FINAL REPORT

EVALUATING POTENTIAL BIAS IN THE LARGE PELAGIC SURVEY FOR THE ATLANTIC BAYS TUNA FISHERY

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EXECUTIVE SUMMARY

EVALUATING POTENTIAL BIAS IN THE LARGE PELAGIC SURVEY FOR THE ATLANTIC *BAYS* TUNA FISHERY

by Andrew J. Loftus and Richard B. Stone

The accuracy of the data for the recreational catch of tuna is crucial for proper assessments by the International Commission for the Conservation of Atlantic Tunas (ICCAT) and establishment of country quotas. Concerns about the accuracy of the data for Atlantic tunas have been voiced at the ICCAT Advisory Committee for many years and remain a priority for the BAYS (bigeye, albacore, yellowfin, skipjack) working group. Currently, BAYS tuna assessments are compiled through the Large Pelagic Survey (LPS), which is conducted Maine-Virginia during June - October, and from a variety of pre-existing surveys for other Atlantic and Gulf States and time periods. However, the LPS was designed more for capturing bluefin tuna information, and none of the other surveys used to piece together the BAYS estimates accurately samples the entirety of the U.S. fishery temporally or spatially.

In 2002, the NMFS Office of Sustainable Fisheries commissioned a pilot study to assess the extent of this problem. This study was intended to provide an indication of the *potential* magnitude of the inaccuracy, if any, of the catch estimates of BAYS tunas for past years. A secondary objective was to provide suggestions for improving the system for documenting the recreational catch of these fish.

Using data from logbook records collected by NMFS as well as held privately by charter vessel operators, combined with other sources of data, an estimate of the magnitude of the problem was developed. In only five states in the northeast, it is likely that underreporting occurred in every year from 1997-2001, with a conservative estimate for the for-hire sector alone ranging from 1,553 to more than 12,000 yellowfin annually. Conversely, 1996 LPS estimates for the same region may have over estimated landings. The estimates in South Carolina may be overestimating the for-hire yellowfin catch by as much as 10,000 fish (but generally less than 1,000) in that same period, although there is evidence that tournament and private boat data were undercounted. In the Gulf of Mexico, despite an improvement in the for-hire sampling methodology of the MRFSS, evidence suggests that, conservatively, for-hire yellowfin harvests have been underreported by up to 8,500 fish (not including the west coast of Florida). In Puerto Rico, all records of BAYS tunas landed have been missed entirely prior to 2000. Information since that time suggests that more than 400 fish are landed annually in the for-hire sector.

Similar trends are evident for these areas for albacore tuna fisheries. These estimates only pertain to the for-hire sector of the fishery. It is likely that estimates for the private boat fishery for BAYS tunas display similar trends, although the magnitude is still unknown. Further investigation would be needed to determine that magnitude and the extent of this. Based on these findings, the estimates of recreational landings for BAYS tunas as reported by NMFS appear to be a substantial underestimate of the true landings. Providing a consistent sampling framework, with higher sample sizes in some cases, for all areas and a complete census for headboat landings that are both groundtruthed to external data sources is the best method to improve future catch statistics.

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BACKGROUND

Assessing the recreational/charter effort and harvest of any marine fish species is generally extremely difficult and costly. Although the National Marine Fisheries Service (NMFS) spends several million dollars annually on the Marine Recreational Fisheries Statistic Survey (MRFSS), the results do not accurately depict the extent of "rare event" fisheries (i.e. those fisheries where harvest and/or participation on a coast-wide scale are minimal in comparison to other recreational fisheries). Typically, fisheries for highly migratory species (HMS) such as tunas fall into this rare event category.

In an effort to provide the needed information for fisheries targeting highly migratory species, the NMFS initiated the Large Pelagic Survey (LPS) from Maine through North Carolina during the peak fishing periods (June through October). This survey utilizes a combination of dockside sampling and telephone surveying to determine catch and effort of those surveyed. In recent years, these results have been extrapolated to the universe of vessels based on lists generated through the issuance of permits. In 1993, NMFS required vessels fishing in the bluefin "Angling" category to obtain these permits. To further bolster their accuracy, in 1997, NMFS made these permits available through a toll free telephone number and began collecting a cost-recovery fee for the permits. The permits have since been made mandatory for all vessels in the Atlantic tuna fisheries.

Many members of the recreational fishing community have not accepted the LPS. Claims that the survey vastly over estimates the recreational harvest of bluefin and underestimates yellowfin, that the survey universe of permit holders is flawed, and that the survey methodology is inappropriate and therefore inaccurate have been widespread. Compounding this is the geographic limitations of the LPS – Maine to Virginia (North Carolina sampling is conducted separately). Data from other areas of the Atlantic and Gulf coasts are pieced together from various surveys and added to this for the complete estimate. There is no single sampling program designed to collect harvest data from recreational fisheries for tunas and other highly migratory species conducted off the entirety of the U.S. Atlantic and Gulf of Mexico coasts.

Large pelagic fisheries are *extremely* important to the recreational fishing industry and to recreational anglers. The fisheries for tunas have a long history. Yellowfin and albacore have been an important part of that history, but have been even more important from an economic standpoint since more stringent regulations on bluefin tuna went into effect in 1992. Fisheries for these tunas now sustain the HMS charter and headboat fishery in the northeast during the late summer and fall. There is a need to estimate an accurate magnitude of the pelagic recreational fisheries as part of the management, both domestic and international, process. In fully or over exploited fisheries, of which many of the highly migratory species are, allocation among user groups often becomes an issue. Accurate recreational harvest data for the entire stock are important for assessment purposes as well. Therefore, it is very important to obtain accurate recreational harvest data as well as biological and economic information from these fisheries, collected in a manner in which anglers have confidence.

The issue of accurate catch and effort data for Atlantic tunas has been voiced at the Advisory Committee Meeting of the International Commission for the Conservation of Atlantic Tunas

(ICCAT) for many years and remains a priority for the BAYS (bigeye, albacore, yellowfin, skipjack) working group. The accuracy of the data for the recreational catch of tuna is crucial for proper ICCAT assessments and any recommendations for country quotas. For example, as it stands now, existing yellowfin estimates, which recreational fishermen dispute, place U.S. recreational fisheries at a disadvantage if country quotas are instituted. Decisions that may be made at ICCAT could involve country quotas in the future for other species including yellowfin. Recreational anglers need the benefit of accurate harvest data throughout the range of their fisheries if they are to get an equitable share of any future country quotas.

In September 2002, the NMFS Office of Sustainable Fisheries commissioned a baseline study to try to assess the potential magnitude of over or under reporting of the BAYS tunas in NMFS statistical data collection programs. A key component of this study was to engage the recreational fishing community in the project in order to access available angler-generated data. This report summarizes the results of that review.

STUDY OBJECTIVE

This study was intended to provide an indication of the *potential* magnitude of the inaccuracy, if any, of the catch estimates of BAYS tunas for past years. A secondary objective was to provide suggestions for improving the system for documenting the recreational catch of these fish. It is not intended to be a thorough and complete critique of the LPS.

METHODS

This project commenced on October 9, 2002. During the fall and early winter months, extensive communication was held with NMFS regional personnel, recreational anglers (primarily for-hire sector) and state officials to identify and obtain data from the various survey/sampling programs that collect data on recreational tuna fishing. Site visits were made to various ports in New Jersey for the purposes of collecting data from charter/headboat operators to be used in ground-truthing LPS and logbook estimates. Additional data were obtained from the Recreational Billfish Survey (RBS), Southeast Head Boat Survey (HBS), North Carolina state surveys (private and charter), New Jersey (historical data 1981-1991), MRFSS, LPS, Northeast Multi-species log books, and South Carolina charter boat survey. Existing NMFS and private sector reports containing tuna data summaries were collected and reviewed. Extensive consultation was conducted with the NMFS Southeast Fisheries Science Center, NMFS Office of Sustainable Fisheries, and NMFS Office of Science and Technology to discuss project approaches, ascertain specific methodologies that were utilized in developing past non-bluefin tuna estimates for ICCAT, and to begin developing recommendations for needed improvements for these estimates. The NMFS Northeast Region provided data from the NMFS Northeast Multi-Species logbook for use in this project.

Once various sources of information were identified, they were scrutinized for their potential to provide quantitative and reliable comparisons to the LPS estimates over a series of years. Further, through consultation with NMFS staff, existing “holes” in LPS estimates were identified and data sources that may provide an indication of the magnitude of these missing data were sought. Finally, anecdotal records of recreational fishing activity (including articles in popular press and personal contact) where current LPS/MRFSS estimates indicated that no (or minimal) activity was occurring were used to direct attention to potential underestimates or the need for gathering data from those areas.

FINDINGS

CURRENT SURVEY SUMMARY and CHANGES IN SAMPLING METHODOLOGY

As stated previously, no single survey provides the harvest estimates needed for the large pelagic species. In general, the Large Pelagic Survey is conducted only from Maine through Virginia. In the remaining areas, a variety of data collected from existing surveys is pieced together to develop the best available estimate (Table 1). Because of this disparity in the way that estimates are developed by region, the individual geographic regions will be discussed separately. For this review, only a sub-sample of states in each region was evaluated. Therefore, for purposes of further discussion, unless otherwise stated, the geographic areas of coverage that will be addressed are:

- Northeast Analysis: Composed of Massachusetts, Rhode Island, Connecticut, New York, and New Jersey;
- South Atlantic Analysis: Composed of South Carolina and Puerto Rico;
- Gulf of Mexico Analysis: Composed of Alabama, Texas, and Louisiana.

Not only are large pelagic recreational harvest estimates determined differently depending on region, but the actual methodology in each of these regions has varied over the past decade. These changes further complicate the analysis of the magnitude of the potential bias in past estimates. Therefore, it is instructive to review some of the changes in methodology that may have had the largest impact on harvest estimates from year to year.

Large Pelagic Survey

There has been some form of Large Pelagic Survey since at least the 1980's, with NMFS fully assuming the execution of the survey since 1992. The following facets, among others, of the LPS have the potential to impede accurate estimation:

Northeast Headboat data - Since headboats typically carry a larger number of passengers, sampling them via traditional telephone survey methodology or dockside interviews would likely lead to inaccurate data on catch. Therefore, headboat sampling as part of the LPS is conducted using ride-along trip sampling to collect this information.

LPS Temporal Limitations - For purposes of cost and sampling efficiencies, the LPS survey is only conducted during the peak fishing months for these species, May through October. In order to fill in data for fish harvested outside of this time frame, NMFS scientists add the estimates generated from the MRFSS for those months. Typically, the catches in these months are relatively low and the proportional standard errors (pse's) for these estimates relatively high for most HMS. However, in some years (such as 2002-2003), substantial late season fisheries have developed, which therefore would not be covered by as tuna-specific survey such as the LPS. Also, headboats that do fish in November and even in December seem not to have been sampled by the MRFSS.

North Carolina Sampling - Due to refinements made to the conduct of the North Carolina MRFSS survey (principally from supplemental interviews funded by the state) the NMFS stopped including that state in its survey coverage in the mid 1990's (prior to this, there was a survey to capture bluefin data for only a two month period). From this point forward, the large pelagic species harvest estimates from North Carolina are derived from the MRFSS sampling frame. Additionally, the North Carolina winter fishery (January-April) is surveyed through a cooperative venture between North Carolina and NMFS using catch cards specifically designed to capture the activity of this fishery.

<u>Gulf of Mexico Sampling</u>

Large pelagic harvest estimates for the Gulf of Mexico have always relied on the MRFSS, the Southeast Head Boat Survey, and the RBS. However, in 2000, a refined for-hire survey was implemented to provide more reliable estimates for this sector. In brief, the new methodology utilizes a vessel directory framework for sampling charter and headboats rather than relying on the random digit dialing as employed in the MRFSS. This change could provide more accurate estimates for for-hire vessels and could also account for potential differences in estimates pre and post survey implementation. Additionally, Texas is not sampled through these programs.

<u>Puerto Rico</u>

Prior to 2000, no surveys were conducted in this region. In 2000, the MRFSS began to collect data. However, catches of BAYS tunas may be small in comparison to other regions.

QUANTITATIVE COMPARISONS

Because of the regional disparity in data collection that makes up the large pelagic harvest estimates as discussed previously, the findings for the four regions will be discussed separately.

<u>Northeast Region</u>
(Massachusetts, Rhode Island, Connecticut, New York, and New Jersey)

In 1994, the NMFS implemented the Multi-species Logbook program, initially for summer flounder and then for the management of groundfish. Under this program, any for-hire vessel fishing for a list of 13 species is required to complete a monthly logbook on their fishing activity and harvest. Although not all for-hire vessels that fish for large pelagic species would need to subscribe to this reporting requirement, a large percentage of them could be expected to participate (in effect, select logbook records provide a subset of the LPS sampling of the for-hire fishery). Any vessel that reported in their logbook harvesting a BAYS tuna would also presumably be within the sampling frame of the LPS.

Several adjustments were made to improve the quality of the logbook data. The logbook data for yellowfin catch and effort (Table 2) has been supplemented with data obtained from for-hire vessels contacted during this study who had not participated in the logbook program but who were willing to provide logbook records. During the personal contacts and interviews that were made in the course of this investigation, a number of these vessels were identified. Adding data from these additional vessels (both catch and effort) improves the sample size for the next step in the evaluation. Further, the logbook data provided by the NMFS were screened and any entries that were deemed to be in error (such as reported in pounds instead of numbers of fish) were removed. If there was any question as to the validity of the data, it was removed, thereby taking a conservative approach with the use of this data. The only impact that such removals *may* have would be if a vessel truly did catch an inordinately high number of tuna that was misinterpreted as pounds. The impact on the subsequent analysis would be to reduce the catch per vessel estimates. However, even this would not necessarily be detrimental since such a vessel that deviated substantially from the norm would unduly skew the catch per vessel estimates to the high side.

The initial comparison that is possible with these two sources of data is the absolute number of fish reported as "landed[3]" in the LPS and the number reported kept in the logbook. Tables 2 and 3 provide this comparison for yellowfin and albacore tuna respectively. Since the logbooks do not report the total catch of the LPS fleet but only those vessels that also participate in the Northeast multispecies fisheries, a comparison of absolute numbers only provides portion of the catch. It is worth noting that in this simple comparison of a limited number of logbooks, the landings reported in those logbooks exceeds the entire landings projected by the LPS in some years.

In the next step of the analysis, the relative catch rate per vessel (CPV) in each survey can be determined by simply dividing the total catch by the total number of vessels reporting (tables 4 and 5). It is clearly evident that the CPV as reported in the logbook records is many times greater than the CPV calculated from the LPS in each year, ranging anywhere from 2.7 to 27 times greater for charterboats only. The disparity in CPV values seems to be increasing in later years.

It is important to note that for the 1998-2001 time frames, the LPS did not sample headboats. Further, based on our analysis, it is uncertain how thorough the sampling was done in 1996-97 (these records could be obtained from NMFS if further analysis was deemed necessary). Therefore, it would be most accurate to concentrate on a comparison of the CPV for charterboats only.

It is also important to realize that these CPV estimates are derived from the logbook are only from vessels that presumably have an interest in yellowfin or albacore (this interest is expressed by reporting their catch or trip to the logbook) and therefore can be considered a yellowfin-specific CPV. Logbook records did indicate trips reported where no yellowfin or albacore were kept, but not in the number that one would expect. Conversely, the LPS sampling frame is composed of all vessels that have an interest in *any* HMS-permitted species, not just yellowfin,

[3] In this discussion, "for the LPS landed" means those reported landed plus those reported as discarded dead. For the logbook estimates, "landed" means the number reported on the logbook, presumably kept, but does not included dead discards.

and it includes trips where no catch was made. Therefore, it would be inappropriate to apply the logbook CPV estimates to the entire sampling frame of the LPS without making appropriate adjustments, since it would likely over estimate the potential total catch. For example, in 2000, if a vessel fishes only for bluefin (and hence is in the LPS frame) and the CPV of 53.67 yellowfin per vessel per year (from Table 4) were applied, we would be in error since that vessel would never had the "chance" of such a success rate.

Therefore, an adjusted sampling frame must be developed to extrapolate the CPV of the logbook to only the "yellowfin fleet" (remember that not all HMS vessels report to the logbook, so we cannot simply use the number of vessels reporting in the logbook as our frame). Therefore, we make the assumption that the proportion of HMS vessels that report yellowfin in the logbook is similar to the proportion of vessels in the LPS frame that had an interest in yellowfin (in actuality, the proportion of yellowfin vessels in the LPS frame may be higher since sampling is focused on the HMS species grouping, but lacking such information we will remain conservative in our approach). Therefore, the "yellowfin sampling frame" can be defined as the percentage of all "HMS vessels" in the logbook that report at least one successful yellowfin trip in a given year (Table 6) multiplied by the LPS sampling frame size. The CPV derived from the logbooks can then be applied to this new frame to provide a rough estimate of yellowfin landings over the entire fleet. An analysis of the "charter only" (i.e., excluding headboats) and "all for-hire" vessels did not reveal substantial differences in the percentage reporting yellowfin or albacore catches. For this analysis, we utilized the "charter only" percentage.

One more correction factor must be applied before applying the logbook catch rates to the LPS sampling frame. Since the LPS sampling frame contains all HMS-permitted vessels, it inherently includes those vessels that obtained an HMS permit but never went fishing. Therefore, to apply the yellowfin CPV from the logbook, the LPS sampling frame must be reduced by that percentage of nonfishers. Data from the 2002 LPS survey suggest that approximately 2/3 of all permitted vessels <u>may</u> <u>not</u> fish for an HMS species in a given year. (Table7). Although this assumption cannot be considered definitive, the fact that the proportion of vessels that report making no trips appear to be similar whether they are interviewed two, three, four, or five times during the sampling period provides some support for it. Given the uncertainty about the actual number of vessels that take no trips over the course of the year, we have provided estimates of catch under various levels of no fishing.

In summary, the calculation of yellowfin and albacore harvest by applying the catch rates from the logbook results to the universe of HMS permitted-boats is as follows:

Harvest= CPV x Yellowfin (or albacore) Fishers x % Active Fishers x LPS Frame

Where,

Harvest=estimated harvest calculated from logbook catch rates
CPV=Average annual catch-per-vessel reported by vessels harvesting yellowfin (or albacore) in logbooks.

Yellowfin (or albacore) Fishers=percentage of vessels reporting any HMS permitted species harvest in the logbook that reported harvesting yellowfin (or albacore).
% Active Fishers=percentage of HMS-permitted vessels that are assumed to have fished in a given year.
LPS=number of for-hire permits reported in the LPS sampling frame

For example, in 2000, 34% of vessels that reported *any* HMS landings in the logbook reported at least one successful yellowfin trip. Further, we assume that only 1/3 of the permitted-vessels fish in that year, based on Table 7. There were 1,077 HMS for-hire permits issued. Therefore, the calculation of the potential harvest based on logbook catch records is:

Potential charter harvest= 53.67 yellowfin per vessel x .34 x .33 x 1,077

Potential charter harvest = 6,486 yellowfin (Table 8).

Additionally, since the CPV for "charter only" was applied, the number of yellowfin harvested by headboats must be added in. Lacking a better estimate, the actual number of tuna as reported kept by headboats in the logbooks can be added, although it is recognized that this does not constitute all of the catch from headboats. This process can be repeated for each year, resulting in the revised potential yellowfin and albacore tuna catch (Tables 8 and 9).

Tables 8 and 9 are developed under the assumption that 2/3 of the HMS-permitted vessels do not fish at all in a given year, based on data presented in table 7. As described previously, this assumption is based on responses to the normal LPS question of whether a vessel had taken a trip in the previous week. Whether this level of non-fishing is high or not is uncertain. A number of factors could effect this degree of nonfishing. For example, if a late season fishery develops after the LPS survey concluded in October (as has happened in the past), some charter boats that have not fished up to that point may take advantage of the late season fishing opportunities when other species are not available. As a result, the specific level of nonfishing cannot be precisely determined without further study. For that reason, a range of potential harvest levels are presented in tables 10 and 11 under varying assumptions of nonfishing levels.

As can be seen, using this method a pattern of under reporting by the LPS survey seems to be evident and increasing each year. Particularly troubling is the substantial differences exhibited in 2001. These differences are clearly driven by the disparity in the catch rates between the two sampling methodologies. It could be argued that logbook records may overestimate the trip catches and thereby contribute to higher CPV's for logbooks. However anecdotal evidence received during this study indicates that this is unlikely to be occurring on a large scale. Further, any large aberrant observations would have likely been discounted as reported weights (instead of fish) and removed from the analysis, thereby preventing one or two vessels from skewing the results. Further, a comparison of the South Carolina logbook program and a modified MRFSS sampling program (that relied on a vessel directory much like that used in the LPS), concluded that both methods were deemed to be closely equal in accuracy of reported catches. The weakness of the logbook system was in its ability to conduct accurate biological sampling (lengths, weights, etc.) and not in its reliability for assessing catch and effort as was done in this analysis (ACCSP 2002).

South Atlantic and Puerto Rico

Estimates of tuna reported to ICCAT for South Carolina, are composed of landings reported in the MRFSS, RBS, and HBS. However, data for yellowfin tuna were not recorded in the RBS in this region until 2001.

For South Carolina, charter boat and tournament data were obtained from the South Carolina Department of Natural Resources. Although South Atlantic headboat data have been included in South Carolina yellowfin estimates reported to ICCAT because of the HBS, tournament data would be in addition to any reported catch since it is not covered under the aforementioned surveys (MRFSS does not sample tournaments). Also, not all offshore tournaments in South Carolina were sampled (see Table 12).

There is no way of estimating the additional yellowfin tuna from these tournaments but it is obvious that the yellowfin count would be higher based on the values in Table 12. This would be true for any RBS sampling in any state along the Atlantic.

Lacking any better data, the NMFS estimates of HMS harvest from South Carolina include MRFSS data. In comparing MRFSS estimates for South Carolina charter boats with South Carolina logbook data, the MRFSS estimates are consistently higher (much higher in 1998). The exception to this pattern is 1996 when the logbook data was slightly higher (Table 13). Note from Table 13 that the private boat catch is missing from South Carolina estimates for most of the years, and thus there would have been no yellowfin reported as caught by private boats in the LPS estimates. However, there is a very large private boat fleet fishing offshore even though the MRFSS data show zero private boat catch for 1995-1999 and the data for other years (2000 and 2001) are seemingly low. There should be some attempt to determine private boat catch for South Carolina to include in the LPS analysis before a determination of over or under-estimation of catch in this state can be made.

The MRFSS started collecting data for yellowfin tuna in Puerto Rico in 2000. For the charter and private boat fleets the data indicate that 557 fish were landed or discarded dead in 2000, 43 in 2001(charter only), and 5,379 (preliminary) in 2002 (Table 14). While there is substantial charter and private boat fishing for HMS species off Puerto Rico, contacts made with charter captains during this study indicated that yellowfin have been relatively scarce in recent years. One captain said that there used to be great yellowfin fishing on large schools that were often seen around whales, but that they have not seen this condition in the last 10 years. It is impossible to make any quantitative determinations of the under reporting attributable to Puerto Rico without additional data. However, landings of over 5,000 fish in 2002 (if these preliminary numbers are valid) indicate a large number of fish were potentially missed in U.S. records in years prior to any surveys being conducted (pre 2000).

Gulf of Mexico

Based on conversations and anecdotal information gathered during this study from Alabama, Louisiana, and Texas, it is apparent that the MRFSS is missing considerable charter catch (and probably private boat catch as well) from the Orange Beach/Mobile Pass area. Logbook data indicating the number of yellowfin tuna kept were obtained from nine charter vessels in Alabama (Table 15). Additionally, estimates obtained through conversations with local marina operators indicated that over 50 charter boats fish for tunas during the year. This potential number of vessels is supported by data provided by the Gulf States Marine Fisheries Commission which indicate that 77 charter vessels over 36 feet in length and 34 vessels between 26 and 35 feet operate in fisheries off Alabama and Louisiana.

Based on this logbook catch data combined with various estimates of fleet size, a range of potential landings of yellowfin tuna can be made. For example, if it is assumed that half of the 77 vessels over 36 feet fish for tuna (and that vessels less than that do not) a conservative estimate of charter catch of yellowfin tuna off Alabama would be 5,548 for 2002; 4,332 for 2001; and 3,230 for 2000. If it is assumed that 2/3 of that fleet does not fish (the same level of nonfishing indicated for HMS-permitted vessels in the Northeast) then landings range from 2,125 yellowfin to 3,650 yellowfin for these same years (Table 16). The Alabama tuna fishery is not a new fishery according to those in the area that have been involved in the fishing business for many years, therefore it would be realistic to assume that recent years have been similar to 2000 – 2002.

For comparison, the 2001 MRFSS charter estimate for yellowfin was only 82 fish and the MRFSS private boat estimate was 4,604 (Table 17). Using the charter estimate derived from logbook-based vessel catch (4,332 yellowfin) in place of the MRFSS charter estimate the 2001 yellowfin estimate for Alabama (private boat plus for-hire) would be 8,936, or 4,250 yellowfin greater than the MRFSS estimate that would have been used in the official LPS estimates .

The MRFSS does not report any catch of yellowfin at all for 2000 for either the charter or private boats (table 17). However, this is inconsistent with logbook records. Based on the logbook-derived estimates (Table 16), at least 3,230 fish were caught by charter (at the 50% participation level). Although the level of the private boat catch is uncertain, if the ratio of private boat harvest to charter boat harvest is similar to that of 2001, the private boat catch could be expected to be at least be equal to that of charter. Therefore, we could expect that a total of 6,460 yellowfin were caught by private boats and charter vessels in Alabama in 2000 (compared to 0 listed from MRFSS data). Similarly, there is no MRFSS catch listed for Alabama for 1999. We believe that using the 2000 projected catch of 6,460 yellowfin for 1999 would be a conservative estimate. This means that the catch for Alabama in recent years, and perhaps a number of years before as well, has been underestimated by close to 6,000 yellowfin tuna per year. For 1998, there is 0 charter catch listed in the MRFSS data base while there were 1,113 yellowfin reported for the private boat fleet. Using the rationale above, a charter catch of 2,200 - 3,000 yellowfin would not seem unreasonable for 1998.

Louisiana has several ports near the mouth of the Mississippi River where there are intensive yellowfin fisheries by both private and charter boats, particularly in the Venice/Grande Isle area of Louisiana. This is an area that has easy access to great fishing grounds off the mouth of the Mississippi River. The yellowfin tuna fishery is available throughout the year but is most famous for the winter Lump fishery. The Lump is less than 16 miles from the mouth of the Mississippi River. This spot has been written up in many fishing magazines including the *Saltwater Sportsman* (Cooper 2002).

The winter fishery in this area is most active from December through March. According to the captains that were contacted, during this time of year, it is not uncommon for 15 to 20 charter vessels and up to 80 private boats from the Grande Isle/Venice area to be fishing on the Lump plus vessels from the Mobile Pass and Orange Beach area of Alabama. Catch estimates and fishing days provided by captains and charter operations managers indicated that there were 21 fishing days in January, 14 in February and 20 in March of 2003 and that catches ranged from 3 to 10 fish per charter vessel (large charter vessels may average 10 to 30 yellowfin per trip). Fifteen to twenty charter vessels fished during this period since this was when the bite was famous and according to reports the fish ran to 150 pounds and higher at times. Using a conservative four fish average for 15 vessels fishing just these 55 days could result in 3,300 yellowfin for the Louisiana winter fishery (large charter vessels were not used to determine this average due to uncertainty in the number of trips taken and the desire to remain conservative). The summer fishery takes place around gas and oil structures, behind shrimp boats and on schools of yellowfin. The number of fishing days is much greater but the targets are much more mixed so it is difficult to determine effort for yellowfin during this time of year. When school yellowfin are encountered the catch can be much higher though. Even when red snapper or other species are targeted, yellowfin are often caught during part of the fishing trip. Using a conservative estimate of 10 days a month for the other 9 months that vessels might target yellowfin and a catch of 3 fish per trip by 10 charter vessels could result in 2,700 additional yellowfin for an annual total of approximately 6,000 yellowfin from the charter fleet.

Although the above figures are rough approximations, they are supported by data provided by five charter captains from Louisiana, who estimated an annual catch totaling 1,867 yellowfin, or an average of 373.4 yellowfin per vessel in the 2002-2003 season. If this is expanded to 15 charter boats (there are actually more than 30 charter boats in this area) this would equate to 5,600 yellowfin per year for this area.

Three of the charter captains reported the number of days that they fished in addition to the estimated number of yellowfin caught. They averaged 111 fishing days with 2 of the captains reporting an average of 6 fish per trip and the other captain averaging 4 fish per trip. So if we use 100 fishing days at an average of 4 yellowfin times 15 charter boats we get approximately 6000 yellowfin per year for Louisiana once again. From these calculations, observations of web sites, and talking with fishermen in this area, it is clear that an annual catch of approximately 6,000 yellowfin for the charter fisheries out of Louisiana is not unreasonable. These calculations may not be statistically valid but they are statistically possible and may be much more reasonable than the existing MRFSS estimates.

From discussions with the captains, it appears that the fishery on the Lump has existed for a substantial time but has only become very intense in the last six years. Follow- up investigations should be conducted to determine how to retrofit past data. Assuming that this fishery has been at a similar level since 1998 (6,000+ yellowfin), then the MRFSS charter estimate for yellowfin may be underestimated by 3,758 - 5,120 fish between 1998 and 2002 (Table 18). Making these assumptions or checking on potential level of catch is relatively easy if communications are maintained with charter captains and marina operators. Also, web pages give daily reports of catches and list charter operations. Not many charter captains seem to keep logbooks but several indicated they would be willing to do this.

Another identified gap in the large pelagic estimates is from the fisheries off of Texas. The Texas Parks and Wildlife survey of recreational fishing is not designed to collect rare event species like tunas and has too small a sample size for offshore fishing to accurately predict catch. Headboat catches and data from the RBS have been included in estimates sent to ICCAT. However, the private boat catch estimates are missing. Based on conversations with fishermen, the missing catch at least in recent years may be in hundreds of yellowfin rather than thousands like in Alabama and Louisiana, although they did state that there have been times in the past when the yellowfin fishing was very good. It should be noted that the RBS, which has been an effective data collection program since 1971, only records data on yellowfin that are weighed in at tournaments. Since not all fish are necessarily weighed-in, the RBS in the Gulf underestimates even yellowfin that are caught in tournaments. There may be a way to estimate the magnitude of the underestimate with further analysis. Based on information from these three states and recognizing that we have not looked at the west coast of Florida, we can see a potential underestimate of over 10,000 yellowfin per year in the Gulf for recent years for both private and charter boats.

SUMMARY

It is evident that NMFS estimates of recreational harvest of BAYS tunas is likely under reporting the true harvest. In all but two circumstances that we evaluated in this study, the NMFS estimates were lower than estimates that were calculated with alternative data. A conservative estimate of under reporting of t*he for-hire sector yellowfin alone* by the regions that we evaluated may be:

Year	Northeast[1]	South Carolina Charter[2]	South Carolina Tournament[3]	Puerto Rico	Gulf[4]
1996	-1,101 to -4,192	78	181+	40-550?	?
1997	7,546 to 1,764	-518	153+	40-550?	?
1998	2,952 to -60	-10,446	178+	40-550?	6,917+
1999	21,382 to 1,553	-787	528+	40-550?	7,500+
2000	16,136 to 7,882	-504	322+	40-550?	8,300+
2001	12,797 to 6,728	-1,359	247+		8,100+

Note that a negative number indicates an over reporting of catch in the LPS estimates
[1] New Jersey, New York, Connecticut, Massachusetts, Rhode Island
[2] Note that there was no private boat catch recorded for South Carolina from 1996-99
[3] Tournament catches only, includes charter and private boat catch
[4] Alabama and Louisiana

Note again that these estimates include only <u>for-hire</u> vessels unless otherwise noted in select states identified. It is unknown whether the harvest from the private boat sector follows the same pattern, but given that both sectors are sampled through the same mechanisms (LPS and MRFSS) it is reasonable to assume that private boat estimates suffer from a similar under reporting bias. Additionally, in some years in South Carolina and the Gulf states there is no catch reported from the private boat fleet although other data sources indicate that there were catches made. These private boat catches may actually be substantial.

During our evaluation, numerous instances of "missed fish" were identified. Although NMFS scientists have utilized the existing survey data from a variety of sources to the best of their ability, the fundamental flaw of the current system is the lack of a uniform survey framework. Further, there is clearly a need for survey personnel to periodically "groundtruth" the sampling regimes with external data sources to help adapt to changes in fishing patterns.

The apparent under reporting of the LPS for-hire sector in the northeast is troubling. While the survey design has been structured on sound principles, the large discrepancies between the catch rates represented in this survey and the catch rates reported by for-hire vessels in logbooks is substantial. NMFS is implementing a new sampling framework for the for-hire sector and it would be advisable to concurrently conduct an evaluation with the logbook records where they overlap to ascertain the reasons behind these discrepancies. Further, given the relatively small number of headboats in the Northeast, we encourage a strong consideration of implementing a mandatory logbook system with these vessels (rather than sampling) to provide a complete census of their catch.

In the southeast/Caribbean and the Gulf of Mexico, the lack of a complete sampling frame for the for-hire sector (and the private-boat sector) for HMS is impeding accurate record collection. This should be rectified if accurate statistics from these regions is desired. In the Gulf, we were surprised at the apparent discrepancies in catch between our estimates (based on the records provided to us) and the estimates from the refined MRFSS sampling of the for-hire sector that has been conducted since 2000. The new MRFSS system for the for-hire sector was intended to provide greater precision and more accurate estimates. While the samples provided to us were primarily anecdotal and few in number (nine vessels in Alabama and five in Louisiana), we believe that they should provide impetus for the GulfFin program to assess whether there may be some areas that are being missed with the existing sampling program. Also, the average weights for fish landed in the MRFSS seems very low compared to what we heard from fishermen or saw in other data collection programs.

In conclusion, the estimates of recreational landings (kept plus dead discards) for BAYS tunas as reported by NMFS appear to be a substantial underestimate of the true landings. While estimates of the magnitude of this error are conservative and rough, they nonetheless provide a clear indication that the current system needs substantial improvement. Providing a consistent sampling framework, with higher sample sizes in some cases, for all areas and a complete census for headboat landings that are both groundtruthed to external data sources is the best method to improve future catch statistics.

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Table 1. Primary surveys currently used to derive large pelagic recreational harvest estimates

	Large Pelagic Survey	MRFSS[2]	Recreational Billfish Survey	NMFS Southeast Headboat Survey
Northeast/Mid Atlantic	x[1]	x[3]		
South Atlantic		x	x	X
Gulf of Mexico		x[4]	x	X
Puerto Rico		2000	x	

[1]Maine through Virginia

[2] "Enhanced " MRFSS used in North Carolina and for winter North Carolina fishery

[3] Only used in months that LPS is not operating

[4]In 2000-2003, a special survey of for-hire vessels was implemented in the Gulf of Mexico as part of the MRFSS.

Table 2. Comparison of yellowfin tuna records from NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish.

YEAR	LPS[1] FOR-HIRE ONLY		LOGBOOK[2] CHARTER ONLY		LOGBOOK HEADBOAT ONLY		LOG BOOK[2] TOTAL	
	Harvest	Vessels	Harvest	Vessels	Harvest	Vessels	Harvest	Vessels
1996	8,483	1446	1,527	96	1,862	25	3,389	121
1997	6,156	1495	2,708	100	3,378	26	6,086	126
1998	5,650	968	2,350	92	3,224	20	5,574	112
1999	6,047	1055	5,915	104	9,878	26	15,793	130
2000	6,303	1077	4,401	82	7,699	23	12,100	105
2001	1,622	1023	3,553	83	3,581	16	7,134	99

[1] From 1998-2001, the LPS did not collect data from headboats
[2] Includes some data not in logbook data base, but is missing some vessels that fished but are not in the logbook data base

Table 3. Comparison of albacore tuna records from NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish.

YEAR	LPS[1] FOR-HIRE ONLY		LOGBOOK CHARTER ONLY [2]		LOGBOOK HEADBOAT ONLY [2]		LOG BOOK TOTAL[2]	
	Harvest	Vessels	Harvest	Vessels	Harvest	Vessels	Harvest	Vessels
1996	3,394	1,446	506	57	305	16	811	73
1997	1,181	1,495	1,015	45	2,374	23	3,389	68
1998	5,513	1,064	2,220	74	5,415	24	7,635	98
1999	1,927	1,055	914	33	2,136	16	3,050	49
2000	3,404	1,077	1,790	73	1,669	20	3,459	93
2001	1,062	1,023	1,230	58	2,269	17	3,499	75

[1] From 1998-2001, the LPS did not collect data from headboats
[2] Missing some vessels that fished but are not in the logbook data base

Table 4. Comparison of yellowfin tuna catch per vessel (CPV) from NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead.

YEAR	LPS[1] FOR-HIRE	LOGBOOK CHARTER	LOGBOOK HEADBOAT	LOG BOOK TOTAL
1996	5.87	15.91	74.48	28.01
1997	4.12	27.08	129.92	48.30
1998	5.84	25.54	161.20	49.77
1999	5.73	56.88	379.92	121.48
2000	5.85	53.67	334.74	115.24
2001	1.59	42.81	223.81	72.06

[1] From 1998-2001, the LPS did not collect data from headboats

Table 5. Comparison of albacore tuna catch per vessel (CPV) from NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as “kept” while LPS estimates are those landed plus those reported as discarded dead.

YEAR	LPS[1] FOR-HIRE	LOGBOOK CHARTER	LOGBOOK HEADBOAT	LOG BOOK TOTAL
1996	2.35	8.88	19.06	11.11
1997	0.79	22.56	103.22	49.84
1998	5.18	30.00	225.63	77.91
1999	1.83	27.70	133.50	62.24
2000	3.16	24.52	83.45	37.19
2001	1.04	21.21	133.47	46.65

[1] From 1998-2001, the LPS did not collect data from headboats

Table 6. Percent of boats catching HMS-permitted species that reported in logbooks catching yellowfin and albacore tuna.

YEAR	TOTAL BOATS	PERCENT OF BOATS REPORTING YELLOWFIN	PERCENT OF BOATS REPORTING ALBACORE
1996	328	32	18
1997	335	34	14
1998	352	29	24
1999	326	39	13
2000	296	34	27
2001	295	33	22

Table 7. Percent of HMS for-hire permit holders reporting making the specified number of trips in the week prior to the survey during the 2002 LPS.

Number of Observations	Number of Contacts throughout the season	% 0 trips	% 1 trip	% 2 trips	% 3 trips	% 4 trips	% 5 + trips
682	1	83.4	9.5	4.1	1.3	0.7	0.8
347	2	69.2	14.7	8.1	4.0	1.7	2.4
134	3	61.9	15.7	10.4	4.5	4.5	2.8
39	4	61.5	23.1	5.1	5.1	2.6	2.6
17	5	64.7	29.4	5.9			

Source: Craig Brown, NMFS Southeast Fisheries Science Center, Miami, FL, personal communication

Table 8. Potential difference in yellowfin tuna landings between NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish. Assumes that 1/3 of permitted vessels fish in the year.

YEAR	LPS FOR-HIRE	LOGBOOK CHARTER[1]	LOGBOOK HEADBOAT	TOTAL LOGBOOK	DIFFERENCE (# OF FISH)[2]	DIFFERENCE (PERCENT)[2]
1996	8,483	2,429	1862	4,291	-4,192	-49
1997	6,156	4,542	3378	7,920	1,764	29
1998	5,650	2,366	3224	5,590	-60	-1
1999	6,047	7,722	9878	17,600	11,553	191
2000	6,303	6,486	7699	14,185	7,882	125
2001	1,622	4,769	3581	8,350	6,728	415

[1] Logbook charter projections assume that only 1/3 of HMS-permitted vessel fish in a given year.
[2] A negative number indicates LPS-reported harvest was greater than Logbook projections.

Table 9. Potential difference in albacore tuna landings between NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish. Assumes that 1/3 of permitted vessels fish in the year.

YEAR	LPS FOR-HIRE	LOGBOOK CHARTER [1]	LOGBOOK HEADBOAT	TOTAL LOGBOOK	DIFFERENCE (# OF FISH) [2]	DIFFERENCE (PERCENT) [2]
1996	3,394	762	305	1,067	-2,327	-69
1997	1,181	1,558	2,374	3,932	2,751	233
1998	5,513	2,528	5,415	7,943	2,430	44
1999	1,927	1,254	2,136	3,390	1,463	76
2000	3,404	2,353	1,669	4,022	618	18
2001	1,062	1,575	2,269	3,884	2,782	262

[1] Logbook charter projections assume that only 1/3 of HMS-permitted vessels fish in a given year.
[2] A negative number indicates LPS-reported harvest was greater than Logbook projections.

Table 10. Comparison of yellowfin tuna landings between NMFS Large Pelagic Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey, using various assumed fishing rates to adjust logbook estimates. Logbook estimates include those reported as “kept” while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish.

		Percentage of HMS-Permitted Vessels That Actually Fish in Each Year			
YEAR	**LPS FOR-HIRE**	**25% nonfishing rate**	**33% nonfishing rate**	**50% nonfishing rate**	**66% non fishing rate**
1996	8,483	7,382	6,793	5,542	4,291
1997	6,156	13,702	12,600	10,260	7,920
1998	5,650	8,602	8,028	6,809	5,590
1999	6,047	27,429	25,557	21,579	17,600
2000	6,303	22,439	20,867	17,526	14,185
2001	1,622	14,419	13,263	10,807	8,350

Table 11. Comparison of albacore tuna landings between NMFS Large Pelagic Species Survey and NMFS Northeast Multi-Species Logbook, Massachusetts through New Jersey, using various assumed fishing rates to adjust logbook estimates. Logbook estimates include those reported as "kept" while LPS estimates are those landed plus those reported as discarded dead. Landings are in numbers of fish.

		Percentage of HMS-Permitted Vessels That Actually Fish in Each Year			
YEAR	**LPS FOR-HIRE**	**25% nonfishing rate**	**33% nonfishing rate**	**50% nonfishing rate**	**66% non fishing rate**
1996	3,394	2,038	1,853	1,460	1,067
1997	1,181	5,915	5,537	4,734	3,932
1998	5,513	11,161	10,548	9,245	7,943
1999	1,927	4,985	4,681	4,035	3,390
2000	3,404	7,017	6,446	5,234	4,022
2001	1,062	5,849	5,467	4,655	3,884

Table 12. South Carolina tournament sampling and harvest of yellowfin tuna.

Year	Total SC Tournaments	Tournaments Sampled	Tournament Yellowfin Harvest
1993	22	13	393
1994	21	9	242
1995	18	9	374
1996	22	8	181
1997	23	8	153
1998	18	7	178
1999	17	7	528
2000	18	6	322
2001	16	6	247

Table 13. Comparison of MRFSS records (A+B1) and South Carolina Charter logbook data for yellowfin tuna harvest (numbers of fish).

Year	South Carolina Charter Logbook	MRFSS Charter	MRFSS Private Boat Catch
1996	553	475	-0-
1997	266	784	-0-
1998	933	11,379	-0-
1999	1,407	2,194	-0-
2000	1,666	2,170	857
2001	1,511	2,870	818

Table 14. MRFSS harvest (numbers of fish) of yellowfin tuna from Puerto Rico.

Year	Charter Catch (A+B1)	Private Boat Catch (A+B1)	Total Catch (A+B1)
2000	63	494	557
2001	43	-0-	43
2002	561 (preliminary)	4,818 (preliminary)	5,379 (preliminary)

Source: MRFSS

Table 15. Annual charter yellowfin tuna catches (fish kept) in the Alabama based on logbook data provided by nine charter vessels.

Year	Boats Reporting	Tuna Kept	Catch Per Vessel
2000	6	508	85
2001	7	797	114
2002	9	1,312	146

Table 16. Potential charter landings of yellowfin tuna in Alabama based on varying levels of participation. The 77 boat level represents all vessels above 36 feet while the 25 boat level represents 1/3 of the fleet fishing.

Year	25 boats	38 boats	50 boats	77 boats
2000	2,125	3,230	4,250	6,545
2001	2,850	4,332	5,700	8,778
2002	3,650	5,548	7,300	11,242

Table 17. Comparison of MRFSS yellowfin tuna harvest (A+B1) for Alabama to potential conservative estimates of yellowfin kept based on self-reported charterboat logbook results.

Year	MRFSS Charter Only	MRFSS Private	Potential Charter Only Estimate (logbook)[1]
1999	-0-	0	~3,000
2000	-0-	0	3,230
2001	82	4,604	4,332
2002	553	0	5,548

[1] Based on the assumed participation rate of 50% of boats>36 feet

Table 18. Comparison of MRFSS yellowfin tuna harvest (A+B1) for Louisiana to potential conservative estimates of yellowfin kept based on self-reported charterboat results. Projections for all years are based on 2003 catch rate estimates.

Year	MRFSS Charter Only	Potential Charter Estimate Only (logbook)	Potential Difference
1998	2,083	~6,000	3,917
1999	1,482	~6,000	4,518
2000	880	~6,000	5,120
2001	2,145	~6,000	3,855
2002	2,242	~6,000	3,758