Large pelagic species permit holders in the Caribbean Sea and Gulf of Mexico: Statistics, characteristics, and demographic trends.

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ABSTRACT

Vessel owners who fish recreationally for regulated tunas, sharks, swordfish, and billfish in U.S. federal waters of the Caribbean Sea and the Gulf of Mexico must obtain a Highly Migratory Species (HMS) permit. Vessel owners who fish commercially for regulated tunas in the Caribbean Sea and the Gulf of Mexico must obtain an Atlantic Tunas permit. This paper explores statistical and demographic trends over the past seven years in U.S. vessels permitted to fish for large pelagics in the Caribbean Sea and Gulf of Mexico. Data from permitted vessels with principle ports in the following states/ territories were included in this study: Florida, Alabama, Mississippi, Louisiana, Texas, Puerto Rico, and the U.S. Virgin Islands. Historical permit databases were analyzed for the three largest permit categories for large pelagic species: HMS Angling category, HMS Charter / Headboat category, and Atlantic Tunas General category. Trends in the number of permits sold by category, principle port state/territory, and city were investigated. This study also assessed the prevalence of permit category switching over time and evaluated turnover among Caribbean and Gulf of Mexico large pelagics fishing vessels based on persistence in permit databases. Vessel length was also analyzed by permit category and principal port state. Implications of these findings for the management of large pelagic fishes in the Caribbean Sea and Gulf of Mexico are discussed.

KEYWORDS: fishing permit, highly migratory species, Caribbean, Gulf of Mexico

Tendencias de las Características Demográficas y Estadísticas de los Poseedores de Permisos para Especies de Grandes Pelágicos en el Mar Caribe y el Golfo de México en la Pasada Década.

Los dueños de embarcaciones quienes realizen pesca recreativa de las especies de atunes, tiburones, pez dorado ("swordfish"), y peces de pico ("billfish") en el Mar Caribe y el Golfo de Mexico pertenecientes a aguas federales de los Estados Unidos deberán obtener el permiso llamado Especies de Alta Migración, mejor conocido como "Highly Migratory Species (HMS) Permit" por sus siglas en inglés. Los dueños de embarcaciones quienes realizen pesca comercial para las especies reguladas de atunes en el Mar Caribe y el Golfo de Mexico deben obtener el Permiso para Atunes del Atlántico mejor conocido como "Atlantic Tunas Permit" por sus siglas en inglés. Este artículo explora las tendencias demográficas y estadísticas de los pasados siete años de los embarcaciones con permisos que les autoriza a pescar grandes pelágicos en el Mar Caribe y el Golfo de Mexico. El mismo incluye información de aquellas embarcaciones con permisos adscritos a los puertos principales de los siguientes estados o territorios: Florida, Alabama, Mississippi, Louisiana, Texas, Puerto Rico, e Islas Vírgenes de los Estados Unidos. El banco de datos que contiene estos permisos ha sido analizado históricamente para las tres grandes categorías de pesca de las siguientes especies de grandes pelágicos como: "HMS Angling category", "HMS Charter/Headboat category", and "Atlantic Tunas General category". Este estudio describe la tendencia del número de permisos vendidos por categoría, puerto principal del estado o territorio por ciudad. El análisis del estudio incluye la prevalencia de los cambios en las categorías de permisos a través de los años, y evalúa los cambios de las embarcaciones pesqueras autorizadas a pescar grandes pelágicos en el Mar Caribe y el Golfo de Mexico basado en la renovación y consistencia de estos permisos en el banco de datos estudiado. Por último, este estudio discute las implicaciones de estos hallazgos a nivel administrativo para las especies de grandes pelágicos realizados en el área de estudio.

PALABRAS CLAVES: permisos de pesca, especies de alta migración, Mar Caribe, Golfo de Mexico

INTRODUCTION

The National Marine Fisheries Service (NMFS) is responsible for monitoring and managing U.S. marine fisheries resources. Large pelagic species, which are caught in offshore oceanic waters, are of particular interest to NMFS as these species support socially and economically important recreational and commercial fisheries (NMFS 2006). Pelagic species targeted by recreational anglers in the Atlantic, Caribbean and Gulf of Mexico include billfish (blue marlin, sailfish, white marlin), dolphin, wahoo, tunas (bluefin, yellowfin, albacore, skipjack, bigeye), and several species of shark. Successful stewardship of these valuable resources requires close monitoring of trends in directed effort and catch. The authority to collect data on large pelagics comes from the Atlantic Tunas Convention Act (ATCA) and the Magnuson-Stevens Fishery Conservation and Management Act. Sustainability of highly migratory species also requires a high level of cooperation among the

many nations that pursue these stocks. The collection of catch and effort information on large pelagics fulfills U.S. obligations to the International Commission for the Conservation of Atlantic Tunas (ICCAT).

Recreational fishing trips targeting offshore large pelagics are often considered "rare events" because they constitute a relatively small proportion of all recreational fishing trips taken. As a result it is difficult to efficiently sample large pelagic fisheries, or to obtain adequate sample sizes for estimation and analyses, using generalized recreational surveys that are designed to sample all species. When sampling such "rare events" efficiency is greatly improved by using a list or frame that represents the universe of participants (or vessels) in the fishery. In 1975 the ATCA authorized the issuance of federal permits for commercial and recreational vessels targeting large pelagics species. This Act calls for "a comprehensive research and monitoring program" which includes "the collection of comparable real-time data on commercial and recreational catches and landings through the use of permits, logbooks, landing reports for charter operations and fishing tournaments, and programs to provide reliable reporting of the catch by private anglers." Under current regulations, vessels fishing recreationally for regulated tunas, sharks, swordfish, and billfish must obtain a NMFS Highly Migratory Species (HMS) permit while commercial tuna vessels must obtain a federal Atlantic Tunas permit (e-CFR 2006). HMS and Atlantic Tunas permits are required for vessels fishing in federal and state waters in the Atlantic, Gulf of Mexico, and Caribbean Sea. The Large Pelagics Survey (LPS), a special survey designed to estimate catch and effort for large pelagic species, utilizes HMS and Atlantic Tunas vessel permit lists as a sampling frame from which to randomly sample captains/owners of large pelagic fishing vessels. However, at present the LPS is not conducted in the U.S. Caribbean and Gulf of Mexico (only from Maine through Virginia). Currently there is no comprehensive recreational survey specifically designed for monitoring large pelagic catch and effort in the U.S. Caribbean and Gulf of Mexico.

This paper presents an exploratory study of statistical and demographic trends in U.S. vessels permitted to fish for large pelagics in the Caribbean Sea and Gulf of Mexico. The objective of this study was to identify fishery characteristics and gain a better understanding of the rod and reel large pelagic fisheries in this region. Data from historical permit databases were analyzed as a surrogate for more detailed and directed information which might be collected from specialized surveys of large pelagic fisheries participants. Trends in the number of permits sold by category, principle port state/territory, and city were investigated. This study also evaluated turnover among Caribbean and Gulf of Mexico large pelagic fishing vessels based on renewal rates and new permits issued and prevalence of permit category switching over time. Finally, vessel length was analyzed by permit category and principal port state/territory.

METHODS

Data from permitted vessels with principle ports in the following states/territories were included in this study: Florida, Alabama, Mississippi, Louisiana, Texas, Puerto Rico, and the U.S. Virgin Islands. Although the focus of this study was on the Gulf of Mexico and Caribbean, all of Florida (including the Atlantic coast) was included in analyses. Data on individual vessel fishing locations necessary to split Florida vessels into Atlantic, Gulf or both were not available. Principle port could not be used for this split since large pelagic vessels with ports along Florida's Atlantic coast could presumably fish in the Gulf of Mexico and/or Caribbean Sea. Historical permit databases were analyzed for the three large pelagic permit categories which predominantly fish with rod and reel: HMS Angling category, HMS Charter / Headboat category, and Atlantic Tunas General category. The Angling category is recreational only (no sale) while the General category is a commercial category. Vessel captains fishing in the Charter / Headboat category can choose to fish either commercially or under recreational regulations on any given trip.

Historical permit databases for the years 1999-2005 were analyzed for each permit category. While the federal permit system for large pelagics pre-dates this time span, reliable electronic datasets were not available prior to 1999 for this study. The following permit application variables were used for analyses: principle port state, principle port city, permit number, owner name, vessel I.D. (either state registration or Coast Guard number), and vessel length. SAS error-checking programs were developed to flag and clean erroneous city/state combinations that did not exactly match any combinations in a comprehensive U.S. Postal Service database. Other permit database fields such as area code, mailing address, billing address, and home port city/state were used to make judgment calls in cases where principle port city/state was not obvious. Duplicate permit records for the same vessel in a given year were removed using permit number since no two vessels should be issued the same permit number. Obvious outliers for the variable vessel length were converted to missing. Analysis of primary target species was conducted using NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) databases.

Brief Permit History and Background

The federal permitting system for large pelagic species has undergone several changes since its inception. These include changes in the number of category types issued, category definitions, species covered, renewal requirements, fishing season dates, and purchase options. Any statistical or demographic trends assessment using the permit database must be made in the context of these changes. A timeline outlining some of the relevant regulatory and administrative changes implemented by NMFS is shown in

Table 1. Timeline of important regulatory and administrative changes to the HMS/Tunas federal permit system.

Year	Regulatory or Administrative Change
1975	ATCA authorizes permits for commercial and recreational fishing for ICCAT species.
1979	Certificates required for vessels taking bluefin tuna for sale (recreational sector exempted). No renewal required.
1982	Commercial bluefin tuna vessel permits established for General (handgear), Harpoon, Purse Seine, and Incidental (other gear) categories. No permit renewal required.
1991	Annual renewal of bluefin permits required.
1993	Charter/Headboat bluefin tuna category permits issued.
1994	Angling category recreational bluefin tuna permits issued. Permit fees waived due to administrative burden and government downsizing. Renewal cycle changed from annual to every three years.
1996	All bluefin tuna permits changed to Atlantic tunas permits. Atlantic tunas permit required for all vessels taking bluefin, yellowfin, bigeye, albacore, or skipjack tunas (and bonito for commercial vessels).
1997	NMFS hires contractor to administer permit system. Renewal cycle changed back to annual renewal. Automated telephone system and Internet site used to issue/renew permits.
1999	Highly Migratory Species (HMS) management plan goes into effect. Atlantic tuna management season changed from calendar year to June 1 – May 31. NMFS drops bonito from list of tunas for which a commercial permit is required. Incidental category dropped; Trap and Longline categories added.
2001	HMS Charter/Headboat permit covering sharks, billfish, swordfish and tunas replaces Atlantic Tunas Charter/ Headboat permit.
2003	HMS Angling permit covering sharks, billfish, swordfish and tunas replaces Atlantic Tunas Angling permit. Atlantic Tunas General category permit holders can no longer fish recreationally for sharks, billfish, or swordfish.

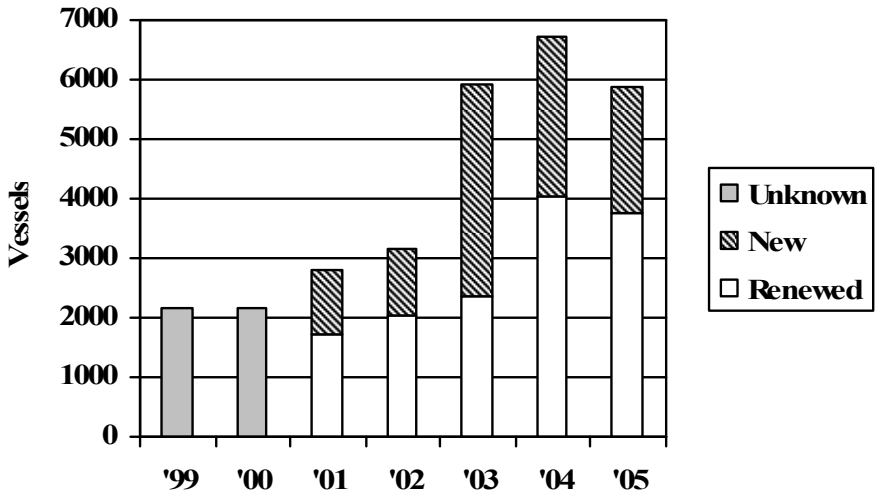

Figure 1. Number of Angling category Atlantic Tuna and HMS vessel permits sold in the Gulf of Mexico and Caribbean from 1999 to 2005 (Atlantic Tuna 1999-2002, HMS 2003-2005).

The first federal large pelagic permits were required only for vessels targeting bluefin tuna. Four commercial bluefin tuna permit categories were established in 1982: Harpoon, Purse Seine, and Incidental (other gear). Recreational bluefin tuna permits were first issued in 1993 in the Charter/Headboat category, and in 1994 in the Angling category. In 1996 the single species bluefin tuna permits (all categories) were changed by NMFS to multi-species Atlantic Tunas permits. Atlantic Tunas permits were required for all vessels fishing for either bluefin, the BAYS tunas (i.e., Bigeye, Albacore, Yellowfin, and Skipjack), or bonito (for commercial vessels only) in the Atlantic, Gulf of Mexico or Caribbean. Commercial and recreational vessels fishing in the Gulf of Mexico may target BAYS tunas. Atlantic bluefin tuna may not be targeted, but HMS Angling and HMS Charter/Headboat vessels in the Gulf of Mexico may retain one trophy bluefin tuna (curved fork length 73 inches or greater) per vessel per fishing year incidental to fishing for other species.

The recreational category Atlantic Tunas permits were converted to the more general Highly Migratory Species (HMS) permits in 2001 for the Charter/Headboat category and in 2003 for the Angling category. The HMS permits are required for all vessels fishing for any species covered under the NMFS HMS management plan. These include all of the tunas listed above, billfish, swordfish, and most pelagic sharks. The HMS permits were the first federal multi-species recreational fishing permits required in the U.S. Although not used in this study, it is worth mentioning another permit requirement for large pelagic species that went into effect in 2004. NMFS now requires owners of commercial vessels and/or charter/headboats to obtain permits to fish for dolphin and wahoo. Private boat recreational anglers are currently not required to obtain a dolphin-wahoo permit. Dolphin-wahoo permits are administered by the NMFS Southeast Regional Office whereas the HMS/Atlantic Tunas permits are administered by the Northeast Regional Office.

RESULTS

The total number of Angling category permits sold to vessels in the Gulf of Mexico and Caribbean increased each year from 1999 to 2004, before decreasing in 2005 (Figure 1). The largest single year increase was in 2003, the year the Angling category permit was converted from a tuna only permit to an HMS permit covering tunas, billfish, swordfish, and sharks.

The total number of Charter/Headboat category permits sold to vessels in the Gulf of Mexico and Caribbean increased each year from 2000 to 2003, followed by a declining trend from 2003-2005 (Figure 2). The largest single year increase was in 2001, the year the Charter/Headboat permit was converted from a tuna only permit to an HMS permit covering tunas, billfish, swordfish, and sharks. The total number of Atlantic Tunas General category permits sold to vessels in the Gulf of Mexico and Caribbean increased each year from 1999-2002 and then decreased each year from 2002-2005 (Figure 3).

Turnover (or alternatively persistence) in the large pelagics permit databases over time was explored. Vessel turnover, not participant turnover, was analyzed since it is the vessel that is permitted, not the captain or owner. HMS and Atlantic Tunas permit numbers are supposed to stay with the vessel throughout its life in the fishery even if the vessel is sold and/or renamed. However, this does not always happen which makes it difficult to track vessels that are sold and renamed but remain in the fishery. Vessel turnover can be overestimated if vessels for which permits are not renewed are actually remaining in the fishery and appear in the permit database with all new information. The prevalence of owners with multiple vessels permitted in a given category from 1999-2005 was examined as an indicator of the prevalence of boats changing ownership within the fishery. In the Angling category from 1999 to 2005 8,376 permits were issued to 7,801 owners with vessels in the Gulf of Mexico and Caribbean. Ninety-five percent off these owners only had one Angling category vessel permitted between 1999 and 2005. Similarly, 94% and 96% of Charter/Headboat and General category vessel owners, respectively, only had one vessel in that category permitted from 1999-2005. Thus, within the time frame analyzed there was relatively little vessel switching amongst owners within a permit category. The variable "vessel I.D." (representing either state registration or Coast Guard number) was also used to track vessels that may have been sold to new owners entering the fishery, and given new permit numbers within the same permit category database. While the vessel I.D. field contained many missing values and some obvious permit holder entry errors, initial investigation suggested that very few vessels were duplicated in the database, i.e. same vessel I.D., different permit number. These results indicate that if turnover rates were overestimated as a result of vessels switching hands, this overestimation was minimal. This also suggests that the analysis of vessel turnover could be used as an indicator and close approximation of vessel owner turnover in the fishery.

Newly permitted vessels were compared to renewals as an indicator of vessel turnover in the fishery from year to year. Newly permitted vessels were defined as any vessel that appeared in the 1999-2005 database, for that particular category, for the first time that year. Renewed vessels were those that appeared in the database in any prior year from 1999-2005 (not necessarily the previous year). Permit status for 1999 is defined as 'unknown' (Figures 1, 2, and 3) since historical databases prior to 1999 were not available to determine renewal rates. The management season for tunas changed in 1999 from a calendar year (Jan.-Dec.) to a June though May (following year) season. Since some vessels may have fished with 1999 permits in 2000 during this transition period it was difficult to determine definitively which vessels were "newly permitted" in

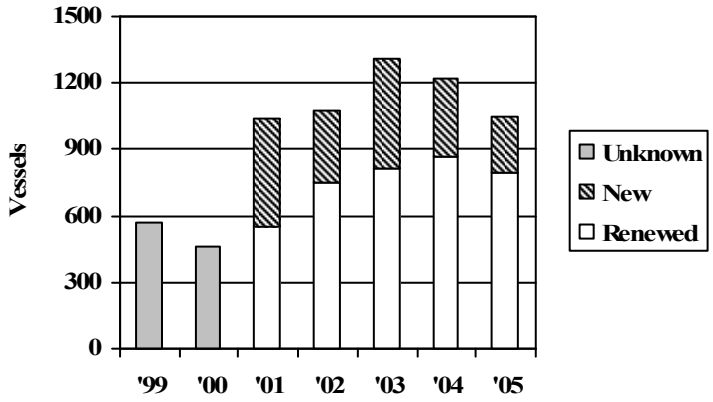

Figure 2. Number of Charter/Headboat category Atlantic Tuna and HMS vessel permits sold in the Gulf of Mexico and Caribbean from 1999 to 2005 (Atlantic Tuna 1999-2000, HMS 2003-2005).

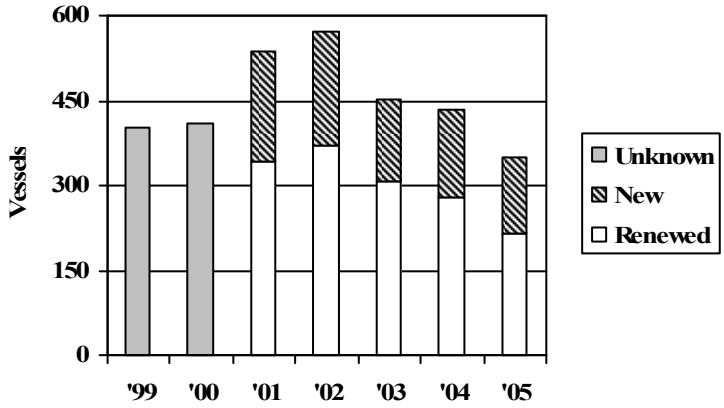

Figure 3. Number of General category Atlantic Tuna vessel permits sold in the Gulf of Mexico and Caribbean from 1999 to 2005.

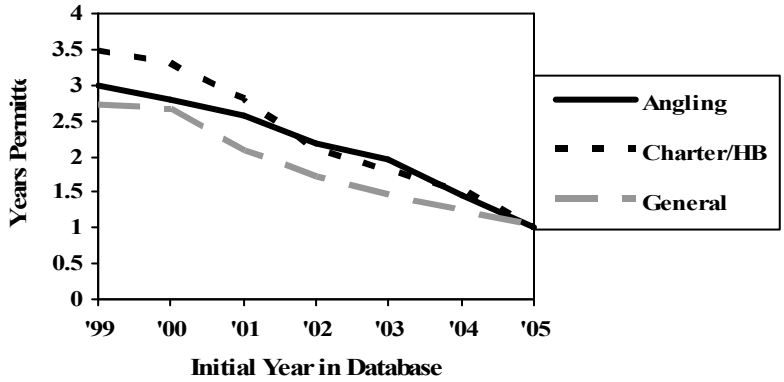

Figure 4. Average number of years each Gulf of Mexico and Caribbean vessel was permitted (between 1999 and 2005) within permit category by initial year in database.

2000. For this reason the year 2000 is also defined as 'unknown' in terms of renewal status.

The proportion of newly permitted Angling category vessels in 2003 in the Gulf of Mexico and Caribbean was 60% compared to 36% newly permitted vessel in 2002 (Figure 1). The decline in Angling permits from 2004 to 2005 was due to a combination of fewer newly permitted vessels and a lower renewal rate (68% versus 56%). Similarly, a large proportion (47%) of the HMS Charter/ Headboat permits issued in 2001 (first year of the HMS permit) were issued to vessels that did not hold Atlantic Tuna Charter/Headboat permits in 1999 or 2000 (Figure 2). The proportion of newly permitted Charter/Headboat vessels from 2002-2005 ranged from 25% to 37%. The decline from 2003 to 2004 in Charter/Headboat permits issued was also due to a combination of fewer newly permitted vessels and a lower renewal rate (76% versus 66%). The ratio of renewed vessels to newly permitted vessels in the General category is fairly constant from 2001-2005, ranging from 1.6:1 to 2.1:1 (renewed permits:new permits; Figure 3). The number of General category permits issued in the Gulf of Mexico and Caribbean dropped by 39% between 2002 and 2005. In 2002 69% of General category permit holders renewed and about 200 new permits were issued whereas in 2005 only 50% renewed and 133 new permits were issued.

Average number of years permitted was analyzed as another measure of persistence (or alternatively turnover) in the fishery. Figure 4 shows (by permit category) the average number of years (Y-axis) vessels were permitted from 1999 through 2005 versus initial year vessel appeared in database (X-axis). Years permitted are not necessarily sequential as a vessel could have dropped out for one or more years and return to the fishery in a subsequent year. For example, vessels initially in the Charter/Headboat database in 1999 were permitted, on average, 3.5 years between 1999 and 2005. This compares to 3 years average for vessels initially in the Angling database in 1999, and 2.7 years for vessels initially in the General category database in 1999. In general, for vessels initially in the database between 1999 and 2001, Charter/Headboat vessels persist longer (i.e., less turnover) compared to Angling category vessels. For vessels added to the fishery in more recent years (2002-2005) there is no apparent difference in average years permitted between Charter/Headboat and Angling categories. From 1999-2004 General category vessels appear to have greater turnover, (i.e., fewer years in the fishery on average), compared to the other two categories. Table 2 shows the frequency distribution of number of years permitted from 1999 to 2005 for 2005 Gulf of Mexico and Caribbean permit holders. Only 18% of vessels permitted in the Angling category in 2005 had four years or more in the permit database. This reflects the large number of vessels that first purchased the Angling permit in 2003 when it switched to the more inclusive HMS permit. By comparison, 39% of Charter/Headboat category vessels permitted in 2005 had four years or more in the permit database, and 40.5% of General category vessels had four years or more in the permit database.

The prevalence of permit category switching was explored. Owners of vessels that target large pelagics must decide which permit category to fish in each year. Vessels may switch permit categories from one year to the next but only one permit category may be assigned to a vessel per year (e-CFR 2006). The decision of which category to fish in may be based on several factors including whether or not the vessel takes paying passengers, what species are targeted, if any tunas will be sold, and recent market prices for tuna. Most large pelagics vessels that operate as purely private, recreational boats (i.e., do not take paying passengers) and do not sell their catch will have an Angling permit. Vessel owners who want the ability to sell their tuna catch will fish in the General category. Although the General category is considered a commercial category, not all vessels owners with this permit would necessarily consider themselves commercial fisherman. Some otherwise recreational anglers opt for the commercial permit to offset operating costs by selling tuna. General category vessels are allowed to fish under recreational regulations for tunas, sharks, swordfish and/or billfish only when fishing in a

Table 2. Frequency distribution of the number of years permitted within category from 1999 to 2005 for 2005 permit holders.

	Angling	Charter/Headboat	General
7 years	1.3%	2.8%	3.1%
6 years	5	12.2	16.7
5 years	5.6	14.2	8.6
4 years	6.2	9.8	12.1
3 years	21.9	15.8	7.4
2 years	24.2	20.5	13.6
1 year	35.8	24.7	38.5

federally registered HMS tournament (e-CFR 2006). Vessels permitted in the HMS Charter/Headboat category are given the option of either fishing commercially (under commercial regulations) and selling their catch or fishing recreationally under recreational regulations, including no sale of fish. Charter/Headboat permit holders must chose how they are going to fish for a particular trip (i.e., they cannot be both commercial and recreational on the same trip). Some private boat (not for-hire) anglers may prefer to fish in this category for the flexibility of being allowed to fish either recreationally or commercially. Vessels fishing under the HMS Charter/Headboat category must have a valid Merchant Marine License or Uninspected Passenger Vessel License.

Category switching prevalence was positively correlated to the number of years the vessel was permitted (in any category) (Figure 5). Nearly one-half of the vessels permitted every year from 1999-2005 (7 years) switched permit categories at some point. Category switching was also analyzed for vessels that initially appeared in at least one of the three permit databases between 1999 and 2001. Sixteen percent of these vessels were permitted in more than one category from 1999-2005: 8% in Angling and Charter/Headboat; 5% in Angling and General; 2% in Charter/Headboat and General; and 1% all three categories.

Vessel length for Gulf of Mexico and Caribbean large pelagic vessels was analyzed by permit category. Figure 6 shows the frequency distribution of vessel length category for all vessels permitted between 1999 and 2005. Angling category vessels were, on average, smaller than Charter/Headboat vessels. Nearly 70% of Angling category vessels were smaller than 35 feet, while only 47% of Charter/Headboat vessels were less than 35 feet. The General category had the largest proportion of vessels greater than 54 feet (12%) and the largest proportion of vessels under 25 feet (27%) among all categories. This highlights the diverse make-up of the General category which includes both large and small-scale commercial vessels, subsistence ves-

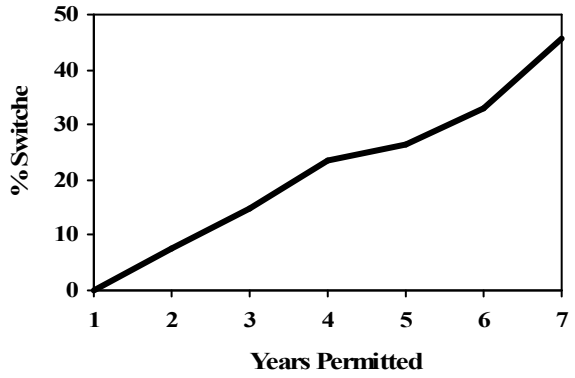

Figure 5. Percent of Gulf of Mexico and Caribbean vessels that switched between permit categories (Angling, Charter/Headboat, General) at least once from 1999-2005 by number of years permitted.

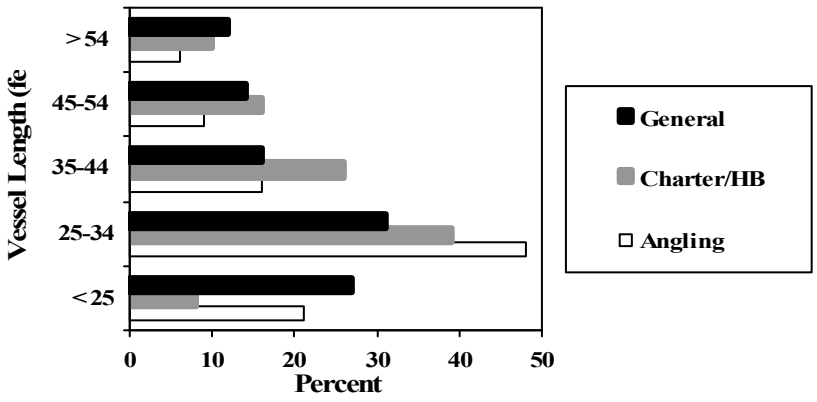

Figure 6. Frequency distribution of vessel length for Caribbean and Gulf of Mexico vessels permitted from 1999-2005, by permit category.

sels, and recreational vessels. More than one-half of the General category vessels under 25 feet had principle ports in Puerto Rico, and 71% of the General category vessels larger than 54 feet had principle ports in Florida. Florida vessels were, on average, larger than Puerto Rico vessels for all three categories. More than 70% of Puerto Rico's Charter/Headboat permitted vessels (1999-2005 inclusive) were under 35 feet long compared to only 43% under 35 feet in Florida.

The maps in Figure 7 show the distribution of 2005 Gulf and Caribbean permits by principle port county as

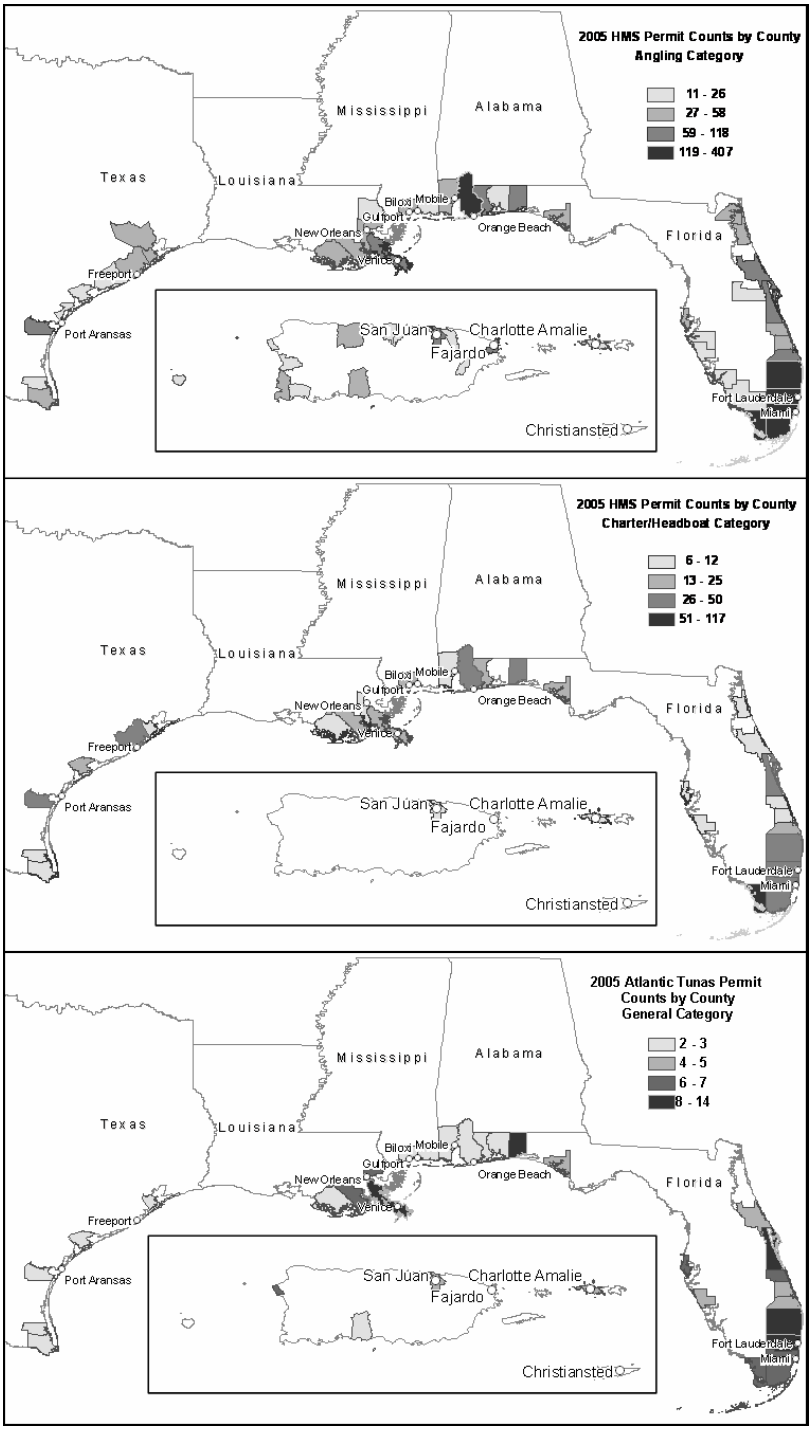

Figure 7. Maps showing distribution of 2005 permits sold in the Gulf of Mexico and Caribbean by principle port county for each permit category: HMS Angling, HMS Charter/Headboat, and Atlantic Tunas General. Note: Not all counties with permits sold are shown (e.g., counties with less than 11 Angling category permits not indicated on map).

indicated by the vessel owner on his/her permit application. Florida had by far the most HMS Angling category vessels (3,238) in 2005, followed by Puerto Rico (899), Louisiana (602), and Texas (586). Areas of concentration for HMS Angling category permitted vessels are Puerto Rico (San Juan and Fajardo), southeast Florida (Palm Beach, Broward, and Dade counties), Florida Keys, Florida Panhandle (Escambia and Okaloosa counties), and Orange Beach, Alabama. Other notable areas include Venice, Louisiana and Port Aransas, Texas. Florida had the most HMS Charter/Headboat vessels in 2005 (632) followed by Texas (168). Areas of concentration for HMS Charter/Headboat category permitted vessels are the Florida Keys, southeast Florida (Palm Beach, Broward, and Dade counties), Florida Panhandle (Okaloosa county), Orange Beach, Alabama, Port Aransas and Freeport, Texas. Florida also had the most Atlantic Tunas General category vessels in 2005 amongst Gulf of Mexico and Caribbean states/territories. Areas of concentration for Atlantic Tunas General category permitted vessels are east Florida (Palm Beach, Broward, and Brevard counties), Florida Panhandle (Okaloosa county), and Venice, Louisiana.

For most states/territories the trend in Angling category permits from 1999-2005 was similar to the overall trend for the Gulf of Mexico and Caribbean: i.e., general increasing trend from 1999-2004 with a slight decline in 2005 (Figures 8 & 9). Louisiana showed a sharper decline in 2005 compared to other states, presumably due to the major storm events. The sharp increase in 2003 in Florida and Puerto Rico reflects the switch from the Atlantic Tunas permit to the more inclusive Highly Migratory Species (HMS) permit required for tunas, sharks, billfish and swordfish. MRFSS 2003 data on primary target species were analyzed for Florida and Puerto Rico. In Florida, out of 14,438 anglers interviewed in the private/rental boat mode in 2003, 244 (1.7%) indicated their primary target species for that trip was one covered by the HMS permit. More than one-half (59%) of these anglers were primarily

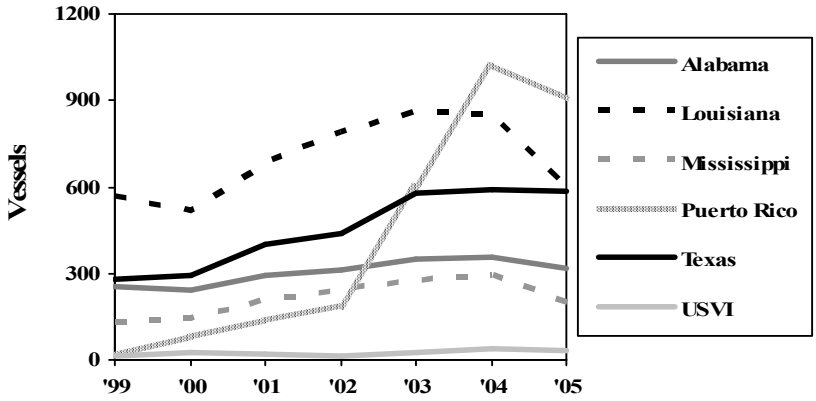

Figure 8. Number of Angling category Atlantic Tuna and HMS vessel permits sold by state/territory from 1999 to 2005 (Atlantic Tuna 1999-2002, HMS 2003-2005).

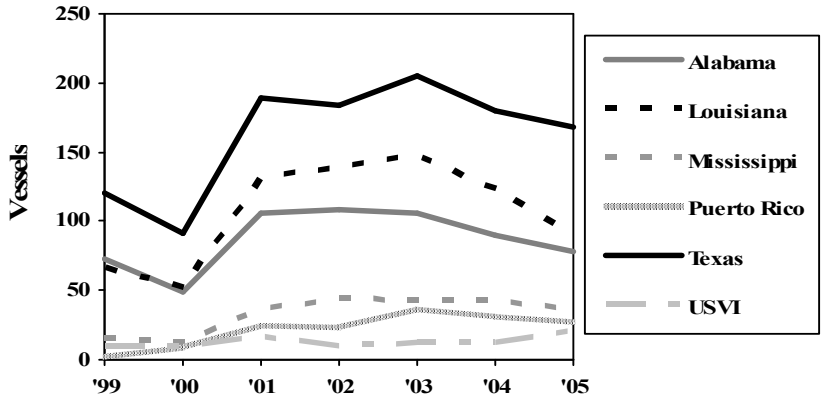

Figure 9. Number of Angling and Charter/Headboat category Atlantic Tuna and HMS vessel permits sold to Florida vessels from 1999 to 2005.

targeting sailfish and more than one-third (36%) were primarily targeting one or more species of shark. Only 4 out of the 244 indicated targeting tuna (i.e., yellowfin) as their primary target. In Puerto Rico, out of 1,080 anglers interviewed in the private/rental boat mode in 2003, 284 (26.3%) indicated their primary target species was one covered by the HMS permit. Virtually all of these anglers (98%) said blue marlin was their primary target species. It should be noted that the MRFSS does not interview at fishing tournament sites. Therefore, the proportion of angler trips targeting species frequently targeted during tournaments will likely be higher than presented here.

Trends in the number of Charter/Headboat permits issued by state are shown in Figure 10. The sharp increase in 2001 in all five Gulf of Mexico states reflects the switch from the Atlantic Tunas permit to the more inclusive HMS permit. In the Gulf states (excluding Texas), out of 5,654 anglers interviewed by the MRFSS in the charter/headboat mode in 2001, 797 (14%) indicated their primary target species for that trip was one covered by the HMS permit. About three-fourths (74%) of these 797 angler trips were primarily targeting sailfish (all in Florida), 20% were targeting one or more species of tuna, and 4% were targeting one or more species of shark. HMS Charter/Headboat permits sold in Florida fluctuated widely from year to year. Alabama, Louisiana, and Texas showed declining trends in HMS Charter/Headboat permits from 2003 to 2005.

DISCUSSION

This exploratory study highlights some important trends, demographic changes, and characteristics of the rod and reel large pelagic fisheries in the Gulf of Mexico and Caribbean. Trends in large pelagic permit sales over time may be indicative of important demographic shifts, socioeconomic changes, and behavioral and attitudinal changes among boat captains and recreational anglers. Large pelagic fishing requires larger investments of time and money compared to most other types of saltwater fishing. Costs associated with vessels, gear, bait, tackle, ice, boat fuel, and transit time to and from fishing sites are all typically greater for offshore fishing trips (Mateo et al. 2000, Ditton and Stoll 2000, Bohnsack et al. 2002). In many cases the risks associated with offshore large pelagic fishing are also heightened. Therefore, the decision of vessel owners/captains to fish for large pelagics in any given year may involve weighing multiple socioeconomic factors. In addition to cost, owners and captains may also consider resource status (status of stocks), management regulations, past years fishing success, anticipated business success (e.g. booked charters), and weather (past and/or predicted) in deciding whether to fish for large pelagics.

Principle port was used as the determinate of vessel location in this study. The actually number of permitted vessels in any given state/county/city will vary seasonally as some vessels change ports during the course of a year. Captains pursuing large pelagics may change ports in response to weather, tourism, or seasonal changes in availability/location of highly migratory fish stocks. Transient large pelagic charterboats from northern states often move south in the winter (NMFS 2006). Likewise, vessels with principle ports in Florida and Caribbean may move north in the summer in pursuit of bluefin tuna and other pelagics. The U.S. Caribbean is one of the most important locations in the world for blue marlin fishing (Friedlander 1995). Mateo et al. (2000) found that about one-fourth of the St. Thomas offshore recreational fishing fleet was vessels from mainland U.S. that visit during the marlin season (June to October). Therefore, during certain times of year the actual number of HMS permitted vessels fishing out of USVI ports may be considerably higher than the number of permitted vessels with principle ports in the USVI. The number of vessels fishing for large pelagics may also be underestimated in this study due to vessels fishing illegally without a permit. Additional survey research is needed to address seasonal movement patterns of permitted vessels in the fishery and prevalence of non-permitted vessels targeting large pelagics.

All three permit categories showed an initial increas-

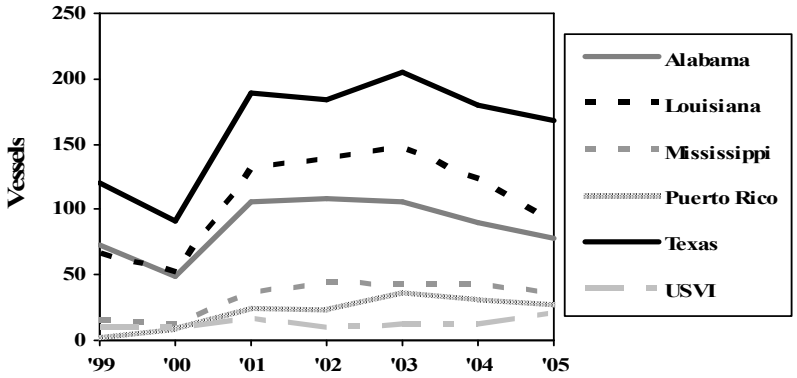

Figure 10. Number of Charter/Headboat category Atlantic Tuna and HMS vessel permits sold by state/territory from 1999 to 2005 (Atlantic Tuna 1999-2002, HMS 2003-2005).

ing trend in permits issued followed by a decrease over the time series 1999-2005. Marked increases in Angling and Charter/Headboat permits coinciding with implementation of HMS permits were likely driven by Florida vessels targeting sailfish and Puerto Rico vessels targeting blue marlin. Florida, with nearly four times the total population size of Puerto Rico, also had about four times as many Angling category permitted vessels as did Puerto Rico in 2005. However, relative to other types of recreational saltwater fishing, large pelagic fishing in Puerto Rico appears to be a more common pursuit (i.e., less of a "rare event") than it does in Florida or the other Gulf states. More than one in four MRFSS intercepted angler trips in Puerto Rico targeted blue marlin in 2003. While decreases in permits sold in the last few years can be due to several factors, major weather events (i.e., Katrina and several others) and rising fuel costs are probable causes. The longest continuous decline (and largest proportional decrease) in permits issued was in the Atlantic Tunas General category (nearly 40% from 2002-2005). The decrease form 2002 to 2003 may have been indirectly related to the change in the Angling permit species coverage. Prior to 2003 a General category vessel could still fish recreationally for sharks, billfish, and swordfish. Starting in 2003 General category vessels could no longer fish recreationally for these species, unless participating in a federally registered fishing tournament. This change, which forced vessel owners to chose between the commercial General and the recreational Angling categories, may have contributed to the drop in General category permits in 2003. However, General category permits in the Gulf of Mexico and Caribbean continued to decline from 2003-2005 suggesting these declines may be part of a long-term trend rather than a single year anomaly.

Turnover in a fishery can be evaluated in terms of fishery participant (e.g., vessel owners, captains, mates, anglers) turnover or vessel turnover. Vessel turnover could be more directly evaluated in this study since large pelagics permits are vessel-based, not owner/captain based. However, since about 95% of vessel owners in the permit databases owned only one vessel, vessel turnover rates were presumed to be a good indicator of vessel owner turnover. Vessel turnover rates for Gulf of Mexico and Caribbean rod and reel large pelagic fisheries appear to be consistently high over the time period analyzed. For all categories and years (1999-2005) between 30-40% of permits in any given year were newly issued (only exception Charter/ Headboat 2005, 25% new). These results suggest that many captains may try their hand at large pelagic fishing for a few years before dropping out of the fishery. Considering the skill level and specialized gear needed to catch large pelagics, the majority of the large pelagic rod and reel catch may be caught by a relatively small proportion of successful permit holders. More in-depth studies are needed to explain the trends presented here, including motivations for entering and leaving the fishery and for permit category switching. Additional surveys can also be designed to segment permit holders into meaningful subgroups for analysis based on catch rates, skill level, avidity, target species and other relevant characteristics.

The history of large pelagic fishing permits has been one of expanding scope in terms of fishery sector and species covered. Federal large pelagic permits, initially only required for commercial bluefin tuna vessels, are now required for commercial, for-hire, and recreational vessels targeting bluefin tuna, BAYS tunas, sharks, billfish, swordfish, dolphin, or wahoo. With this expanding scope the sampling frame of vessels targeting large pelagics becomes more robust as does the ability to monitor catch, directed effort and other important characteristics associated with these fisheries. The results of this study can be used by fisheries managers to gain a better understanding of the Gulf of Mexico and Caribbean large pelagic fisheries and in the design and implementation of additional survey research on HMS and Atlantic Tunas permit holders in this region.

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