and all self-reported information is verifiable and available in a timely manner. A logbook program with high compliance rates and independent validation could significantly improve catch and effort estimates for all species, including HMS. As part of the redesign of the MRFSS into the new Marine Recreational Information Program (MRIP), a pilot study in the Florida Panhandle and Corpus Christi, TX is currently testing a mandatory logbook monitoring program for the for-hire industry and results from that study are expected in 2012.

Alternatively, this study employed a telephone-access survey design directed at for-hire HMS fishing, similar to the LPS program conducted in the northeastern United States. Therefore, the recommendations in this report primarily focus on survey-based monitoring programs, addressing modifications to the existing MRFSS APAIS and FHS to improve HMS monitoring in Florida. Improvements to the existing census programs for landed HMS catches are also recommended.

It is important to emphasize that although these recommendations do not weigh the advantages and disadvantages of a survey-based design versus a logbook program, a common design feature is shared by both sampling approaches: the for-hire fishing mode requires sampling methods that are different from private boat and shore fishing modes. A recent MRIP report (2011) that reviewed the MRFSS APAIS estimation methodology specifically recommended the discontinuation of alternate mode sampling, thereby eliminating the need for similar sampling designs among all recreational modes. Without this constraint, the for-hire fishery therefore should be sampled by an independent program that employs methods specifically designed for the mode, both for effort and catch estimation, regardless if the new program employs surveys and/or logbooks.

5.3.1 Modifications to MRIP Access Point Intercept Survey

As part of the redesign of the MRFSS, the results of this study identify several modifications that can be incorporated by a new MRIP access point intercept survey to improve coverage of both HMS and non-HMS fisheries. These include 1) the use of site clusters as primary sampling units, 2) conduct for-hire dockside intercept interviews with captain or crew members at the vessel-trip level, and 3) proportional stratification of field assignment start and stop times to better distribute sampling efforts across all hours of the day. These recommendations could also apply to a modified field survey conducted to validate for-hire logbooks.

Site clusters as primary sampling units in conjunction with vessel-level sampling

The FIS site cluster sampling approach successfully intercepted most for-hire vessel trips operating from multiple access sites that transited a common ocean access point (*i.e.*, inlets, passes, cuts). Conducted as a modified roving creel survey, the site cluster design extended coverage to all vessels operating from both high and low pressure sites within a central area, enabling each field assignment to collect a more representative sample of for-hire fishing for that day. By designating the site cluster as the primary sampling unit, sampler movement to all sites within the cluster was accounted for in the probability sampling design of the survey. It should be noted that designating a cluster of sites as the primary sampling unit in an access point survey was also recommended by the MRIP project team that reviewed the MRFSS APAIS estimation methodology to identify limitations and biases associated with the MRFSS design (MRIP, 2011). Sampling efficiency within a site cluster is affected by a multitude of factors that need to be considered when initially grouping access sites into clusters. These include: 1) activity levels and vessel return time patterns at each site, 2) distance between sites and local traffic patterns, and 3)

ability to directly observe the ocean access point vessels transit to increase the likelihood of intercepting vessels immediately upon their return. Potential changes in these factors (*e.g.*, seasonal fluctuations) warrant periodic re-evaluation of site cluster groupings that may result in the removal or addition of access sites from individual clusters to ensure optimal efficiency.

The success and efficiency of the FIS pilot was largely due to the collection of vessel-trip interviews with a for-hire captain or crew member. Samplers would not have had sufficient time to intercept all vessels at different sites within the cluster had angler-trip interviews been conducted with for-hire customers. The vessel-trip interview design also increased the probability of intercepting landed sailfish and shark catches; many of which were still with the crew hours after their customers had departed. Whereas the MRFSS angler-trip design is tied to its effort estimation for shore and private boat anglers, this is not a necessary requirement for the party-charter (for-hire) fishing mode. For-hire effort has been quantified by the FHS, a vessel-based survey, for more than a decade in some regions. Modifying the new MRIP access point intercept survey to collect vessel-trip interviews would facilitate increased on-site sampling efficiency and minimize under- or over-inflated off-frame adjustments which are currently improperly weighted by the number of on-board customers.

Proportional stratification of field assignment start and stop times

The results of this study clearly demonstrate it is essential for sampling efforts to be distributed throughout the day to collect a representative sample of fishing activity. Sailfish catch rates were shown to be significantly greater on trips that returned after 15:00 hours, whereas differences in trip durations were apparent among the HMS groups as swordfish, marlin, and tuna trips typically returned later in the day. A more representative sampling distribution can be accomplished by dividing the day into shorter sampling periods or blocks, and proportionally stratifying the selection of field assignment across these time blocks. A 2010-2011 MRIP pilot study in North Carolina tested a similar stratification that employed 6-hr time blocks across a 24-hr period. A review of FHS data across multiple years could provide guidance on an appropriate division of time blocks and respective weights for proportional selections. A simpler but potentially more costly approach is the one employed in this study; conducting sampling activities until either all vessels have returned for the day or a specific time has been reached, with no limits to the number of interviews that can be collected. Independent of the outcome of the North Carolina study, the results of this study indicate there is very limited HMS fishing conducted at night by for-hire vessels in South Florida. In consideration of the significantly higher costs and safety concerns associated with nighttime sampling to extend coverage to less than 3% of all HMS for-hire trips, nighttime field sampling is not recommended for the for-hire HMS fishery at this time.

5.3.2 Modifications to MRIP For-Hire Telephone Survey

The collection of some catch data through the ongoing FHS is recommended to increase HMS catch sample sizes for billfish and swordfish. Despite the recognized deficiencies and potential error associated with the collection of self-reported catch via a recall survey, catches of blue marlin, white marlin, or swordfish are extremely rare events in field intercept surveys. Collecting released and landed catch information for these species via the FHS throughout Florida and the broader southeastern United States – Gulf of Mexico region would require minimal additional cost expenditures, yet provide fishery managers with recreational CPUEs to fill existing data gaps for these species. Self-reported catches collected in the FHS would also facilitate validation of the NTR to measure compliance with the mandatory reporting requirement to help determine the accuracy of each census. The poor compliance

rates identified in this study highlight the need for such a method of verification or validation. Given that most sailfish landings reported to the NTR occur during for-hire trips, sailfish catch information should also be collected by the FHS as part of this validation approach.

At the same time, the collection of billfish and swordfish catch information from for-hire vessels that return at night or to private access sites (as well as non-MRFSS public access sites) would be a cost-effective approach to help fill additional data gaps. By comparison, extending coverage via a field survey to account for the small proportion of private access and night HMS trips would require much greater expenditures. Although telephone catch rates for sailfish were likely over-reported during this study, FHS catch rates from private access trips could still be compared to FHS catches from public access trips so that the extent of any private access under-coverage bias could be monitored (assuming any prestige or recall bias would affect both groups equally). If a private access bias is present, catch rates from the on-site survey could ultimately be adjusted, but only after field survey catch rates were first compared to telephone data for public access sites to account for potential bias in the FHS catch.

The expanded collection of HMS catch information by the FHS across a broader area should result in larger sample sizes to allow for further investigation regarding the accuracy of self-reported catch information. If deemed reliable, the FHS CPUEs could be used to produce estimates of released and landed catch for swordfish and marlin (the MRIP access point intercept survey would continue to be the primary source of sailfish CPUEs for catch estimation). Likewise, the precision of these estimates is expected to improve with increased geographic coverage compared to those produced from this study's results. If greater precision is still needed, then FHS sample sizes could be evaluated to determine what sample level is necessary to produce estimates with high precision or if a census method is more appropriate to accomplish the needed precision for released catches.

5.3.3 *Improved census of landed HMS catches*

The recommended changes to the new MRIP and FHS primarily address the estimation of released HMS catches by Florida's for-hire fishery. However, none of these changes would significantly improve monitoring efforts for the small number of billfish, swordfish, and sharks that are recreationally landed each year. Despite considerable effort expended to intercept more landed HMS catches in the field, the FIS only observed 28 sailfish, swordfish, and sharks dock-side over 14 months of sampling in one of the busiest HMS fishery regions of the United States. With the exception of swordfish, social changes within the recreational fishery over the past two decades has relegated billfish and shark fisheries to predominantly catch and release fisheries, with only a small proportion of recreational catches being landed. The rarity of such events cannot be ignored; both due to management needs for ensuring landing rates remain sustainable as well as to make certain the United States is in compliance with recommended billfish and swordfish quotas set by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The existing NTR telephone hotline/website attempts to do this by census, requiring all non-tournament landed billfish and swordfish to be reported to NOAA Fisheries within 24 hours upon the conclusion of the trip (the RBS covers tournament landed catches). The State of Florida also requires all landed billfish and swordfish to be reported to NOAA Fisheries via the NTR, even though anglers are not required to obtain an HMS permit while fishing in State waters (anglers landing tunas in State waters are still required to first obtain a Federal HMS or Atlantic Tunas General category permit and report bluefin tuna landings to NOAA Fisheries via the Automated Landings Reporting System).

Unfortunately, in its present format, NOAA Fisheries' attempted landings census is difficult to validate and enforce; and the results of this study indicate compliance is poor and the harvest counts underestimate the true number of landed fish. Therefore, modifications to the NTR to enhance enforcement while minimizing the reporting burden for anglers are necessary for the census to be more effective. Currently, upon returning from a trip in which a billfish, swordfish, or bluefin tuna is landed, the angler is required to report their catch to NOAA Fisheries within 24 hours either by the NTR telephone number or website. Although the rule was designed to ease the burden of the reporting requirement, it makes enforcement extremely difficult. Rules that are deemed necessary to effectively monitor the sustainability of landings have to be enforceable. Consequently, the 24-hour period should be eliminated and landed catches would have to be reported prior to the fish being removed from the vessel. At the same time, the reporting burden for anglers can be minimized by providing additional reporting options. The reporting telephone line can be upgraded to accept landings reports and automatically produce a landing report number to confirm the report has been received. Furthermore, anglers should be able to submit landings reports via text messaging, e-mail, or through smart phone applications (Baker and Oeschger, 2009). The new electronic reporting formats should be capable of accepting landings reports from anglers that do not possess a current HMS permit as Florida does not require the permit if the fish was landed in State waters (with exception to bluefin tuna). It should be noted the existing NTR telephone and website reporting methods already have this capability. Law Enforcement officers should also be able to instantly access a landings report database from the field to verify a report has been submitted by an angler; either by the HMS permit number, vessel registration number, Florida charter license number (captain or boat), or other identifying number.

In conjunction with these changes, public outreach that emphasizes the conservation and management benefits of the reporting requirement should be initiated and/or expanded to target industry-related forums (*e.g.*, fishing magazines, television and radio programs, fishing clubs, tackle shops, taxidermists).

The high release rates for sharks present a monitoring challenge for the limited harvest that continues to occur. Like billfish, any survey will be greatly challenged to adequately monitor rare event landings, but that does not eliminate the management need for landings estimates and biological data to ensure shark populations are continuing to rebuild to more sustainable levels. A mandatory reporting requirement should be established for some more easily identifiable shark species, including bull, great hammerhead, lemon, scalloped hammerhead, shortfin mako, smooth hammerhead, and tiger sharks. All these species are directly targeted by for-hire vessels in South Florida, as well as in other areas of the southeastern United States - Gulf of Mexico region.

It should be emphasized that implementation of a mandatory logbook program would not sufficiently address the need for landed catches to be reported prior to being removed from the vessel. Logbooks are typically submitted on a monthly, bimonthly, or weekly basis whereas the current census already requires notification of landed catches to NOAA Fisheries within 24-hours, yet experiences poor compliance. Enforcement of the reporting requirement requires near real-time notification to NOAA Fisheries that cannot readily be achieved through a logbook.

Lastly, all parties that are in possession of landed billfish, swordfish, bluefin tuna, and sharks (if added) should be held accountable for ensuring the reporting requirement has been fulfilled. This would require individuals or businesses (*e.g.*, taxidermy companies) that take possession of the fish, or parts of the fish (*i.e.*, jaws, fins, rostrum, etc.) are able to produce the NTR reporting number upon request.

5.4 Final Summary

The results and subsequent recommendations of this study highlight the need for significant modifications to existing recreational monitoring programs. Florida's for-hire HMS fishery has different sampling requirements and monitoring challenges that need to be addressed in order to precisely estimate both released and landed catches with a high degree of accuracy. These can be best summarized by the following statements and recommendations for improved coverage:

- The for-hire fishing mode requires sampling methods that are different from private boat and shore fishing modes. Thus, the for-hire fishery should be sampled by an independent program that employs methods specifically designed for the mode.
- A modified access point intercept survey will provide the most reliable information on HMS released catches for more common species such as sailfish and sharks, as well as total catch information for skipjack tunas and small coastal sharks.
- Catch information for billfish and swordfish should be collected through the For-Hire Telephone Survey to increase sample sizes for rare species (*i.e.*, swordfish and marlin), facilitate validation of the NTR to measure compliance with the mandatory reporting requirement, and to supplement field survey CPUE data gaps pertaining to under-coverage of trips that return at night or to private access sites.
- Landed catches for billfish, swordfish, and some shark species should be monitored by a census program that requires near real-time reporting to ensure the reporting requirement can be *effectively* enforced.

The final recommendations to better monitor Florida's for-hire HMS fisheries are summarized in Table 14. These recommendations are not limited exclusively to Florida's for-hire fishery. Similarities among the for-hire industry throughout the southeastern United States and Gulf of Mexico will likely make these monitoring approaches applicable to addressing coverage gaps for HMS fisheries throughout the region.

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Table 14 – Summary of data collection and management recommendations for Florida’s for-hire HMS fishery.

Recommended Improvements to MRIP Access Point Intercept Survey	
1.	For-hire fishing mode should be sampled independently from other recreational fishing modes <ul style="list-style-type: none"> - Sampling methods specifically designed for the for-hire fishing mode are required, regardless if they are based on surveys and/or logbooks
2.	Designate site cluster as the primary sample unit in the MRIP. <ul style="list-style-type: none"> - Incorporates alternate sites into probability selection of primary sample unit - Facilitates greater sampling efficiency to intercept for-hire vessels returning to multiple access sites - Increases opportunities to sample for-hire vessels operating out of less active sites
3.	For-hire mode access point intercept interviews should be conducted at the vessel-trip level with captain or crew member, rather than the angler level (as is done for private boat and shore modes). <ul style="list-style-type: none"> - Will facilitate sampling of for-hire vessels even if customers are not present - Eliminates reporting burden on for-hire customers - Cooperation rates and data quality is anticipated to be higher with for-hire vessel representatives - Minimizes under- and over-inflated off-frame adjustments based on number of on-board customers
4.	Proportional stratification of field assignment start and end times across the day. <ul style="list-style-type: none"> - Ensures CPUE sample is more representative of differences in catch rates associated with trips returning at different times of the day - Will extend sampling coverage to increase likelihood of capturing long-range trips returning in the late afternoon - Time blocks should be determined by evaluating for-hire trip return time patterns so that assignment start and stop times occur during slower periods of the day
Recommended Improvements to MRIP For-Hire Telephone Survey	
1.	Collection of sailfish, marlin, and swordfish catch data during FHS telephone sampling. <ul style="list-style-type: none"> - Expands data collection efforts to capture more rare event HMS catches (<i>i.e.</i>, swordfish, marlin) - Facilitates validation of NTR reporting requirement to measure compliance to help assess the accuracy of the census - Provides CPUEs from trips returning during nighttime hours or to private access sites to supplement CPUEs collected from access point intercept survey
2.	Evaluate accuracy of self-reported swordfish and marlin catches for potential catch estimation <ul style="list-style-type: none"> - If the self-reported catch is deemed to be reliable, evaluate the appropriate percentage of vessels on the FHS vessel frame that would need to be sampled on a weekly basis to produce reasonably precise catch estimates (released and landed) for swordfish and marlin
Recommended Improvements to the Census of Landed HMS Catches	
1.	Eliminate the 24-hr reporting period allowed for reporting landed catches upon returning from a trip.
2.	Upgrade NTR to be capable of receiving landing reports and automatically provide a confirmation number. <ul style="list-style-type: none"> - The new system must be capable of accepting landing reports from anglers that do not possess an HMS permit, as is currently possible with the existing telephone and website formats.
3.	Expand reporting options for anglers (<i>i.e.</i> , text messaging, E-mail, or smart phone applications) to minimize reporting burden and encourage compliance.
4.	Provide Law Enforcement with instant access to the reporting system database from the field to verify a landings report has been submitted.
5.	Extend reporting requirement to include 7 shark species: bull, great hammerhead, lemon, scalloped hammerhead, shortfin mako, smooth hammerhead, and tiger.
6.	Hold all individuals or businesses in possession of a landed billfish, swordfish, bluefin tuna, or above listed sharks, accountable for ensuring the reporting requirement has been fulfilled.

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Appendix A – Field Intercept Survey Assignment Summary Form

HMS FIELD INTERCEPT SURVEY - 2008 FL PILOT

OMB PRA 0648-0380 exp. 6/30/2009

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	INTERVIEWER ID					
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	CONTROL NUMBER					
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DATE (YR/MO/DAY)					
<input type="text"/>	<input type="text"/>	SITE CLUSTER _____							
<input type="text"/>	<input type="text"/>	COUNTY _____							
<input type="text"/>	<input type="text"/>	TOTAL ON-SITE TIME							
	<u>EDITING TIME</u>		<u>KEY ENTRY TIME</u>						
ON-SITE	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	ON-SITE				
OFF-SITE	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OFF-SITE				
TOTAL	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	TOTAL				
<input type="text"/>	TOTAL MILES TRAVELED								

SITE	HMS INTERCEPTS	Non-HMS INTERCEPTS	INITIAL REFUSALS	MID-INT REFUSALS	MISSED	LANGUAGE BARRIER	NOT DONE	COMMER. VESSELS
<input type="text"/>								
<input type="text"/>								
<input type="text"/>								
<input type="text"/>								
<input type="text"/>								
<input type="text"/>								
<input type="text"/>								

TOTALS
 HMS **Non-HMS**

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26a. UNAVAILABLE CATCH. Did you catch any fish that are not here for me to look at?
For example, any that you may have thrown back or used for bait?

Catch Disposition Codes		
1 Released alive/legal	4 Used for bait/plan to use for bait	8 Released alive/legality refused - exceed bag limit
2 Released alive/legality refused - undersized	5 Sold/plan to sell	9 Released alive/legality refused - prohibited spp
3 Eaten/plan to eat	6 Released dead/plan to throw away	0 Other purpose
	7 Taxidermy mount/trophy souvenir	

	Spp. Abbrev.	Species ID Code	First Disposition			Second Disposition			Third Disposition		
			# of Fish	Dis.	HK	# of Fish	Dis.	HK	# of Fish	Dis.	HK
1.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
2.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
3.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
4.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
5.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
6.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
7.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
8.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
9.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□
10.	_____	□□□□□□	□□□□	□	□	□□□□	□	□	□□□□	□	□

26b. AVAILABLE CATCH. May I look at and measure your fish?

	Spp. Abbrev.	Species ID Code	# of Fish	Fork Length (mm)	Whole Weight (kg)	Dis.	HK	PR	Sex
1.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
2.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
3.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
4.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
5.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
6.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
7.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
8.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
9.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
10.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
11.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
12.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
13.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
14.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□
15.	_____	□□□□□□	□□□□	□□□□□□	□□□□ • □□□□	□	□	□	□

Comments:

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Date:	Date:	Date:	Date:	Date:
Time:	Time:	Time:	Time:	Time:
Phone:	Phone:	Phone:	Phone:	Phone:

Call Back				
1 <input type="checkbox"/> Line Busy				
2 <input type="checkbox"/> No Answer				
3 <input type="checkbox"/> Answering Machine/Service				
4 <input type="checkbox"/> Wrong Number - new number avail.	4 <input type="checkbox"/> Wrong Number - new number avail.	4 <input type="checkbox"/> Wrong Number - new number avail.	4 <input type="checkbox"/> Wrong Number - new number avail.	4 <input type="checkbox"/> Wrong Number - new number avail.
5 <input type="checkbox"/> Not available				
11 <input type="checkbox"/> Fax/Computer				
No Call Back				
6 <input type="checkbox"/> Not in service/ Wrong number				
7 <input type="checkbox"/> Refusal				
8 <input type="checkbox"/> Communication problem				
9 <input type="checkbox"/> Ineligible				
10 <input type="checkbox"/> Successful Contact				

Week No:

Vessel ID:

Vessel Reg.:

Vessel name:

Vessel length:

Year Vessel Built:

Vessel Capacity:

Vessel loc:

Loc. Site Code:

County:

Phone #1:

Phone #2:

Phone #3:

Comments:

Interview Status (to be completed when telephone contact made):

- 1 Complete Interview (**Result=10**)
- 2 Incomplete, but all key (*) questions answered
- 3 Refusal (**Result=07**)
- 4 Language Barrier
- 5 Mid-interview Refusal
- 6 Ineligible (**Result=09**)
- 7 Unable to Contact
- 8 Inactive (**Result=10**)

Representative (REP_ID=1):

Other Contact

Capt1 (Rep_id=2):

Capt2 (Rep_id=3):

Capt3 (Rep_id=4):

Ownr (Rep_id=5):

Other (Rep_id=6):

Best time to call:

Region:

Representative

Captain 1

Captain 2

Captain 3

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Appendix D – For-Hire Telephone Survey HMS Add-on Questionnaire & catch data form used for the HMS Charter/Headboat Permit Telephone Survey

Sample week: _____ **Vessel Name:** _____ **Sampler ID:** _____

Date	Day of Week	* Trip No.	Location	Tourn. (Y/N) & Name	Avg Bottom Depth	Fishing Method Employed		HMS Catch			
						Primary	Secondary	Species	# Fish	Disposition	Hook Type
	MON	1									
	MON	2									
	MON	3									
	TUE	1									
	TUE	2									
	TUE	3									
	WED	1									
	WED	2									
	WED	3									
	THU	1									
	THU	2									
	THU	3									
	FRI	1									
	FRI	2									
	FRI	3									
	SAT	1									
	SAT	2									
	SAT	3									
	SUN	1									
	SUN	2									
	SUN	3									

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HMS Trip screening question: Did your vessel go out on a fishing trip to catch, or try to catch, any billfish, sharks, tunas, or swordfish during the week of Monday, _____ to Sunday, _____?

(Exclude the following species for HMS trip status – Little Tunny, Blackfin Tuna, Nurse Shark, Atlantic Sharpnose, & Bonnethead)

Trip Type:

- 6=Charter
- 7=Headboat
- 9=Other

HMS Trip:

- 1=Yes
- 2=No

Fish Area:

- 1=Gulf, Ocean, or Open Bay
- 2=Sound
- 3=River
- 4=Enclosed Bay
- 5=Other

Distance from Shore:

- | | |
|------------------------|-------------------------|
| Ocean - | Gulf - |
| 1= ≤3 miles from shore | 3= ≤10 miles from shore |
| 2= ≥3 miles from shore | 4= ≥10 miles from shore |
| 8=Not applicable | |

Multi-Day:

- 1=Yes
- 2=No

Add-on Catch Data form for HMS trips only

Fishing Methods:

- 1=Trolling
- 2=Drifting
- 3=Kite-fishing
- 4=Bottom-fishing
- 5=Casting
- 0=Other (write in method: *i.e.*, fly-fishing, chumming, chunking, etc.)

Disposition:

- 1=Released alive/legal
- 2=Released alive/legality refused – undersized
- 3=Eaten/plan to be eaten
- 4=Used for bait/plan to use for bait
- 5=Sold/plan to sell
- 6=Released dead/plan to throw away
- 7=Taxidermy mount/trophy souvenir
- 8=Released alive/legality refused – exceed bag limit
- 9=Released alive/legality refused – prohibited species
- 0=Other purpose

Hook Type:

- 1=Circle
- 2=J-hook
- 3=Other (write in hook type)
- 4=Treble

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Appendix E – HMS Charter/Headboat Permit Telephone Survey Questionnaire

Sample week: _____

Vessel Name: _____ Sampler Name: _____ Sampler ID: _____

*Total Recreational PC HMS Trips _____ *Total Recreational PR HMS Trips _____ *Total Commercial HMS Trips _____

SCREENING QUESTION: Did your vessel go out on a fishing trip to catch, or try to catch, any billfish, sharks, tunas, or swordfish during the week of Monday, _____ to Sunday, _____?

Date	Day of Week	* Trip No.	*Trip Type (Charter, Head, Private, or Commer.)	* # of anglers	Origin of Trip		Access Site (see codes)	Target Spp (see ITIS codes)	*Fish Area (see codes)	*Dist-ance from shore	Time Trip Started (24hr)	Time Trip Ended (24hr)	Time Spent Fishing (nearest half-hr)	Multi-day Trip?
					*State	County								
	MON	1												
	MON	2												
	MON	3												
	TUE	1												
	TUE	2												
	TUE	3												
	WED	1												
	WED	2												
	WED	3												
	THU	1												
	THU	2												
	THU	3												
	FRI	1												
	FRI	2												
	FRI	3												
	SAT	1												
	SAT	2												
	SAT	3												
	SUN	1												
	SUN	2												
	SUN	3												

Representative :
 Vessel Registration:
 Vessel Name:
 Vessel ID:
 Notification Received _____
 Form Used _____
 Verified _____ Errors Found (Y or N) _____
 Initials _____ Date _____

Fishing Areas
 1=Gulf, Ocean, or Open Bay
 2=Sound
 3=River
 4=Enclosed Bay
 5=Other

Multi-Day
 1=YES
 2=NO

If Gulf, Ocean or Open Bay:
 1= <= 3 miles from shore
 2= > 3 miles from shore
 3= <=10 miles from shore
 4= > 10 miles from shore
 8=Not applicable

*KEY QUESTIONS

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Appendix F – HMS Characterization Questionnaire: two versions, one for vessels with HMS permits and the other for for-hire vessels that did not possess an HMS permit at the time they were interviewed.

HMS Permit-Holder Version

VSL Name: _____ VSL ID#: _____ VSL Rep: _____ Smplr ID: _____
 Date: _____

Q1. How many years total have you been saltwater fishing for highly migratory species, including billfish, sharks, tunas, or swordfish?
 _____ Years

Q2. How many years have you gotten an HMS fishing permit for any vessel?
 _____ Years

Q3. What is the current principle port for the [vsl name]?
 _____ Public Marina
 _____ Public Ramp _____ Private Dock
 _____ Private Marina _____ Other

 <MRFSS site code or site name/location>

Q4. Did you **primarily** use this site for the [vsl name] when fishing for highly migratory species in the past 12 months?
 Y / N

Q4a. If no, what access site did you primarily use for HMS trips?
 _____ Public Marina
 _____ Public Ramp _____ Private Dock
 _____ Private Marina _____ Other

 <MRFSS site code or site name/location>

Q5. Did the <VSL_NAME> stop at another marina, fuel dock, or other public access site when returning from highly migratory species fishing trips?
 Always - Go to Q5a
 Often - Go to Q5a
 Sometimes - Go to Q5a
 Never - Go to Q6

Q5a. What is the name(s) of the marina/access site that the <VSL_NAME> stopped at when returning from HMS fishing?

 <MRFSS site code or site name/location>

Q6. Did you ever use any other access sites for the <VSL_NAME> when fishing for highly migratory species in the past 12 months?
 Y / N

If yes, what other access sites did you use for HMS trips?

 <MRFSS site code or site name/location>

Q7. During the past **12** months, approximately how many recreational saltwater fishing trips targeting any highly migratory species did the <VSL_NAME> make?
 _____ Trips

Of these trips, approximately how many or what proportion was targeting:

Billfish	# Trips	% Trips
<Spp name>		
<Spp name>		
Sharks		
<Spp name>		
<Spp name>		
Tunas		
<Spp name>		
<Spp name>		
Swordfish		

Q8. During the past **2** months, approximately how many recreational saltwater fishing trips targeting billfish, sharks, tunas, or swordfish did the <VSL_NAME> make?
 _____ Trips

Of these trips, approximately how many or what proportion was targeting:

Billfish	# Trips	% Trips
<Spp name>		
<Spp name>		
Sharks		
<Spp name>		
<Spp name>		
Tunas		
<Spp name>		
<Spp name>		
Swordfish		

Q9. In the future, would you be willing to participate in a similar survey conducted via email?
 Y / N

Q9a. If yes, would you be willing to provide an active email address?

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Non-Permitted For-Hire Vessel Version

VSL Name: <VSL_NAME>
VSL ID#: <VSL_ID>
REG.#: <VSL_NUM>
VSL Length: <VSL_LEN>
County: <BUSICNTY>

VSL Rep: <REP_1ST> <REP_LST>
Rep Phone#1: <REP_FON1>
Rep Phone#2: <REP_FON2>
Best Time to Call: <BST_TIME>
VSL Loc.: <INTSITE> <PORT>

Sampler ID: _____

Interview Date: _____

Interview Time: _____

Q1. Have you targeted highly migratory species, including billfish, sharks, tunas, or swordfish from the <VSL_NAME> in the past 12 months?

Y <continue with survey>
N <go to Q9>

Q2. How many years total have you been saltwater fishing for highly migratory species?
 _____ Years

Q3. Our records show the principal port of the <VSL_NAME> as being located in <PORT>. Is this still accurate?

Y / N <if no, go to Q4a>

Q4. Did you **primarily** use <PORT> for the <VSL_NAME> when fishing for highly migratory species in the past 12 months?

Y / N

Q4a. If no, what access site did you primarily use for HMS trips?

_____ Public Marina
 _____ Public Ramp _____ Private Dock
 _____ Private Marina _____ Other

 <MRFSS site code or site name/location>

Q5. Did the <VSL_NAME> stop at another marina, fuel dock, or other public access site when returning from highly migratory species fishing trips?

Always - Go to Q5a
 Often - Go to Q5a
 Sometimes - Go to Q5a
 Never - Go to Q6

Q5a. What is the name(s) of the marina/access site that the <VSL_NAME> stopped at when returning from HMS fishing?

 <MRFSS site code or site name/location>

Q6. Did you ever use any other access sites for the <VSL_NAME> when fishing for highly migratory species in the past 12 months?

Y / N

If yes, what other access sites did you use for HMS trips?

 <MRFSS site code or site name/location>

Q7. During the past **12** months, approximately how many recreational saltwater fishing trips targeting any highly migratory species did the <VSL_NAME> make?

_____ Trips

Of these trips, approximately how many or what proportion was targeting:

Billfish	# Trips	% Trips
<Spp name>		
<Spp name>		
Sharks		
<Spp name>		
<Spp name>		
Tunas		
<Spp name>		
<Spp name>		
Swordfish		

Q8. During the past **2** months, approximately how many recreational saltwater fishing trips targeting billfish, sharks, tunas, or swordfish did the <VSL_NAME> make?

_____ Trips

Of these trips, approximately how many or what proportion was targeting:

Billfish	# Trips	% Trips
<Spp name>		
<Spp name>		
Sharks		
<Spp name>		
<Spp name>		
Tunas		
<Spp name>		
<Spp name>		
Swordfish		

Q9. In the future, would you be willing to participate in the For-Hire Telephone Survey conducted via email?

Y / N

Q9a. If yes, would you be willing to provide an active email address?

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Appendix G – Target Species Reported to Each Survey on HMS Charter Trips. For each species, number of trips (#) and proportion (%) of all HMS Charter trips is shown. Species are also assigned to five HMS groups and three non-HMS groups (pelagics, bottom fish, and inshore/beach) shown in bold (note, the sum of trips for species within each group may be greater than the value for the group due to multiple species being reported for the same trip). “No Target” indicates trips in which unidentified fish or no target species were reported. “N/A” indicates a target species that could not be recorded by the CTS (the CTS only allows 50 target species options). The FIS allowed three target species to be reported for each trip, while the CTS only allowed two target species.

<i>Species</i>	FIS Trips		CTS Trips		<i>Species</i>	FIS Trips		CTS Trips	
	#	%	#	%		#	%	#	%
Sailfish	512	61.1%	686	65.1%	Non-HMS Bottom fish	129	15.4%	70	7.3%
					Snapper family	64	7.6%	46	4.8%
Marlin	36	4.3%	6	0.7%	Yellowtail Snapper	34	4.1%	12	1.3%
Billfish family	19	2.3%	1	0.1%	Sea Bass family	24	2.9%	13	1.5%
Blue Marlin	16	1.9%	5	0.6%	Greater Amberjack	11	1.3%	7	0.6%
White Marlin	2	0.2%	-	-	Great Barracuda	10	1.2%	n/a	n/a
					Grouper genus				
Tuna	30	3.6%	35	3.3%	<i>Epinephelus</i>	6	0.7%	n/a	n/a
Tuna genus	29	3.5%	31	2.9%	Mutton Snapper	6	0.7%	n/a	n/a
Yellowfin Tuna	1	0.1%	4	0.4%	Amberjack genus	5	0.6%	3	0.3%
					Gray Snapper	5	0.6%	1	0.1%
Swordfish	8	1.0%	39	3.3%	Vermillion Snapper	1	0.1%	1	0.1%
					Black Grouper	-	-	1	0.1%
Shark	118	14.1%	80	8.3%	Gray Triggerfish	-	-	1	0.1%
Requiem Shark family	80	9.5%	28	3.2%					
Requiem Shark genus	16	1.9%	19	1.7%	Non-HMS Inshore/Beach	62	7.4%	64	6.7%
Unidentified Shark	14	1.7%	34	3.5%	Atlantic Tarpon	32	3.8%	29	3.1%
Bull Shark	3	0.4%	n/a	n/a	Bonefish	12	1.4%	5	0.5%
Hammerhead genus	2	0.2%	-	-	Permit	10	1.2%	n/a	n/a
Scalloped Hammer	2	0.2%	n/a	n/a	Crevalle Jack	8	1.0%	n/a	n/a
Sandbar Shark	1	0.1%	n/a	n/a	Spotted Seatrout	8	1.0%	8	1.0%
Spinner Shark	1	0.1%	n/a	n/a	Jack family	7	0.8%	14	1.4%
					Common Snook	3	0.4%	5	0.5%
Non-HMS Pelagics	454	54.2%	475	45.3%	Ladyfish	2	0.2%	n/a	n/a
Dolphin	335	40.0%	306	29.5%	Red Drum	2	0.2%	3	0.3%
King Mackerel	162	19.3%	161	14.7%	Spanish Mackerel	2	0.2%	5	0.5%
Wahoo	68	8.1%	13	1.2%	Bluefish	1	0.1%	4	0.4%
Blackfin Tuna	37	4.4%	10	0.9%	Seatrout genus	1	0.1%	n/a	n/a
Little Tunny	22	2.6%	n/a	n/a					
Cobia	11	1.3%	9	1.0%	No Target	39	4.7%	41	4.2%
Mackerel family	6	0.7%	3	0.3%					
Cero	1	0.1%	n/a	n/a					

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Appendix H – Summary of Field Intercept Survey Sampling Activities in the Keys and southeast Florida (SEFL) subregions. Status of all selected assignments and their respective sampling success is presented for each site cluster and each 2-month sample wave. Assignment status categories: “Completed”= at least 1 interview was collected, “No Activity”=no interviews were collected on days in which weather was either conducive to fishing (Good Weather) or not (Bad Weather), “Canceled”=assignments that were canceled and could not be reattempted due to the presence of a MRFSS sampler at sites with activity (MRFSS Sampler) or was canceled by the sampler for personal reasons (Personal Reasons). Sampling Success categories: “Missed Vessels”=number of vessels believed to have been fishing but had returned and crew departed prior to being interviewed, “Vessel Refusals”=vessels that fished but crew refused to be interviewed, “Interviews”= interviews that reported to have targeted or caught billfish, swordfish, tuna, or shark during the trip (HMS) or interviews in which no HMS were targeted or caught (non-HMS).

KEYS Site Cluster	Assignment Status						Sampling Success				
	Total # Assignment Selections	Completed	No Activity		Canceled		Missed Vessels	Vessel Refusals	Interviews		
			Good Weather	Bad Weather	MRFSS Sampler	Personal Reasons			HMS	non-HMS	Total
Key Largo	24	20	3	1			8	1	23	45	68
N. Islamorada	25	23	1	1			32	13	65	104	169
S. Islamorada	25	23		1	1		49	6	54	172	226
Lower Macetum	12	11		1			5	0	18	23	41
Duck Key-Key Colony	24	23		1			15	0	37	85	122
Marathon	21	20		1			6	0	22	70	92
Summerland-Ltl Torch	17	12	4	1			11	0	8	37	45
Stock Island	35	32		2		1	22	24	70	80	150
E. Key West	36	33	2			1	9	7	60	83	143
W. Key West	25	24	1				18	30	125	130	255
Sample Wave											
May-Jun 2008	36	36					43	9	78	209	287
Jul-Aug 2008	36	32		3		1	4	14	60	127	187
Sep-Oct 2008	36	24	9	3			4	5	24	66	90
Nov-Dec 2008	32	28	2	1	1		14	6	73	58	131
Jan-Feb 2009	36	35		1			26	10	99	98	197
Mar-Apr 2009	36	34		1		1	32	24	93	143	236
May-Jun 2009	32	32					52	13	55	128	183
Summary	244	221	11	9	1	2	175	81	482	829	1,311
% of all Assignments	-	90.6%	4.5%	3.7%	0.4%	0.8%	*11.2%	**5.8%	***36.8%	***63.2%	-

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SEFL Site Cluster	Assignment Status						Sampling Success				
	Total # Assignment Selections	Completed	No Activity		Canceled		Missed Vessels	Vessel Refusals	Interviews		
			Good Weather	Bad Weather	MRFSS Sampler	Personal Reasons			HMS	non-HMS	Total
Sebastian Inlet	20	13	4	3			0	1	1	20	21
Ft. Pierce Inlet	14	9	5				1	0	11	5	16
St. Lucie Inlet	21	15	6				1	1	39	8	47
Jupiter Inlet	27	25		2			2	1	21	103	124
Palm Beach Inlet	33	32		1			13	4	61	130	191
Boynton Inlet	21	21					4	0	22	49	71
Boca-Hillsborough	22	21	1				7	7	36	61	97
Port Everglades	21	21					32	15	101	77	178
Haulover Inlet	20	20					8	2	25	49	74
Central Miami	27	26	1				6	3	48	36	84
South Miami	18	16	1	1			6	0	41	21	62
Sample Wave											
May-Jun 2008	36	35	1				7	5	73	79	152
Jul-Aug 2008	36	31	4	1			2	1	23	79	102
Sep-Oct 2008	36	26	7	3			2	4	38	50	88
Nov-Dec 2008	32	28	3	1			5	1	59	49	108
Jan-Feb 2009	36	33	2	1			38	10	91	70	161
Mar-Apr 2009	36	35		1			18	6	86	137	223
May-Jun 2009	32	31	1				8	7	36	95	131
Summary	244	219	18	7	0	0	80	34	406	559	965
% of all Assignments	-	89.8%	7.4%	2.9%	-	-	* 7.4%	**3.4%	***42.1%	***57.9%	-

* indicates the proportion of the sum of all vessel interviews and missed vessels that were not interviewed due to the vessel returning and the crew departing prior to being interviewed.

** indicates the proportion of the sum of all vessel interviews and refusals that were not interviewed due to refusal by the crew.

*** indicates the proportion of all vessel interviews

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Appendix I – Expanded Combined Telephone Surveys Catch Estimates for July 2008 to June 2009 sample period.

July 2008 – June 2009 Survey	Released Alive				Landed/Dead Discard				Total Catch	
	FHS		CHS		FHS		CHS		FHS & CHS	
	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE
SAILFISH	19,505	10.1%	1,069	32.7%	56	50.1%	-	-	20,631	9.7%
MARLIN	107	46.2%	24	73.0%	-	-	-	-	131	40.0%
Billfish family	-	-	-	-	-	-	-	-	-	-
Blue Marlin	107	46.2%	24	73.0%	-	-	-	-	131	40.0%
SWORDFISH	249	44.3%	49	65.0%	108	44.9%	14	100%	421	29.8%
TUNA	1,467	36.5%	15	100%	1,701	22.9%	126	90.3%	3,308	20.3%
Albacore	68	100%	-	-	-	-	-	-	68	100%
Bluefin	177	77.5%	15	100%	67	100%	-	-	259	59.3%
Skipjack	1,156	44.2%	-	-	1,197	27.9%	126	90.3%	2,479	25.1%
Yellowfin	65	71.1%	-	-	437	43.4%	-	-	502	38.9%
ALL SHARKS	5,319	16.4%	120	83.9%	122	35.5%	-	-	5,562	15.8%
Blacktip / Spinner	1,222	31.1%	-	-	47	57.8%	-	-	1,269	30.1%
<i>Blacktip</i>	1,149	32.8%	-	-	16	100%	-	-	1,164	32.4%
Spinner	73	70.9%	-	-	32	70.7%	-	-	105	53.9%
Bull	734	24.4%	11	100%	13	100%	-	-	757	23.8%
Hammerheads	78	45.1%	-	-	44	57.9%	-	-	122	35.6%
<i>Hammerhead genus</i>	62	50.6%	-	-	15	100%	-	-	77	45.2%
Great	-	-	-	-	-	-	-	-	-	-
<i>Scalloped</i>	16	100%	-	-	30	71.0%	-	-	46	58.0%
Lemon	2,134	33.2%	10	100%	-	-	-	-	2,144	33.1%
Miscellaneous Sharks	1,152	24.8%	100	100%	18	100%	-	-	1,270	23.9%
Requiem Shark family	123	60.3%	100	100%	-	-	-	-	223	55.8%
Requiem Shark genus	385	48.2%	-	-	-	-	-	-	477	43.4%
<i>Bigeye Thresher</i>	14	100%	-	-	-	-	-	-	14	100%
Blacknose	215	79.6%	-	-	-	-	-	-	251	69.7%
Caribbean Reef	96	60.0%	-	-	-	-	-	-	96	60.0%
<i>Night</i>	43	58.2%	-	-	-	-	-	-	43	58.2%
Sandbar	70	51.8%	-	-	-	-	-	-	200	67.3%
Shortfin Mako	33	71.5%	-	-	18	100%	-	-	51	58.2%
Silky	126	61.0%	-	-	-	-	-	-	126	61.0%
Unidentified Shark	46	57.9%	-	-	-	-	-	-	46	57.9%

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Appendix J – For-Hire Telephone Survey Catch Estimates for the May-June 2008 sample wave.

May 2008 – June 2008 Survey	Released Alive				Landed/Dead Discard				Total Catch	
	FHS		CHS		FHS		CHS		FHS & CHS	
	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE	#Fish	PSE
SAILFISH	1,797	23.4%					-	-	1,797	23.4%
MARLIN	21	100%	-	-	-	-	-	-	21	100%
Billfish family	21	100%	-	-	-	-	-	-	21	100%
Blue Marlin	-	-	-	-	-	-	-	-	-	-
SWORDFISH	-	-	-	-	47	72.4%	-	-	47	72.4%
TUNA	-	-	-	-	52	58.7%	-	-	52	58.7%
Albacore	-	-	-	-	-	-	-	-	-	-
Bluefin	-	-	-	-	-	-	-	-	-	-
Skipjack	-	-	-	-	52	58.7%	-	-	52	58.7%
Yellowfin	-	-	-	-	-	-	-	-	-	-
ALL SHARKS	2,039	33.6%	-	-	16	100%	-	-	2,055	33.3%
Blacktip / Spinner	780	71.6%	-	-	-	-	-	-	780	71.6%
Blacktip	780	71.6%	-	-	-	-	-	-	780	71.6%
Spinner	-	-	-	-	-	-	-	-	-	-
Bull	343	38.2%	-	-	-	-	-	-	343	38.2%
Hammerheads	54	60.4%	-	-	16	100%	-	-	70	51.9%
Hammerhead genus	26	100%	-	-	-	-	-	-	26	100%
Great	28	70.7%	-	-	-	-	-	-	28	70.7%
Scalloped	-	-	-	-	16	100%	-	-	16	100%
Lemon	528	62.4%	-	-	-	-	-	-	528	62.4%
Miscellaneous Sharks	334	52.5%	-	-	-	-	-	-	334	52.5%
Requiem Shark family	76	83.9%	-	-	-	-	-	-	76	83.9%
Requiem Shark genus	92	100%	-	-	-	-	-	-	92	100%
Bigeye Thresher	-	-	-	-	-	-	-	-	-	-
Blacknose	36	100%	-	-	-	-	-	-	36	100%
Caribbean Reef	-	-	-	-	-	-	-	-	-	-
Night	-	-	-	-	-	-	-	-	-	-
Sandbar	130	100%	-	-	-	-	-	-	130	100%
Shortfin Mako	-	-	-	-	-	-	-	-	-	-
Silky	-	-	-	-	-	-	-	-	-	-
Unidentified Shark	-	-	-	-	-	-	-	-	-	-