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ANNUAL REPORT OF THE HAWAII-BASED LONGLINE FISHERY FOR 1995

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PREFACE

The Western Pacific Regional Fishery Management Council (WPRFMC), created by the Magnuson Fishery Conservation and Management Act of 1976, developed the Fishery Management Plan for pelagic species which was first implemented by the National Marine Fisheries Service (NMFS), NOAA, on March 23, 1987. This plan regulates the U.S. domestic fisheries for tuna, swordfish, marlin, and other pelagic species in the region.

The Fishery Monitoring and Economics Program (FMEP) of the Honolulu Laboratory, Southwest Fisheries Science Center, NMFS, NOAA, collects biological and economic information from U.S. domestic longline fishing vessels permitted to fish within the western Pacific U.S. Exclusive Economic Zones. Only information on federally permitted domestic longline vessels landing their catches in or based in Hawaii is presented in this report.

CONTENTS

INTRODUCTION

The Hawaii-based longline fishery has been the largest domestic commercial fishery in Hawaii since 1988 (Pooley, 1989; Boggs and Ito, 1993, Western Pacific Regional Fishery Management Council 1996). Broadbill swordfish (*Xiphias gladius*) and tunas (*Thunnus* spp.) dominate the landings but a variety of other pelagic species (Table 1) are also landed. Much of the longline effort occurs within Hawaiian waters but fishing also extends far beyond the Exclusive Economic Zone (EEZ) into international waters. Although longline activity was somewhat subdued in 1995 compared to the rapid expansion in the late 1980s and early 1990s, the fishery continues to experience change. Some of the 1995 changes included outmigration of many U.S. east coast swordfish longliners and some U.S. Gulf of Mexico (Gulf) longliners, increased activity of the Gulf longliners in targeting swordfish, and purchase of a few Gulf vessels by local tuna longliners for catching bigeye tuna (*Thunnus obesus*), yellowfin tuna (*T. albacares*), and albacore (*T. alalunga*).

The Hawaii-based longline fishery is the largest source of fresh pelagic fish in Hawaii and caters to local, U.S. domestic, and international markets (Pooley, 1993). Recent developments in the Hawaii-based longline fleet are discussed in this report. A description of data sources, data management procedures, and shortcomings of the data is also included. Nonconfidential data summaries on fleet activity, effort, catch, catch-per-unit-effort (CPUE), landings, market, size of catch, and fishery interactions with endangered and protected species are also covered. This report updates longline statistics for the entire period covered by the Federal longline logbook program (1991-95) and shoreside sampling for the longline fishery (1986-95).

RECENT DEVELOPMENTS

Some of the issues concerning the longline fishing industry and longline data in 1995 were: 1) a proposal to fund the observer program by passing the cost on to longline fishermen, 2) an increased number of longline vessels with vessel monitoring systems (VMS), 3) a revised logbook format, and 4) a few longline vessels contracted to transship shark fins from foreign vessels.

Longline logbook data and observer data from 1991 to 1993 indicated a potentially significant level of sea turtle interactions (or "take"). In response, the NMFS Southwest Region (SWR) instituted a mandatory observer program in February 1994. Problems of funding the observer program arose in 1995. A proposal to institute fees on longline vessels was presented at the 87th Western Pacific Regional Fishery Management Council

(Council) meeting in August 1995; however, this proposal was met with strong opposition from the longline fishing community. A study of the cost-earnings on the Hawaii-based longline fleet (Hamilton, et al. 1996) found that although "the Hawaii longline fleet averaged a positive net return from their 1993 operations, the level of profits varied substantially between various groups of vessels". Also, the group of longliners with the highest net return had the largest catches and the lowest relative costs. Consequently, the Council has gone on record saying that the cost of paying for observers "would be a unfair burden on the fishermen." Observer funding remains an important issue for NMFS.

Approximately 113 longline vessels were equipped with a electronic vessel monitoring system (VMS) by the middle of 1995. VMS is used by the U.S. Coast Guard and NMFS Enforcement to determine if longline vessels were fishing in areas closed to longline fishing around the main Hawaiian Islands and the Northwestern Hawaiian Islands. Longline vessels operating within the Hawaii Exclusive Economic Zone (EEZ) are tracked by VMS, which also serves as an additional means of locating a vessel in distress. The system was used to identify a few incidents of longline fishing activity within closed areas in 1995 and has proven to be an effective deterrent to longline fishing in prohibited areas. The VMS system will continue through 1996 and 1997; continuation of the program is an important issue.

The Federal longline logbook format was revised in 1995 to include additional information on fishing operations, oceanographic observations, and more pelagic and protected species. Target species are now entered on a set level by fishermen and may not be consistent with the categorization of target species on a trip level. A category for finned sharks was also added. Diagrams of Pelagic Management Unit Species (PMUS) and protected species are also printed on the inside flap of each logbook to help the fishermen properly identify catch. Distribution of the new logbooks began in January 1995, and by the end of the first quarter most of the data gathered were in the new format. As a result, there are some issues pertaining to interpretation of data prior to 1995. These are explained later in the report.

Three Hawaii-based longline vessels with limited entry permits were contracted to receive shark fins from foreign longline vessels outside of the EEZ in 1995, up from two vessels in 1993. Although no vessels transship shark fins exclusively, transshipment activity has increased. Transshipping operations are appealing because the income from the contract is guaranteed and the risk of poor catches, as well as the uncertainty of receiving poor prices, is avoided. Also, the transshipment operation usually lasts less than a week and requires fewer crew members than longline fishing operations.

DATA SOURCES

NMFS Fishery Monitoring and Economics Program (FMEP) relied exclusively on shoreside sampling for longline vessel activity and landings estimates from 1987 to 1991 (Ito, 1992). Subsequently, a Federal logbook system for domestic longliners operating in the western Pacific region was implemented in November 1990. Therefore, the time span covered in some summaries in this report may differ according to the source of data. Logbook collection and summary procedures are documented in Dollar and Yoshimoto (1991).

Data sources, data formats, and estimation procedures have been updated throughout 1987-95. The basic data have also been revised because of corrections to variable values, receipt of logbooks which were not available to FMEP in previous periods, and some previously overlooked data errors. Therefore, summaries in this report supersede previous summaries. These updates and revisions to the data bases have improved the accuracy of the data and increased the level of detail in describing the Hawaii-based longline fishery.

Longline trips are categorized into one of three trip types according to species targeted: 1) swordfish, 2) tuna, or 3) mixed (targeting both swordfish and tuna). Target species information is obtained by FMEP personnel from dockside interviews with a vessel's captain or deck boss. When neither person is available for an interview or the log sheets are mailed in, trip type is determined by subjectively evaluating logbook set times, number of hooks and light sticks, area fished, duration of trip, catch composition, and previous history of trip types for that particular vessel. It is assumed to be a swordfish trip when gear was fished overnight, when light sticks were attached to 50% or more of the branch lines, when the vessel fished in areas known for high concentrations of swordfish, when the duration of the trip was more than 3 weeks, and when swordfish comprised a significant percentage of the catch. The criteria for targeting mixed species (both swordfish and tunas) is similar, except that mixed trips used less light sticks per day fished, trips were usually shorter, and swordfish was not as predominant in the catch. Targeting of tuna is presumed when gear was set in the morning and retrieved in the afternoon, when no light sticks were used, when the vessel fished in areas known for high concentrations of tuna, and when the trip lasted less than 3 weeks, and when the majority of the catch was tuna. However, exceptions to these generalizations were found in the data. There were instances of techniques typically used to target swordfish or mixed species being used successfully to fish for tunas.

Mean weight of fish, weight-frequency distribution, average fish prices, and revenue information are based on NMFS FMEP shoreside sampling data. The weight of individual fish landed

was recorded as nominal weight. The nominal weight was raised to an estimated whole (round) weight if loss occurred during processing or from predators. Post-1991 landing estimates are based on the product of the average whole weight for each species from shoreside sampling and the corresponding number of fish kept as summarized from longline logbooks. In calculating mean weight and producing weight-frequency histograms, two problems were encountered. First, there was a substantial difference in mean weight of fish caught between the different trip types. Second, the number of fish sampled for each trip type was not in proportion to the number of fish landed from the logbook summaries for each trip type. Therefore, fish sampled for each trip type were "weighted" to represent the same proportion of fish for each trip type as summarized in the logbook. Revenue is estimated as the product of average prices for individual species from the shoreside sampling and estimated landings.

LONGLINE VESSEL OPERATIONS

There were 164 vessels registered with Federal limited entry permits in 1995. The following is a summary of those permits.

Active:	110
Inactive:	37
Permit but no vessel:	17

Long-term vessel monitoring showed a rapid increase in the number of longline vessels from 1987 to 1991 and a period of stability during from 1992 to 1994 (Fig. 1). The number of active longline vessels decreased from 124 in 1994 to 110 in 1995.[1] Thirty-seven longline vessels were not actively using longline gear (they may have been in other fisheries) and 17 limited entry permits were not attached to any longline vessel. Vessel turnover was quite prevalent in 1995. Twenty-seven vessels which fished in 1994 did not fish in 1995. Twelve vessels, which were either new to the longline fishery or returned after a layoff, began or resumed fishing in 1995. One longline vessel sank in 1995.

Hawaii-based longline vessels were categorized by length into three classes: small vessels (<56 ft), medium vessels (56-74 ft), and large vessels (>74 ft). The number of vessels for all different size classes was down in 1995 with 21 small vessels, 53 medium vessels, and 36 large vessels. This was 2 fewer small vessels, 6 fewer medium vessels, and 7 fewer large vessels than in 1994.

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[1]Date of landing (DOL) is the date when a longline trip is concluded. Summaries on number of vessels, number of trips, and average number of days fished per trip are based on date of landing.

Longline Vessel Trip Activity

The number of trips made by Hawaii-based longliners increased slightly to 1,125 trips in 1995 (Table 2). Although the number of trips changed little change during the past 4 years, targeting strategy by longliners has changed substantially. Swordfish trip activity declined slightly in 1994 but the drop in 1995 was the most substantial decrease observed in this relatively new segment of the Hawaii-based longline fishery. The number of trips targeting swordfish declined 56% to only 136 trips during 1995. The dramatic decline is attributed to the exodus of swordfish vessels in 1994 and the remaining swordfish longline vessels redirecting their fishing activity toward targeting tunas. Tuna trip activity has increased consistently from 1992, up 20% to a high of 682 trips in 1995. Some increased tuna trip activity in 1995 resulted from Gulf longline vessels being purchased by longliners and refitted to target tunas. Mixed trips increased to 307 during 1995, up from a low of 228 trips in 1994. This is the first increase in the number of mixed trips in 5 years.

Longline trip activity is always high during the first, second, and fourth quarters (Fig. 2) because of catch rate for bigeye tuna and swordfish near the Hawaiian Archipelago. Fishermen elect to target swordfish during the second quarter when swordfish concentrations are nearer the Hawaiian Islands than during the rest of the year. Trip activity is lowest in the third quarter due primarily to poor catch rates for swordfish and tuna. Consequently, vessel owners and operators usually schedule repair, dry-dock, and annual maintenance during this time. Longline trip activity increases during the fourth quarter when vessels down for maintenance begin fishing again. A major motivating factor for the increased activity during this time of year is the high demand for sashimi during the holiday season. This high level of activity usually carries over into the first quarter.

Average Number of Days Fished

The average days fished per trip (fleet mean) increased by almost a day during 1995 (Table 2) with all three trip types increasing by about a day and a half. Swordfish trips and tuna trips have shown a steady increase in number of days fished since 1991. The average for mixed trips peaked in 1995. The Gulf longliners which were refitted to target tunas replaced some smaller sampan-type tuna longline vessels and, therefore, have increased the duration of tuna trips.

FISHING EFFORT

Number of Sets

Fishing effort[2] was summarized by the number of days fished (equivalent to the number of sets) and by the number of hooks set. Number of days fished peaked in 1991, reached a low in 1994, and increased during 1995 (Table 3). The increase in days fished by tuna and mixed trip types helped offset the decline in number of days fished by swordfish trips.

Most of the days fished within the Hawaii EEZ (main Hawaiian Island EEZ and Northwestern Hawaiian Island EEZ combined) is concentrated near the Main Hawaiian Islands (MHI). Number of days fished in the MHI EEZ has increased consistently from 1992 but was still below its peak in 1991. The number of sets outside the EEZ increased by 24% in 1995 but was well below the number days fished in 1992 and 1993. The shift from fishing effort outside the EEZ to within the Hawaii EEZ is due to decreasing effort targeting swordfish and increasing effort targeting tunas. Very little effort was expended in the EEZ of U.S. possessions (i.e. Baker Island, Howland Island, Kingman Reef, Jarvis Island, Johnston Atoll, Palmyra Island, and Wake Island).

Number of Hooks Set

The number of hooks fluctuated in a narrow range during 1991-94 but jumped to 14.2 million hooks in 1995 (Table 4). Increased numbers of hooks set by tuna trips and mixed trips were responsible for the jump. Hooks set by swordfish trips in 1995 decreased over 50% from those set in 1994. The hooks set by tuna and mixed trips increased by 49% and 79% in 1995.

During 1995, hooks set inside of the Hawaii EEZ increased by 1.4 million hooks due to the increased effort in the MHI EEZ. The number of hooks outside the EEZ increased by an identical amount, and the number set in the EEZ of U.S. possessions was relatively low.

Because of the increasing proportion of tuna-targeted sets, the average number of hooks set per day fished reached a high of 1,210 in 1995 (Table 5). Tuna trips had the highest average number of hooks set--1,470 hooks per day--as well has the most noticeable and consistent increase throughout 1991-95. Mixed trip sets had the next highest average number of hooks, followed by swordfish trips.

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[2]These units of effort are based on date of haul; i.e., the actual date of fishing operations. This is to ensure that these detailed measurements are summarized within the actual time period and not included in a time period which the operations of a trip are concluded (i.e., date of landing).

CATCH

Longline catch was grouped into three major categories: billfish, tunas, and miscellaneous pelagic species. The shift in effort toward tunas resulted in the catch of many pelagic species reaching all time highs in 1995 (Table 6), with the exception of swordfish. Swordfish catch dropped to its lowest level in 5 years, down from a peak in 1993. The decrease in swordfish catch is related to less longline effort directed toward swordfish. Striped marlin catch doubled in 1995 but was still less than the large catch experienced in 1991. Striped marlin catch peaked during alternate years. Blue marlin catch also increased substantially in 1995--up by 90%.

Record catches of the tunas was evident in 1995. Bigeye tuna increased by 26% in 1995 and was at it highest level in the 5-year period. Yellowfin tuna catch jumped by 76%, and albacore catch also showed a substantial increase of 48%, continuing the steadiest increase of all tunas for the 5-year period ending in 1995.

A record number of mahimahi, ono, and moonfish were caught by longliners in 1995. Mahimahi catch has risen by 84% since 1993. Although ono catch is relatively smaller than other pelagics species, it has increased the most--169%--after fluctuating during 1991-95 and peaking in 1991, 1993, and 1995. Moonfish catch also peaked in 1995, and even though moonfish catch is also relatively small, it has continuously increased throughout the 5-year period.

Sharks have consistently been the largest component of the overall longline catch since 1991. However, shark catch has continued to decline since 1993. This decline is related to the reduction in swordfish effort. Swordfish trips were responsible for most of the shark catch, predominantly blue sharks (Table 7). Blue sharks made up over 90% of the sharks caught from 1991 to 1995.

Catch Composition

The composition of the catch was considerably different for each of the trip types (Fig. 3). After the large component of sharks which made up almost half of swordfish trip catch, swordfish was next at 22% of the catch. Mahimahi and albacore were also large catch components while bigeye tuna and marlins made up on a small proportion. In contrast, tunas made up almost half of the tuna trip catch, with the principal components being bigeye tuna and albacore. Marlins and mahimahi were the next largest categories. Composition of the catch for mixed trips shows sharks as the largest component, with mahimahi next, followed by swordfish and bigeye tuna.

A marked difference in catch by area was also apparent (Table 8). Catches of marlin, bigeye tuna, yellowfin tuna, mahimahi, and moonfish were largest around the MHI EEZ. Quite noticeable has been the considerable increase of albacore and mahimahi catch inside the MHI EEZ since 1993. Although a 50-mile area closure around the NWHI islands is enforced, the open area is still productive for swordfish. With the exception of swordfish and sharks, catch for all the pelagic species in the NWHI EEZ is relatively small in comparison to catch in the MHI area. Swordfish, albacore, and shark catches were consistently larger outside the EEZ throughout 1991-95. The catch in the U.S. possessions EEZ was relatively small because of low effort level. The dominant component of the 1995 in the MHI EEZ was bigeye tuna, mahimahi, and sharks (Fig. 4). The catch composition in the NWHI and outside the EEZ was similar, with sharks making up about a third of the catch. Swordfish composition was also about the same for the two areas.

Seasonality

There were strong seasonal patterns for many of the pelagic species caught by longliners. The most noticeable pattern in seasonal variation was the large catches of swordfish in the first and second quarters (Fig. 5). Swordfish catch was usually lowest during the third and fourth quarters. Striped marlin catch was large throughout most of the year except during the third quarter. The relatively slow longline activity in the third quarter magnifies the seasonal decrease. No seasonal pattern was apparent for blue marlin catch.

Tunas also showed strong seasonal patterns (Fig. 6). For example, bigeye tuna catch was largest during the fourth and first quarters. Albacore catch was usually smaller in the third quarter but peaked during the fourth quarter. The number of albacore caught during the fourth quarter of 1993, 1994, and 1995 was comparable to bigeye tuna catch. Yellowfin tuna catch was large in the first and second quarters and smallest in the fourth quarter. There was no consistent pattern of seasonal catch for sharks or mahimahi (Fig. 7). Moonfish catch was largest during the fourth quarter, while ono catch peaked in the second quarter (Fig. 8).

CATCH-PER-UNIT-EFFORT (CPUE)

Overall CPUE (number of fish per 1,000 hooks) for individual species depends on vessel targeting practices (trip type). For example, during 1995 the overall swordfish CPUE dropped to its lowest level, due primarily to the shift in targeting strategy rather than the poor overall swordfish catch rates experienced in 1994 (Table 9). As with record catches for many of the other pelagic species in 1995, CPUE also reached all-time highs. Blue

marlin and striped marlin CPUE were at their highest levels ever. Bigeye tuna CPUE was relatively high, just short of its 1993 high. Yellowfin tuna CPUE fluctuated during the 5-year period while albacore CPUE has consistently increased throughout the same period. CPUE for both peaked in 1995. The catch rate for ono also peaked in 1995, and CPUE for moonfish which rose from 1991 to a high in 1994 remained the same in 1995.

CPUE by Trip Type

There are substantial differences in CPUE among the three categories of trip types. Swordfish trips consistently showed the highest CPUE for swordfish, albacore, and sharks during the 5-year period. After a significant decline experienced in 1994, swordfish CPUE for swordfish trips rose slightly in 1995. Swordfish trip CPUE for albacore has shown a steady increase since 1991 and the lowest CPUE for bigeye tuna, yellowfin tuna, ono, and moonfish. Tuna trips had the largest catch rates for striped marlin, ono, and moonfish, respectable CPUE for bigeye tuna and albacore, and the lowest CPUE for swordfish, mahimahi, and sharks. CPUE for blue marlin, yellowfin tuna, and mahimahi was highest with mixed trips which also had noteworthy catch rates for some of the commercially important species such as swordfish and bigeye tuna.

CPUE by Area

Catch rates between the different areas varied substantially. CPUE for blue marlin, bigeye tuna, yellowfin tuna, ono, and moonfish was usually higher in the MHI EEZ (Table 10) while CPUE for swordfish and sharks were substantially lower. Striped marlin CPUE was highest within the NWHI EEZ. Catch rates for swordfish, bigeye tuna, yellowfin tuna, and sharks were relatively high in the NWHI EEZ while albacore, mahimahi, and ono catch rates were among the lowest of all areas. Although the EEZ surrounding the U.S. possessions had some extremely high CPUEs for bigeye tuna, yellowfin tuna, and ono, a high degree of year-to-year variability was observed. Catch rates for swordfish, albacore, mahimahi, and shark, outside the EEZ were consistently the highest for any area. Bigeye and yellowfin tuna catch rates were fair outside the EEZ while CPUE for marlins and moonfish was low.

LANDINGS

Longline landings have increased tremendously since the late 1980s (Fig. 9). Total longline landings were 23 million pounds in 1995, down from a peak of 25 million pounds in 1993. Changes in composition of landings were caused by increased effort toward tuna. Two of the more obvious changes were decreased landings of swordfish and increased landings of marlins and tunas (Table 11).

Although swordfish landings have declined for the past 2 years, swordfish has been the largest component of longline landings for the past five years. Swordfish landings were estimated to be 6.0 million pounds in 1995, down about 14% from 1994. Landings of blue marlin and striped marlin each increased by nearly half a million pounds in 1995.

Landings of the three major tunas were up considerably in 1995. Bigeye tuna (4.6 million pounds) was the second largest overall component of longline landings and, by far, the largest component of tuna landings. There was also a substantial increase in yellowfin tuna landings during 1995. Albacore landings have shown a steady increases from 1990, but the most substantial increase occurred during 1995.

Prior to 1994 Northern bluefin tuna (bluefin tuna) was categorized as "other tuna" in the longline logbooks, and landings were estimated from the shoreside sample. Since 1994 bluefin tuna has been listed individually in the new logbook format to more accurately monitor the catch of this highly valued species. Bluefin tuna landings increased slightly in 1995. Although bluefin tuna landings have historically been low (estimated at 60,000 pounds in 1995), the high ex-vessel price interests both fishermen and market wholesalers.

Mako and thresher shark fins and carcasses are kept, whereas only the fins from blue and other miscellaneous shark species are kept. Currently, there is no market in Hawaii for these carcasses, and although they are discarded at sea, finning still represents a "kept" fish. The average weight of blue sharks was estimated from observer data collected during 1990-91 (Dollar, 1994). This procedure for estimating round weight of blue and miscellaneous sharks was developed as a crude method to estimate shark biomass.

Sharks were the third largest component of the landings. Shark landings (estimated round weight) doubled to 3.5 million pounds in 1995, composed predominantly of blue sharks. Blue and other miscellaneous sharks are landed in processed "fins only" form. This practice is the driving force behind the increase in shark landings. Almost all the shark fins landed in Hawaii are shipped out by local traders or shipping agents to Asian markets. The remainder of shark landings were composed of mako and thresher sharks which are marketed as fillets. However, fresh shark fillets account for only a small fraction of total shark landings.

Landings of miscellaneous PMUS compose a small but growing fraction of total landings, the largest components being moonfish, mahimahi, and ono. Moonfish landings rose to a high of 630,000 pounds in 1995, mahimahi landings increased 50%, and ono landings doubled in 1995.

MARKET

Revenue

Longline ex-vessel revenue has grown from $10.5 million in 1987 up to $54 million in 1993 (Fig. 10). Total longline ex-vessel revenue in 1995 was $42.8 million. Billfish revenue made up over a third of total longline revenue. Swordfish is by far the most dominant component of billfish revenue while marlins make up a significantly smaller fraction (Table 12). Swordfish revenue has declined for the second year but the decline was not as substantial as that in 1994. Marlins (mainly blue marlin and striped marlin) comprise only 16% of the total billfish revenue. Revenue from tuna made up over half of the total longline revenue in 1995. Consistently high revenue generated from bigeye tuna sales, a substantial increase in yellowfin tuna revenue, and steady increases in albacore revenue all contributed in making tunas the highest revenue producing group for the second year in a row. Bluefin tuna compose only a small fraction of the landings but are highly valued due to the high unit price. Bluefin tuna revenue was estimated to be $1 million in 1995. Revenue from miscellaneous pelagic species and sharks increased in 1995 but made up only a small portion of total revenue.

Average Price

Ex-vessel prices are based on actual or estimated whole weight depending on the degree of processing or damage. Average prices for major pelagic species in Table 13 are aggregate nominal ex-vessel prices. The ex-vessel price for swordfish was the highest of all billfish. To a great extent, the price for swordfish is determined by the U.S. mainland market. Most of the swordfish landed in Hawaii is packed in air freight containers and flown to destinations across the continental U.S. Swordfish prices declined to a low in 1992 but have been relatively steady since 1994. Marlin is one of the most affordable local fresh fish species and is regularly found at retail markets. A few select blue marlin and striped marlin are used for sashimi, but most marlins are used for cooking or grilling. Prices for blue marlin and striped marlin in 1995 were down from the previous year. The decrease in average price for blue marlin and striped marlin may be related to increased landings and a slight decrease in mean size for both species.

Tunas are graded on several characteristics including observable features, anticipated shelf life, and muscle quality (Bartram et al. 1996). These characteristics, seasonal availability, and a variety of wholesale market outlets result in substantial variations in price. The Japan sashimi market is of special interest to dealers in Hawaii because the Japanese are willing to pay the highest prices in the world for the best quality tunas. Generally, the sashimi market ranks bluefin,

bigeye, and yellowfin tunas in decreasing order of desirability. With the exception of bluefin tuna, the average price for all major tuna species was slightly lower in 1995. Since almost all bluefin tuna bought in Hawaii are exported to Japan, the average price for this species was unusually high. Bluefin tuna had the highest average price of all species caught by the longline fishermen. Average price for bluefin tuna increased from $8.63 per pound in 1991 to $17.26 per pound in 1995.

The average prices of bigeye and yellowfin tunas were comparatively much lower. Bigeye tuna prices were quite consistent throughout 1987-95, in the mid $3-per-pound range. Yellowfin tuna prices have increased from the high $1 in the late 1980s to the upper $2 in the 1990s. Although bigeye tuna and yellowfin tuna are exported to Japan, only a few select fish meet the high quality desired by the sashimi market, and the price for these high quality tunas is much higher than average. Albacore is the least expensive of the larger tunas. A growing market for grilled albacore steaks (Bartram et al., 1996) may help enhance the demand for albacore. Due to its characteristic pale color, the meat is used as sashimi to a lesser extent, although, some albacore do have fairly red flesh. The considerable increase in landings may have contributed to the decline in albacore price to its lowest average during the 5-year period.

Fresh mahimahi and ono have been in strong demand by both the Hawaii restaurant and local markets for some time (Takenaka et al., 1984). The average price for mahimahi has been depressed for the past 5 years due to the market's preference for larger fish. Ono received the highest average price of all miscellaneous PMUS but was substantially lower in 1995. Moonfish, which has been used mainly in restaurants, is also establishing itself as a regular item in local retail fish markets as the supply of this fish increases.

SIZE OF FISH

The average size of longline-caught fish is expressed in round (whole) weights. The weight of fish which were processed (e.g., swordfish are headed, gutted, and finned) was raised to an estimated round (whole) weight. Small and badly damaged swordfish have little or no commercial value and are often discarded or given away. Swordfish which were released or discarded ranged from 4% to 7% of catch during 1991-95. These discards slightly bias the market sample to the larger more marketable-sized fish. The mean weight of landed swordfish increased from 1988 to a peak in 1992 at 178 pounds (Table 14). Swordfish mean weight was 171 pounds in 1995. As with CPUE, swordfish weight averages are affected by targeting, with tuna trips landing smaller swordfish than swordfish trips.

Since very large blue marlins are hard to handle, take up much hold space, require a lot of ice to chill, and usually yield lower unit price than other pelagic species, they are sometimes released. In contrast, when small striped marlin are abundant some fishermen will release them because of their low unit price. Blue marlin is one species that has a long history of relatively high mean weights, ranging from 157 to 175 pounds during 1987-95. The mean weight of striped marlin was within a narrow range (56 to 66 pounds) during the same period.

Bluefin tuna was the largest tuna caught by longliners, showing a steady increase in mean weight from 1991 to 1995 to 269 pounds. The mean weight of bigeye tuna showed little variation over the period, ranging from 76 to 87 pounds. The mean weight of yellowfin tuna was consistently higher than bigeye tuna, and also showed more variation in mean weight, ranging from 81 to 117 pounds throughout 1987-95. Mean weight of albacore decreased from 62 pounds in 1989 to 41 pounds in 1994 but increased to 50 pounds in 1995 because more large albacore were caught by tuna longliners.

The mean weight of mahimahi was much higher during 1987-89 in comparison to 1990-94. The mean weight for ono showed the least amount of variation ranging from 31 to 35 pounds.

Mean Weight of Fish by Trip Type

Mean weight differed between trip types. Swordfish trips consistently landed the largest swordfish, blue marlin, striped marlin, and bigeye tuna. However, mean weight for albacore, moonfish, and mako sharks was usually smaller than the other trip types. The mean weight of fish from tuna trips was usually lower, especially for billfish, bigeye tuna, and yellowfin tuna. Most of the mean weights of fish for mixed trips were between those of swordfish trips and tuna trips. Mean weight of yellowfin tuna by mixed trips was consistently the highest for all trip types.

Weight-Frequency Distribution

Weight-frequency histograms were produced for selected billfish (swordfish, blue marlin, and striped marlin) and tunas (bigeye tuna, yellowfin tuna, and albacore). Prior to 1989 longliners targeting tunas accounted for almost all landings of swordfish in the Hawaii fishery (Kawamoto et al., 1989). These incidental swordfish catches were small, predominantly in the 1-25 pound size category (Fig. 11). The distribution of larger swordfish was rather flat. With the increasing success of longliners catching swordfish in 1989, swordfish histograms showed a higher frequency of large fish and a distribution that tapered off above the 76-100 pound increment range. The

frequency of very large swordfish (>475 pounds) is more noticeable from 1990 onward. The dominant mode that appears in 1992 shifts over one increment each year up to 1995. A second, less conspicuous, mode of larger fish between 150-200 pounds occurs in 1992 and 1993 but is not noticeable during 1994 and 1995.

Blue marlin showed no substantial changes in distribution throughout 1987-95 (Fig. 12). The dominant mode for blue marlin was consistently in the 101-125 pound range except for 1990 when it was in the 126-150 pound range. There is a low frequency of blue marlin below 50 pounds.

The weight-frequency distribution for striped marlin in 1987 was flat and broadly distributed (Fig. 13). Distribution of striped marlin was clearly bimodal thereafter. The mode of small striped marlin occurred below 36-40 pounds while the mode of large striped marlin ranged from 51 to 55 pounds--up to 76-80 pounds. A dominant mode of small fish appeared in 1988 and 1989.

Many small bigeye tuna appeared in 1987, 1989, 1992, 1994, and 1995 (Fig. 14). The bimodal peaks of bigeye tuna were more evenly distributed in 1988, 1990, 1991, and 1993. The distribution of bigeye tuna tapers off above the 96-100 pound range.

Yellowfin tuna varied greatly in its weight-frequency distribution. A pronounced peak of small (26-35 pound) and medium (61-70 pound) yellowfin tuna in 1987 and 1989, respectively, were clearly visible (Fig. 15). Larger yellowfin tuna dominated the distribution in 1991, and its weight-frequency was more evenly distributed across a wide range of increments in 1990, 1992, 1993, 1994, and 1995.

Weight-frequency of albacore showed a distinct change in distribution between the first 4 years of histograms (1987-90) and the following 4 years (1991-94) (Fig. 16). The first 4 years showed distribution of albacore clustered toward larger fish. Weight-frequency was spread out over a wider range of sizes in subsequent years due to increased landings of small fish caught by swordfish and mixed longliners fishing in the higher latitudes of the North Pacific. Albacore weight-frequency distribution was substantially different in 1995: the distribution of fish had a definite peak in the 47-48 pound increment.

INTERACTIONS WITH ENDANGERED AND PROTECTED SPECIES

Interactions between longline gear and endangered and threatened species were summarized from the daily longline logbook data. Interactions are defined in this report as any endangered or threatened species caught (hooked or entangled) in longline fishing gear. These summaries are based on data as reported by the fishermen in their logbooks. Fishermen may often

interact with greater numbers of protected species than they actually report; hence, those are indicated in the protected species section of the logbook summaries. In fact, suspected underreporting of interactions with protected species, turtles in particular, was the major factor which led to the establishment of the mandatory observer program. The level of turtle interactions by the longline fleet is assessed using the SWR observer data and not the logbook data.

A more detailed protected species interaction section in the revised logbooks in 1995 and fishermen who are not adequately trained to identify different species may have contributed to incorrect reporting of interactions with endangered turtle species. Consequently, there may be species identification and underreporting problems in the summary of protected species interactions presented in Table 15 and Figure 17.

Forty-four different Hawaii-based longline vessels reported interactions with endangered or protected species on 88 different trips during 1995 (Table 15). Reported interactions occurred on 280 sets (266,694 hooks) and included 549 interactions with endangered or protected marine species. It is unlawful to retain any endangered or protected species; therefore, interactions are reported as animals released or lost. The condition of animals upon release is categorized as either alive, injured, or dead.

Four hundred seventy-six interactions occurred with seabirds, 464 of which were with albatrosses. The exact species of albatross is unknown because there is no distinction between albatross species for interaction data. High mortality was reported with seabirds: 75% were reported dead upon retrieval, 10% were reported released injured, and 15% were reported released alive.

Interactions with turtles were the second most frequent type of interaction. Of the 64 turtle interactions, 19 were with green sea turtles, 15 with leatherback turtles, 15 with loggerhead turtles, 5 with olive ridley turtles, and 3 were reported with hawksbill turtles. An additional 7 interactions were with unidentified turtles. The initial condition of most turtles upon retrieval appeared good. Eighty-seven percent of the turtles were reported alive upon retrieval, 8% were reported released injured, and 5% (2 unidentified and 1 olive ridley) were reported dead upon retrieval.

Nine incidents of interactions with cetaceans were reported. The incidents involved five false killer whales and four dolphins. These interactions may have resulted from cetaceans either taking catch or bait. Observations of this behavior with longline and other Hawaii fisheries have been documented (Nitta and Henderson, 1993; Dollar, 1991). All the cetaceans were reported to have been released alive. No interactions with monk seals were reported.

Interactions were summarized by three general areas: MHI and NWHI EEZs and outside the Hawaii EEZ. Most reported interactions with seabirds occurred in the NWHI and outside the EEZ (Fig. 17). Three hundred thirty-nine interactions with seabirds were reported around the NWHI, while 120 interactions were reported outside. Only 17 interactions were logged within the MHI EEZ, and 48 were reported outside. The MHI and NWHI areas reported 8 turtles each. All interactions with false killer whales occurred in the MHI EEZ. Three interactions with dolphins were reported outside the EEZ, and one dolphin interaction was logged inside.

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Table 1.--List of common and scientific names of fishes and endangered or protected species commonly encountered by fishing vessels in the western Pacific longline fishery.

Common name	Scientific name
	PELAGIC MANAGEMENT UNIT SPECIES
Billfish	
Swordfish	*Xiphias gladius*
Black marlin	*Makaira indica*
Blue marlin	*Makaira mazara*
Striped marlin	*Tetrapturus audax*
Shortbill spearfish	*T. angustirostris*
Sailfish	*Istiophorus platypterus*
Tunas	
Bigeye tuna	*Thunnus obesus*
Albacore	*T. alalunga*
Yellowfin tuna	*T. albacares*
Northern bluefin tuna	*T. thunnus orientalis*
Skipjack tuna	*Katsuwonus pelamis*
Kawakawa	*Euthynnus affinis*
Sharks	
Blue shark	*Prionace glauca*
Thresher (big eye)	*Alopias superciliosus*
Mako (short fin)	*Isurus oxyrinchus*
White tip (oceanic)	*Carcharhinus longimanus*
Tiger shark	*Galeocerdo cuvieri*
Miscellaneous sharks	Carcharhinidae, Alopiidae, Sphyrnidae, and Laminidae
Miscellaneous PMUS	
Mahimahi	*Coryphaena hippurus*
Wahoo (ono)	*Acanthocybium solandri*
Moonfish	*Lampris guttatus*
Pomfret	family Bramidae
Oilfish	family Gempylidae
	MISCELLANEOUS PELAGICS
Lancet fish	*Alepisaurus* spp.
Barracuda	*Sphyraena barracuda*
Brown stingray	*Dasyatis violacea*
	ENDANGERED OR PROTECTED SPECIES
Hawaiian monk seal	*Monachus schauinslandi*
Humpback whale	*Megaptera novaengliae*
Dolphins	family Delphinidae
Green turtle	*Chelonia mydas*
Olive ridley turtle	*Lepidochelys olivacea*
Hawksbill turtle	*Eretmochelys imbricata*
Leatherback turtle	*Dermochelys coricea*
Laysan albatross	*Diomedea immutabilis*
Black-footed albatross	*D. nigripes*
Brown booby	*Sula leucogaster plotus*

Table 2.--Hawaii-based longline vessel activity,* 1991-95.

Year	Vessels	Trips	Avg. No. of days fished per trip
Fleet			
1991	141	1,670	7.3
1992	123	1,265	8.4
1993	122	1,192	9.5
1994	125	1,106	9.3
1995	110	1,125	10.2
Swordfish trips			
1991	98	291	10.2
1992	66	277	11.5
1993	79	319	11.7
1994	74	310	11.7
1995	44	136	13.3
Tuna trips			
1991	104	556	7.6
1992	55	458	8.1
1993	61	542	8.6
1994	83	568	8.7
1995	78	682	10.0
Mixed trips			
1991	94	823	6.1
1992	72	530	7.1
1993	59	331	8.8
1994	51	228	7.8
1995	49	307	9.3

*Based on date of landing

Table 3.--Number of days fished* by the Hawaii-based longline fleet, 1991-95.

		Trip type			Area			
Year	Total	Swordfish trips	Tuna trips	Mixed trips	Main Hawaiian Islands	Northwestern Hawaiian Islands	U.S. Possessions	Outside EEZ
1991	12,151	2,998	4,183	4,970	6,212	1,257	42	4,640
1992	10,704	3,159	3,745	3,800	4,145	753	13	5,793
1993	11,351	3,717	4,674	2,960	4,409	1,277	---	5,663
1994	10,108	3,607	4,901	1,600	4,442	1,929	127	3,610
1995	11,708	1,846	6,944	2,918	5,439	1,693	98	4,478

*Sets based on date of haul.

Table 4.--Number of hooks set* by the Hawaii-based longline fleet, 1991-95.

		Trip type			Area			
Year	Total	Swordfish trips	Tuna trips	Mixed trips	Main Hawaiian Islands	Northwestern Hawaiian Islands	U.S. Possessions	Outside EEZ
1991	11,914,608	2,243,375	5,124,277	4,546,956	6,853,272	1,056,478	38,422	3,966,436
1992	10,946,721	2,515,909	5,072,525	3,358,287	4,880,514	694,626	16,030	5,355,551
1993	12,137,533	3,207,976	6,359,162	2,570,395	5,553,586	1,305,786	---	5,275,761
1994	11,319,023	3,079,634	6,842,517	1,396,872	5,451,028	2,225,352	172,590	3,470,053
1995	14,155,169	1,464,589	10,186,299	2,504,281	7,112,744	1,996,036	153,435	4,892,954

*Number of hooks set based on date of haul.

Table 5.--Average number of hooks set per day fished, 1991-95.

Year	Fleet mean	Swordfish trips	Tuna trips	Mixed trips
1991	980	750	1,230	910
1992	1,020	800	1,350	880
1993	1,070	860	1,360	870
1994	1,120	850	1,400	870
1995	1,210	790	1,470	860

Table 6.--Hawaii-based longline catch* (number of fish) by trip type, 1991-95.

Year	Billfish				Tunas			Miscellaneous			
	Swordfish	Blue marlin	Striped marlin	Other billfish	Bigeye tuna	Yellowfin tuna	Albacore	Mahimahi	Ono	Moonfish	Sharks
Fleet											
1991	66,289	4,012	26,967	12,464	40,923	13,269	14,051	39,525	2,735	3,079	71,183
1992	74,314	4,516	16,049	5,668	43,902	7,879	19,813	56,684	2,448	3,293	94,897
1993	79,554	5,124	18,210	5,681	54,803	16,062	30,460	26,018	4,442	4,515	154,608
1994	43,345	4,677	11,292	5,117	48,102	13,516	31,129	33,017	2,513	5,090	114,656
1995	37,622	8,873	22,715	11,895	60,680	23,798	46,100	60,748	6,764	6,416	101,773
Swordfish trips											
1991	36,516	---	---	---	5,453	1,876	3,631	8,609	152	44	37,880
1992	41,503	564	2,184	375	4,533	1,301	8,680	13,448	176	87	55,507
1993	48,920	1,073	3,781	648	9,086	2,552	14,472	8,753	475	102	100,075
1994	36,245	724	1,569	277	3,541	1,453	15,701	9,181	140	29	82,155
1995	18,916	950	1,007	231	3,458	1,653	8,103	9,978	241	23	40,561
Tuna trips											
1991	2,156	---	---	---	19,328	3,646	5,831	11,365	2,013	2,788	8,906
1992	1,400	1,922	11,271	3,771	24,895	2,781	4,519	8,764	1,773	3,122	12,599
1993	1,372	2,661	11,895	4,252	30,205	9,552	10,348	9,776	3,557	4,372	16,553
1994	1,118	2,074	8,699	4,305	38,877	8,164	14,273	14,318	2,280	5,032	15,621
1995	2,234	5,023	18,117	10,117	45,497	14,601	32,880	24,825	5,979	6,200	29,166
Mixed trips											
1991	27,617	---	---	---	16,142	7,747	4,589	19,551	570	247	24,397
1992	31,411	2,030	2,594	1,522	14,474	3,797	6,614	34,440	499	84	26,791
1993	29,262	1,390	2,534	781	15,512	3,958	5,640	7,489	410	41	38,000
1994	5,982	1,879	1,024	535	5,684	3,899	1,155	9,518	93	29	16,880
1995	16,472	2,900	3,591	1,547	11,725	7,544	5,117	25,945	544	193	32,046

*Based on date of haul.

Table 7.--Hawaii-based longline incidental shark catch, 1995.

Species	Number caught	Number released	Percent retained
Blue sharks	95,312	64,944	31.9
Mako sharks	1,799	886	50.8
Thresher sharks	1,828	1,463	20.0
Miscellaneous Sharks	2,834	736	74.0
Total	101,773	68,029	33.2

Table 8.--Hawaii-based longline catch* (number of fish) by area, 1991-95.

	Billfish				Tunas			Miscellaneous			
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Bigeye tuna	Yellowfin tuna	Albacore	Mahimahi	Ono	Moonfish	Sharks
Main Hawaiian Islands EEZ											
1991	13,598	---	---	---	22,517	7,150	5,763	17,672	1,885	2,569	13,295
1992	7,102	2,759	9,838	3,368	22,980	3,846	3,979	13,313	1,194	2,387	11,748
1993	4,388	2,720	10,426	3,440	25,031	8,895	6,496	9,366	2,641	3,261	12,955
1994	6,494	3,344	6,494	3,213	27,022	6,815	10,833	17,660	1,332	3,626	14,455
1995	5,273	4,207	12,580	6,963	32,253	13,078	18,363	30,759	2,787	4,076	22,683
Northwestern Hawaiian Islands EEZ											
1991	9,472	---	---	---	4,473	1,375	481	2,003	134	70	10,604
1992	5,228	244	1,776	330	2,624	396	311	2,321	77	187	9,042
1993	9,565	509	2,861	754	7,760	2,019	1,413	2,279	198	398	17,507
1994	9,752	554	2,679	719	10,726	2,015	5,592	3,037	227	707	28,346
1995	8,400	1,379	5,076	1,557	9,011	3,630	5,097	5,836	902	939	19,915
U.S. Possessions											
1991	25	---	---	---	374	139	30	84	21	0	237
1992	16	7	1	7	70	42	0	6	8	0	223
1993	---	---	---	---	---	---	---	---	---	---	---
1994	53	37	173	55	1,127	1,649	151	37	77	24	705
1995	21	98	122	95	472	588	296	254	207	5	908
Outside EEZ											
1991	43,194	---	---	---	13,559	4,305	7,777	19,766	695	440	47,047
1992	61,968	1,506	4,434	1,963	18,228	3,595	15,523	41,044	1,169	719	73,884
1993	65,601	1,895	4,920	1,486	22,008	5,147	22,551	14,367	1,600	856	124,139
1994	30,698	742	1,946	1,130	9,227	3,037	14,553	12,283	877	733	71,150
1995	23,928	3,189	4,937	3,280	18,944	6,502	22,344	23,899	2,868	1,396	58,267

*Based on date of haul.

Table 9.--Hawaii-based longline catch-per-unit-effort* (number of fish per 1000 hooks) by trip type, 1991-95.

	Billfish				Tunas			Miscellaneous			
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Bigeye tuna	Yellowfin tuna	Albacore	Mahimahi	Ono	Moonfish	Sharks
Fleet mean											
1991	5.56	---	---	---	3.43	1.11	1.18	3.32	0.23	0.26	5.97
1992	6.79	0.41	1.47	0.52	4.01	0.72	1.81	5.18	0.22	0.30	8.67
1993	6.55	0.42	1.50	0.47	4.52	1.32	2.51	2.14	0.37	0.37	12.74
1994	3.83	0.41	1.00	0.45	4.25	1.19	2.75	2.92	0.21	0.45	10.13
1995	2.66	0.63	1.60	0.84	4.29	1.68	3.26	4.29	0.48	0.45	7.19
Swordfish trips											
1991	16.28	---	---	---	2.43	0.84	1.62	3.84	0.07	0.02	16.89
1992	16.50	0.22	0.87	0.15	1.80	0.52	3.45	5.35	0.07	0.03	22.06
1993	15.25	0.33	1.18	0.20	2.83	0.80	4.51	2.73	0.15	0.03	31.20
1994	11.77	0.24	0.51	0.09	1.15	0.47	5.10	2.98	0.05	0.01	26.68
1995	12.92	0.65	0.69	0.16	2.36	1.13	5.53	6.81	0.16	0.02	27.69
Tuna trips											
1991	0.42	---	---	---	3.77	0.71	1.14	2.22	0.39	0.54	1.74
1992	0.28	0.38	2.22	0.75	4.91	0.55	0.89	1.73	0.35	0.62	2.48
1993	0.22	0.42	1.87	0.67	4.75	1.50	1.63	1.54	0.56	0.69	2.60
1994	0.16	0.30	1.27	0.63	5.68	1.19	2.09	2.09	0.33	0.74	2.28
1995	0.22	0.49	1.78	1.00	4.47	1.43	3.23	2.44	0.59	0.61	2.86
Mixed trips											
1991	6.07	---	---	---	3.55	1.70	1.01	4.30	0.13	0.05	5.37
1992	9.35	0.60	0.77	0.46	4.31	1.13	1.97	10.26	0.15	0.03	7.98
1993	11.38	0.54	0.99	0.31	6.03	1.54	2.19	2.91	0.16	0.02	14.78
1994	4.28	1.35	0.73	0.38	4.07	2.79	0.83	6.81	0.07	0.02	12.08
1995	6.58	1.16	1.43	0.62	4.68	3.01	2.04	10.36	0.22	0.08	12.80

*Based on date of haul.

Table 10.--Hawaii-based longline catch-per-unit-effort* (number of fish per 1000 hooks) by area, 1991-95.

	Billfish				Tunas			Miscellaneous			
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Bigeye tuna	Yellowfin tuna	Albacore	Mahimahi	Ono	Moonfish	Sharks
Main Hawaiian Islands EEZ											
1991	1.98	---	---	---	3.29	1.04	0.84	2.58	0.28	0.37	1.94
1992	1.46	0.57	2.02	0.69	4.71	0.79	0.82	2.73	0.24	0.49	2.41
1993	0.79	0.49	1.88	0.62	4.51	1.60	1.17	1.69	0.48	0.59	2.33
1994	0.52	0.61	1.19	0.59	4.96	1.25	1.99	3.24	0.24	0.67	2.65
1995	0.74	0.59	1.77	0.98	4.53	1.84	2.58	4.32	0.39	0.57	3.19
Northwestern Hawaiian Islands EEZ											
1991	8.97	---	---	---	4.23	1.30	0.46	1.90	0.13	0.07	10.04
1992	7.53	0.35	2.56	0.48	3.78	0.57	0.45	3.34	0.11	0.27	13.02
1993	7.33	0.39	2.19	0.58	5.94	1.55	1.08	1.75	0.15	0.30	13.41
1994	4.38	0.25	1.20	0.32	4.82	0.91	2.51	1.36	0.10	0.32	12.74
1995	4.21	0.69	2.54	0.78	4.51	1.82	2.55	2.92	0.45	0.47	9.98
U.S. Possessions											
1991	0.49	---	---	---	9.73	11.43	0.78	2.19	0.55	0.00	6.17
1992	1.00	0.44	0.06	0.44	4.37	2.62	0.00	0.37	0.50	0.00	13.91
1993	---	---	---	---	---	---	---	---	---	---	---
1994	0.31	0.21	1.00	0.32	6.53	9.55	0.87	0.21	0.45	0.14	4.08
1995	0.14	0.64	0.80	0.62	3.08	3.83	1.93	1.66	1.35	0.03	5.92
Outside EEZ											
1991	10.89	---	---	---	3.42	1.09	1.96	4.98	0.18	0.11	11.86
1992	11.57	0.28	0.83	0.37	3.40	0.67	2.90	7.66	0.22	0.13	13.80
1993	12.43	0.36	0.93	0.28	4.17	0.98	4.27	2.72	0.30	0.16	23.53
1994	8.55	0.21	0.56	0.32	2.66	0.88	4.19	3.54	0.25	0.21	20.50
1995	4.89	0.65	1.01	0.68	3.87	1.33	4.57	4.88	0.59	0.29	11.91

*Based on date of haul.

Table 11.--Hawaii's longline landings (X 1,000 pounds) of selected pelagic species, 1987-95.

	Billfish				Tunas				Miscellaneous			
Year	Swordfish	Blue marlin	Striped marlin	Other marlin	Bigeye tuna	Yellowfin tuna	Albacore	Bluefin tuna	Mahimahi	Ono	Moonfish	Sharks*
1987	50	110	600	100	1,790	580	330	---	50	50	---	40
1988	50	230	1,110	150	2,740	1,310	680	---	40	90	---	100
1989	620	770	1,340	290	3,140	2,160	550	---	180	200	---	200
1990	4,190	760	1,100	120	3,020	2,230	370	---	350	70	---	200
1991	10,120	660	1,500	350	3,420	1,620	690	---	520	110	510	290
1992	12,570	760	1,010	300	3,280	760	730	20	590	90	320	420
1993	13,100	750	1,040	220	4,660	1,390	970	90	320	140	450	1,740
1994	7,000	800	720	220	3,940	1,340	1,100	40	380	90	520	1,720
1995	6,010	1,280	1,200	410	4,580	2,150	1,930	60	570	200	630	3,490

Table 12.--Hawaii's longline ex-vessel revenue (X $1,000) by species, 1987-95.

	Billfish				Tunas				Miscellaneous			
Year	Swordfish	Blue marlin	Striped marlin	Other marlin	Bigeye tuna	Yellowfin tuna	Albacore	Bluefin tuna	Mahimahi	Ono	Moonfish	Sharks*
1987	170	140	810	240	6,510	1,500	520	---	100	150	---	60
1988	160	190	1,200	260	9,160	3,270	910	---	110	240	---	100
1989	1,130	640	1,370	290	10,640	5,070	710	---	400	450	---	100
1990	9,710	710	1,530	160	10,940	5,750	550	---	590	200	---	120
1991	21,450	510	1,490	320	12,760	4,440	910	30	670	230	590	140
1992	24,130	880	1,280	310	11,710	2,210	910	260	830	220	350	190
1993	26,590	640	1,070	200	16,640	3,810	1,170	1,230	440	270	390	480
1994	16,240	1,020	1,220	290	14,620	3,910	1,360	690	540	240	570	470
1995	13,460	1,110	1,080	300	15,340	6,110	2,080	1,010	810	330	600	830

Table 13.--Hawaii's longline ex-vessel prices (based on estimated whole weight) by species, 1987-95.

	Billfish			Tunas				Miscellaneous				
Year	Swordfish	Blue marlin	Striped marlin	Bigeye tuna	Yellowfin tuna	Albacore	Bluefin tuna	Mahimahi	Ono	Moonfish	Mako	Thresher
1987	3.23	1.02	1.39	3.56	1.86	1.57	---	2.31	2.60	---	---	---
1988	2.87	0.84	1.02	3.33	1.81	1.30	---	2.73	2.56	---	---	---
1989	2.28	0.84	1.10	3.24	2.14	1.30	---	2.26	2.47	---	---	---
1990	2.32	0.92	1.38	3.33	2.19	1.48	---	1.97	2.52	---	---	---
1991	2.12	0.78	0.99	3.73	2.74	1.32	8.63	1.28	2.10	1.15	0.64	0.46
1992	1.92	1.16	1.27	3.57	2.91	1.24	12.33	1.40	2.46	1.10	0.76	0.50
1993	2.03	0.85	1.03	3.57	2.74	1.21	13.42	1.36	1.94	0.86	0.64	0.56
1994	2.32	1.28	1.70	3.71	2.92	1.24	15.53	1.41	2.70	1.10	0.68	0.52
1995	2.24	0.87	0.90	3.35	2.84	1.08	17.26	1.42	1.64	0.95	0.65	0.62

Table 14.--Mean whole weight of catch (in pounds), 1987-95.

Year	Billfish			Tunas				Miscellaneous				
	Swordfish	Blue marlin	Striped marlin	Bigeye tuna	Yellowfin tuna	Albacore	Bluefin tuna	Mahimahi	Ono	Moonfish	Mako	Thresher
Fleet												
1987	129.3	161.4	66.2	76.3	81.9	62.3	---	21.1	33.3	---	---	---
1988	119.2	157.3	56.9	83.2	102.5	59.7	---	20.0	31.9	---	---	---
1989	131.1	164.7	61.5	77.0	103.7	62.0	---	23.0	34.6	---	---	---
1990	147.6	172.0	55.8	85.5	117.2	53.3	---	14.5	31.6	---	---	---
1991	155.3	174.6	59.2	85.0	117.7	51.9	184.2	14.8	31.6	97.2	131.0	177.1
1992	177.6	174.5	65.5	76.8	99.2	45.2	192.3	11.0	35.1	98.3	144.4	176.2
1993	172.2	156.7	63.7	87.9	92.1	44.1	192.6	12.9	32.6	101.2	147.2	198.5
1994	162.6	170.6	63.5	80.9	97.4	41.3	203.6	11.8	34.2	103.3	152.6	163.6
1995	171.1	157.3	57.7	79.0	94.5	49.9	269.2	10.2	30.6	100.6	176.1	175.2
Swordfish trips												
1991	165.1	185.6	71.6	96.8	123.6	44.1	164.3	15.0	35.3	103.5	107.2	173.2
1992	192.7	277.7	83.4	94.6	101.4	37.5	194.6	10.4	36.5	77.5	130.5	235.0
1993	180.2	173.6	78.4	83.3	92.8	34.4	183.7	13.0	36.4	99.5	141.3	260.6
1994	173.3	202.1	83.6	94.7	94.7	34.2	205.2	10.6	40.1	76.0	118.5	195.8
1995	184.8	151.9	79.9	93.0	102.4	37.0	176.3	7.8	34.2	80.3	140.5	---
Tuna trips												
1991	82.7	152.7	51.0	76.5	87.9	57.9	---	14.9	31.2	97.2	154.6	188.0
1992	77.3	144.0	59.0	71.4	68.8	56.0	159.0	13.9	33.8	98.9	157.9	157.3
1993	121.1	145.2	58.8	84.0	87.0	57.5	219.7	13.1	31.7	101.2	152.9	188.7
1994	90.7	156.7	59.6	77.4	81.2	48.9	247.0	12.1	33.7	103.5	176.2	166.9
1995	124.3	151.6	55.8	74.7	77.3	51.4	342.0	11.9	30.2	100.9	181.6	176.0
Mixed trips												
1991	142.4	186.5	66.0	91.5	132.2	49.0	191.7	14.7	33.7	96.4	148.0	177.5
1992	162.4	178.0	81.2	80.6	119.8	44.6	191.8	10.4	39.0	99.5	139.7	192.5
1993	158.4	169.0	74.5	99.8	106.5	36.4	217.1	12.6	36.9	113.0	141.9	208.8
1994	118.7	174.6	67.6	93.5	128.5	57.2	153.5	12.4	38.6	96.0	141.5	148.4
1995	161.3	168.7	63.8	91.3	125.4	46.2	223.6	9.2	34.2	93.6	172.9	136.5

Table 15.--Western Pacific longline logbook summary for protected species interactions for January-December 1995 (vessels landing or based in Hawaii). Report: date of haul, all areas, all species.

Trip Information	
Number of vessels reporting interactions	44
Number of trips reporting interactions	88
Number of sets reporting interactions	280
Number of interactions reported	549
Number of hooks set with interactions	266,694

Reported Protected Species Interactions

Species	Alive	Injured	Dead	Total
Seals				
Monk seals	0	0	0	0
Other seals	0	0	0	0
Total	0	0	0	
Whales/Dolphin	0	0	0	0
Humpback whales	0	0	0	0
False killer whales	5	0	0	5
Other whales	0	0	0	0
Dolphins	4	0	0	4
Total	9	0	0	9
Turtles				
Green turtles	18	1	0	19
Hawksbill turtles	3	0	0	3
Leatherback turtles	15	0	15	15
Loggerhead turtles	13	2	0	15
Olive ridley turtles	4	0	1	5
Unidentified	3	2	2	7
Other turtles	0	0	0	0
Total	56	5	3	64
Birds				
Albatrosses	69	46	349	464
Boobies	0	0	0	0
Other birds	4	0	8	12
Total	73	46	357	476
Other Species	0	0	0	0

Date and time of report: 11/04/96 10:45:09

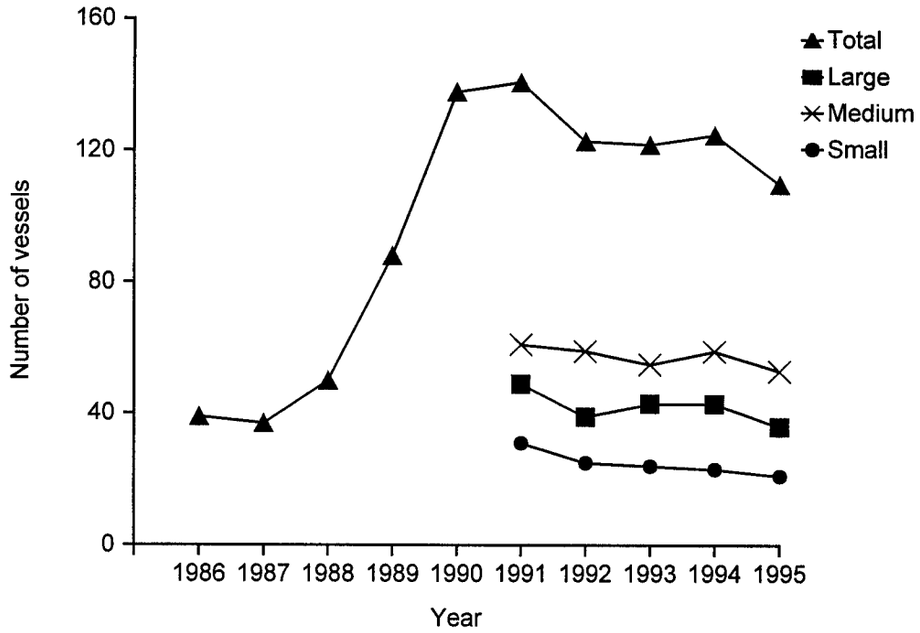


Figure 1.--Number of Hawaii-based longline vessels, 1986-95.

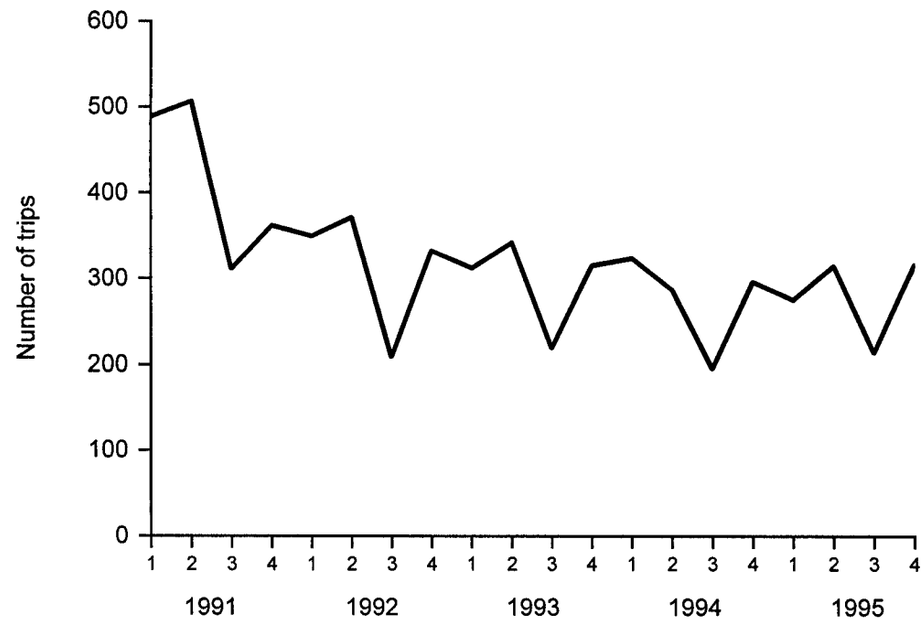


Figure 2.--Number of trips by quarter, 1991-95.

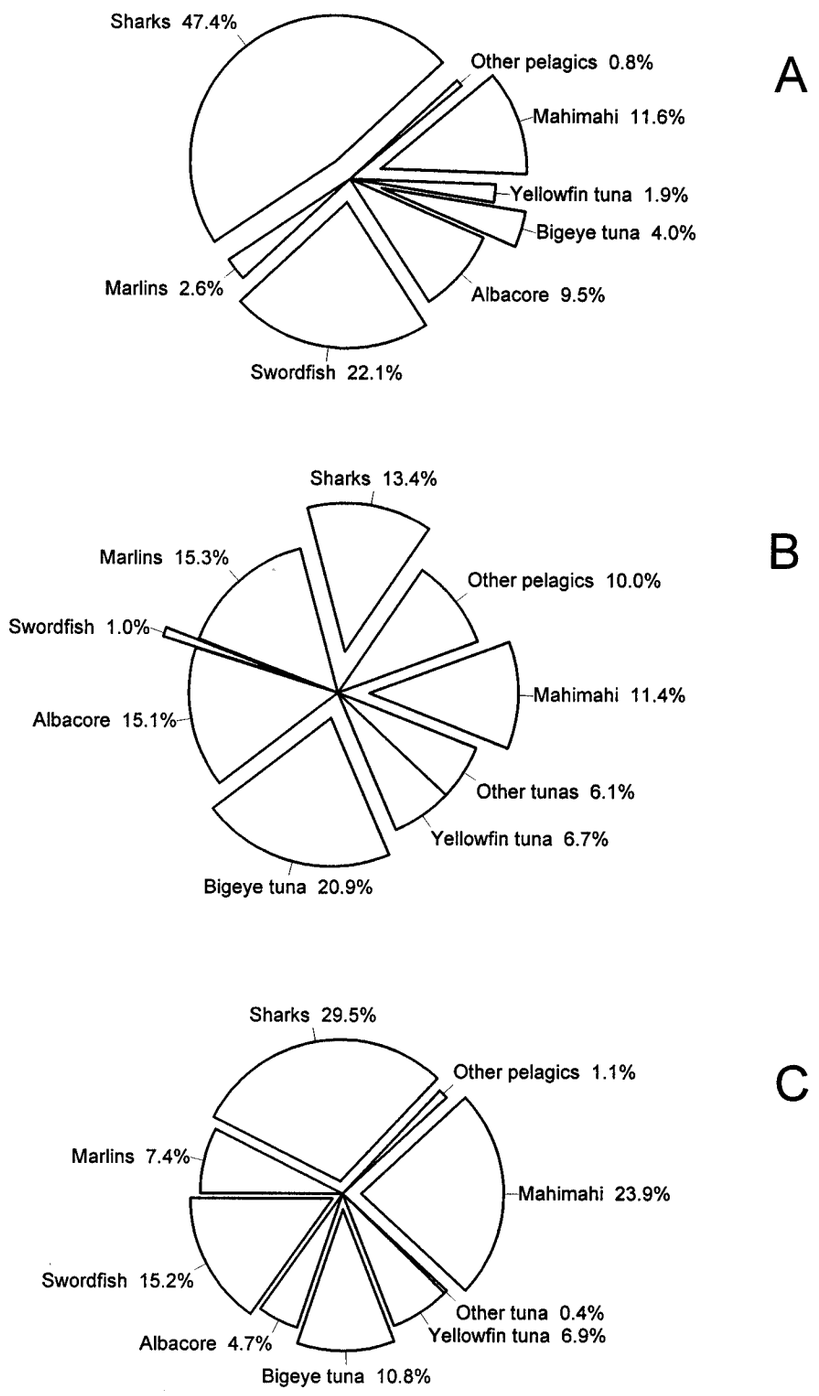
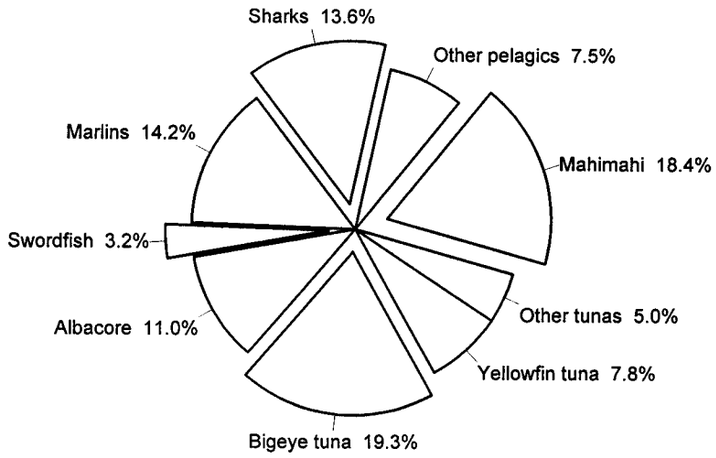
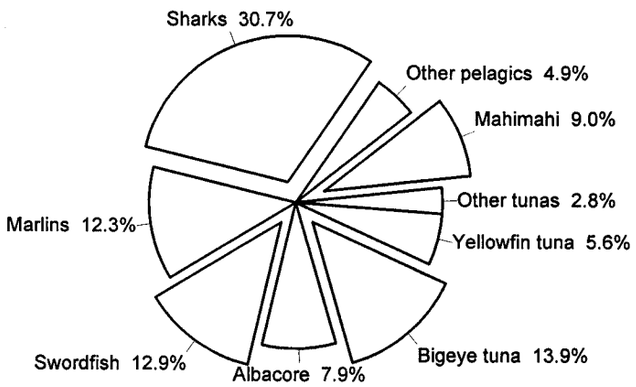


Figure 3.--Species composition of the catch (%) by A) swordfish trips, B) tuna trips, and C) mixed trips, 1995.





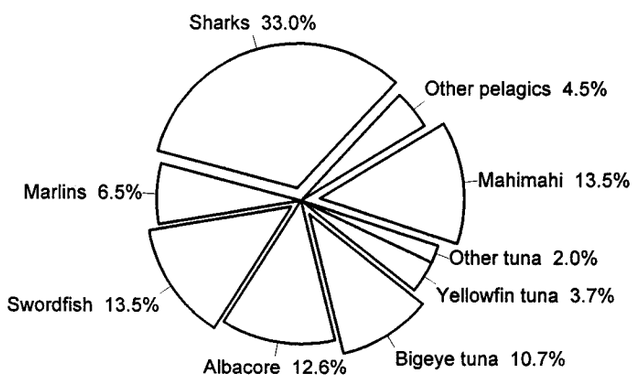


Figure 4.--Species composition of the catch (%) in the A) main Hawaiian Island Exclusive Economic Zone (EEZ), B) northwestern Hawaiian EEZ, and C) outside the EEZ, 1995.

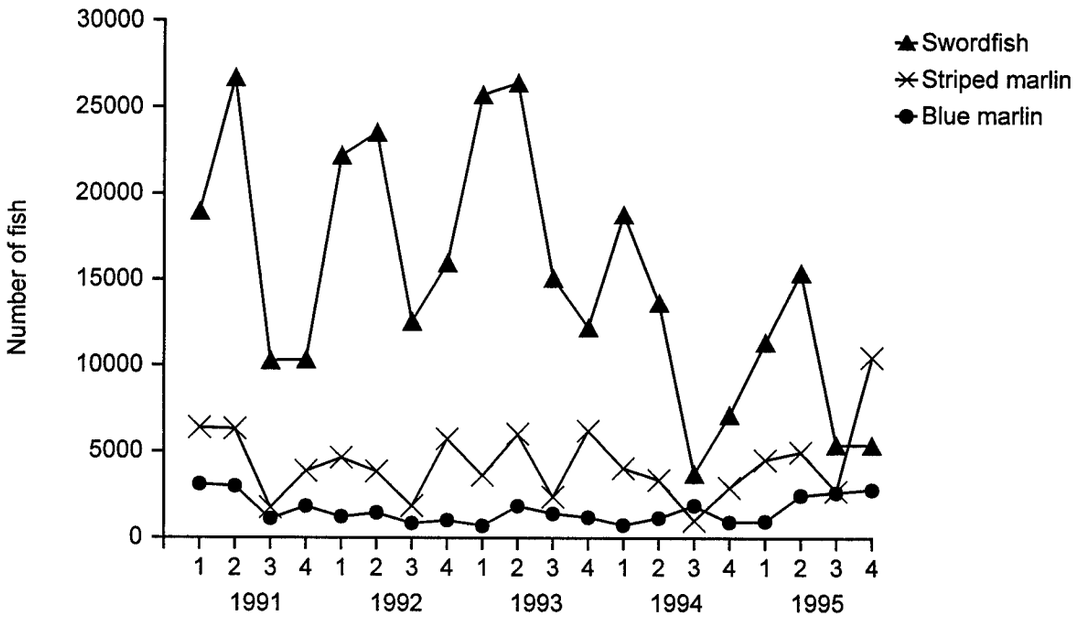


Figure 5.--Catch of billfish by quarter, 1991-95.

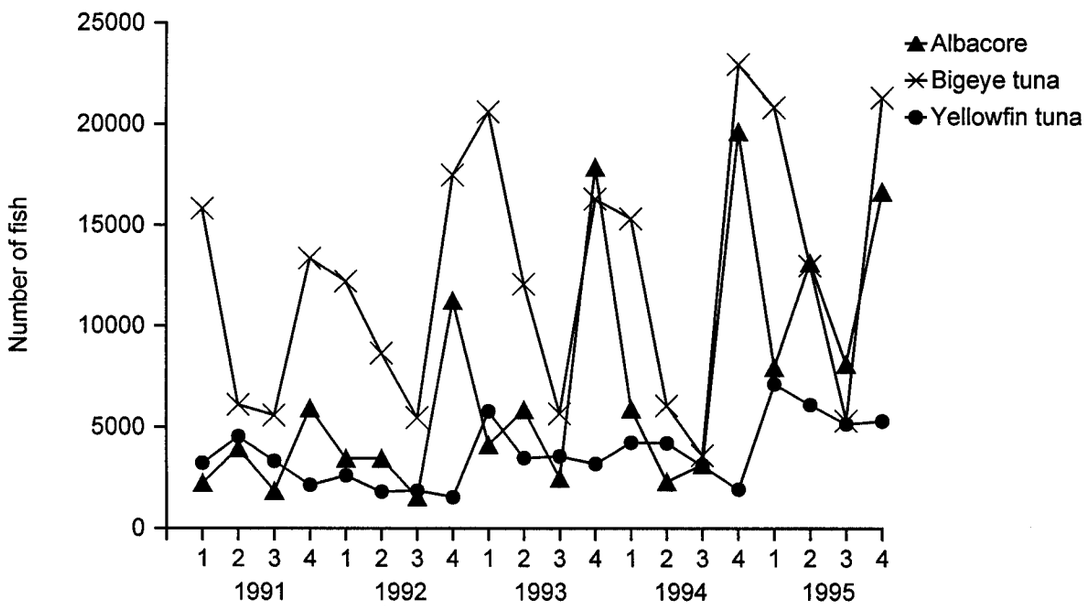


Figure 6.--Catch of tunas by quarter, 1991-95.

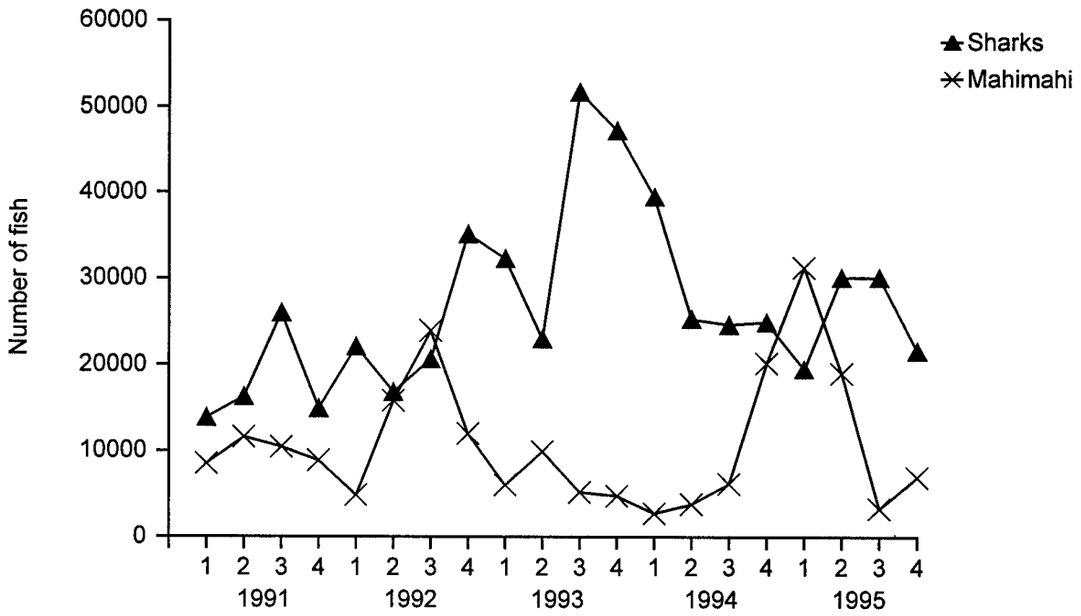


Figure 7.--Catch of sharks and mahimahi by quarter, 1991-95.

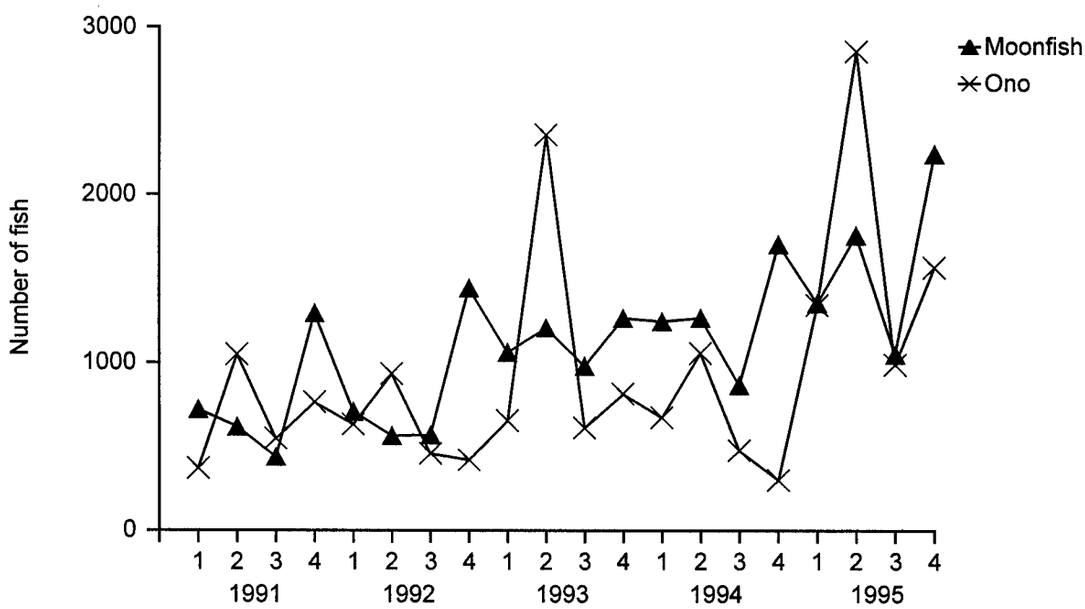


Figure 8.--Catch of moonfish and ono by quarter, 1991-95.

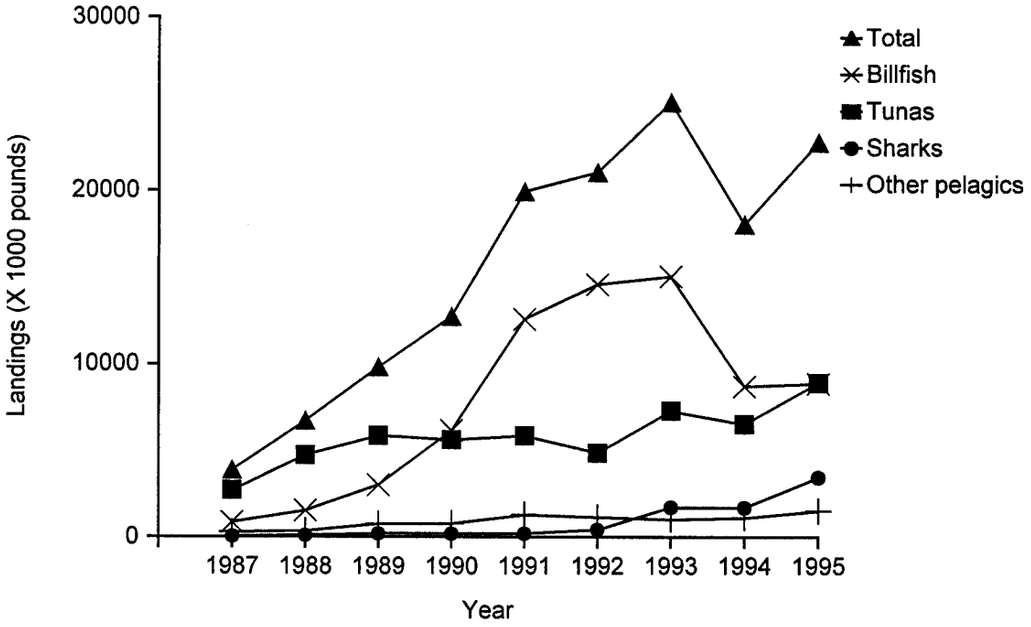


Figure 9.--Longline landings by major pelagic groups, 1986-95.

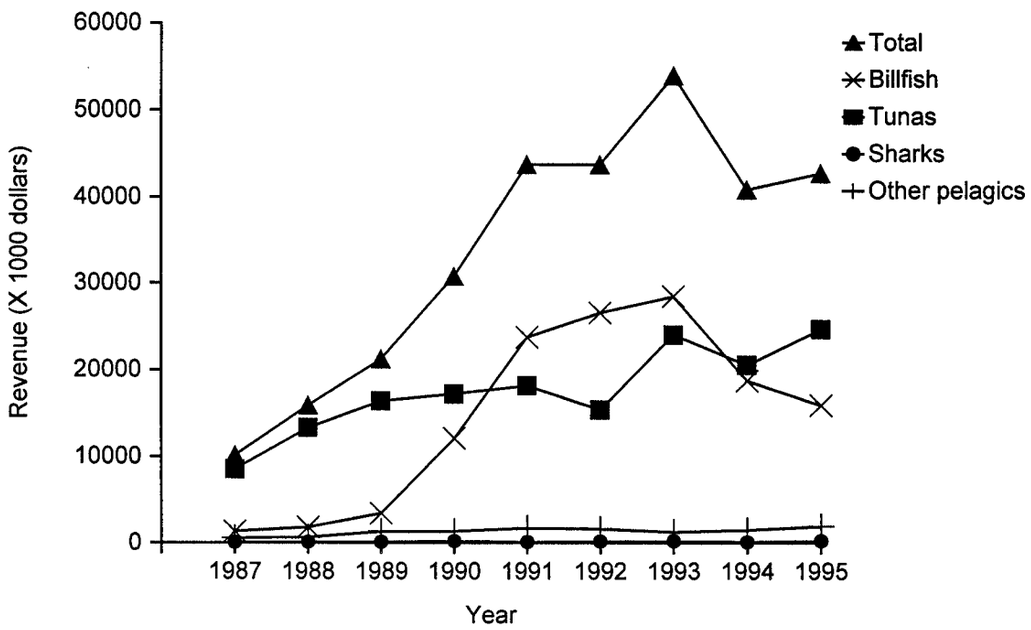


Figure 10.--Longline revenue by major pelagic groups, 1986-95.

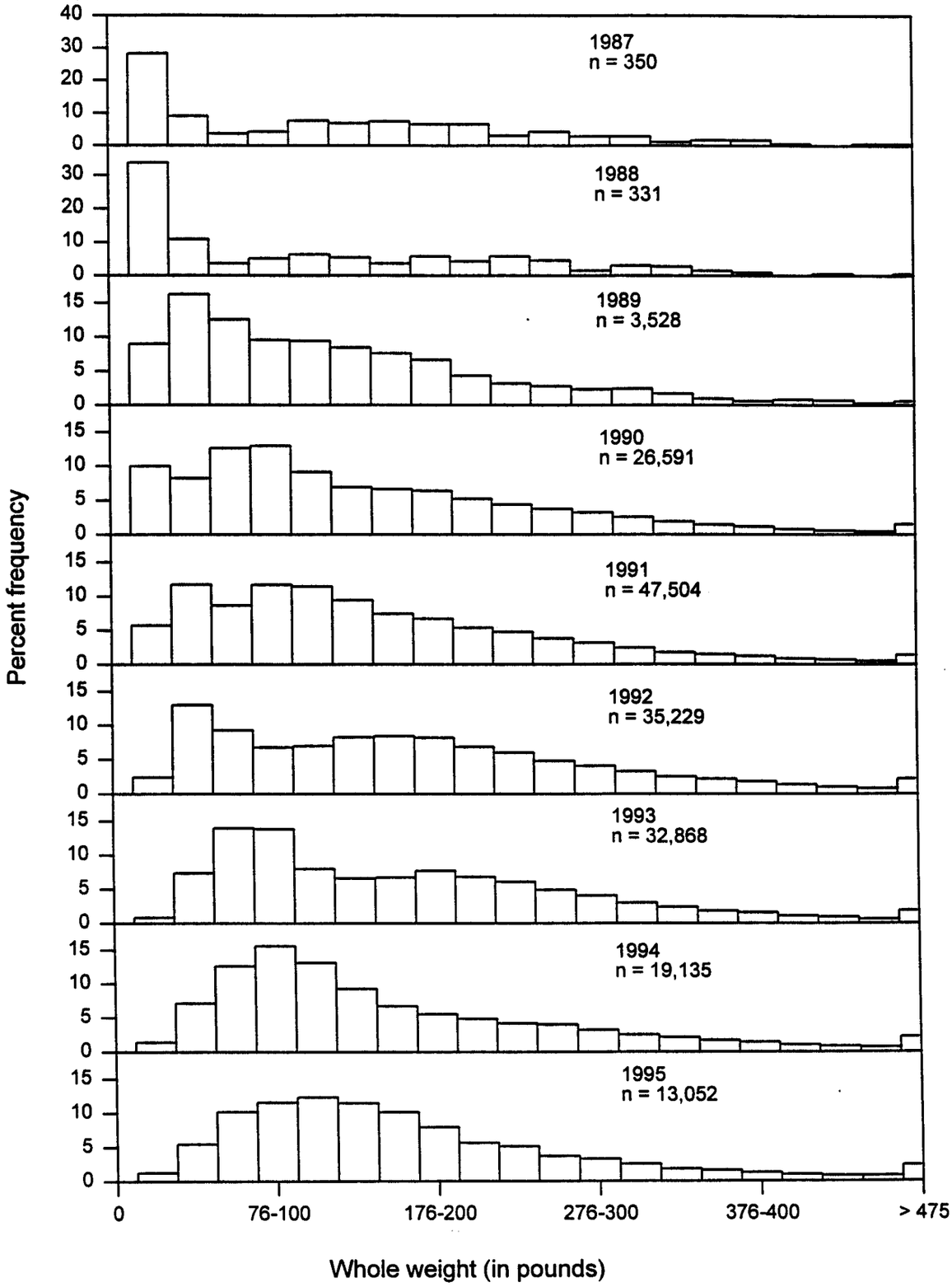


Figure 11.--Swordfish weight-frequency histograms, 1987-95.

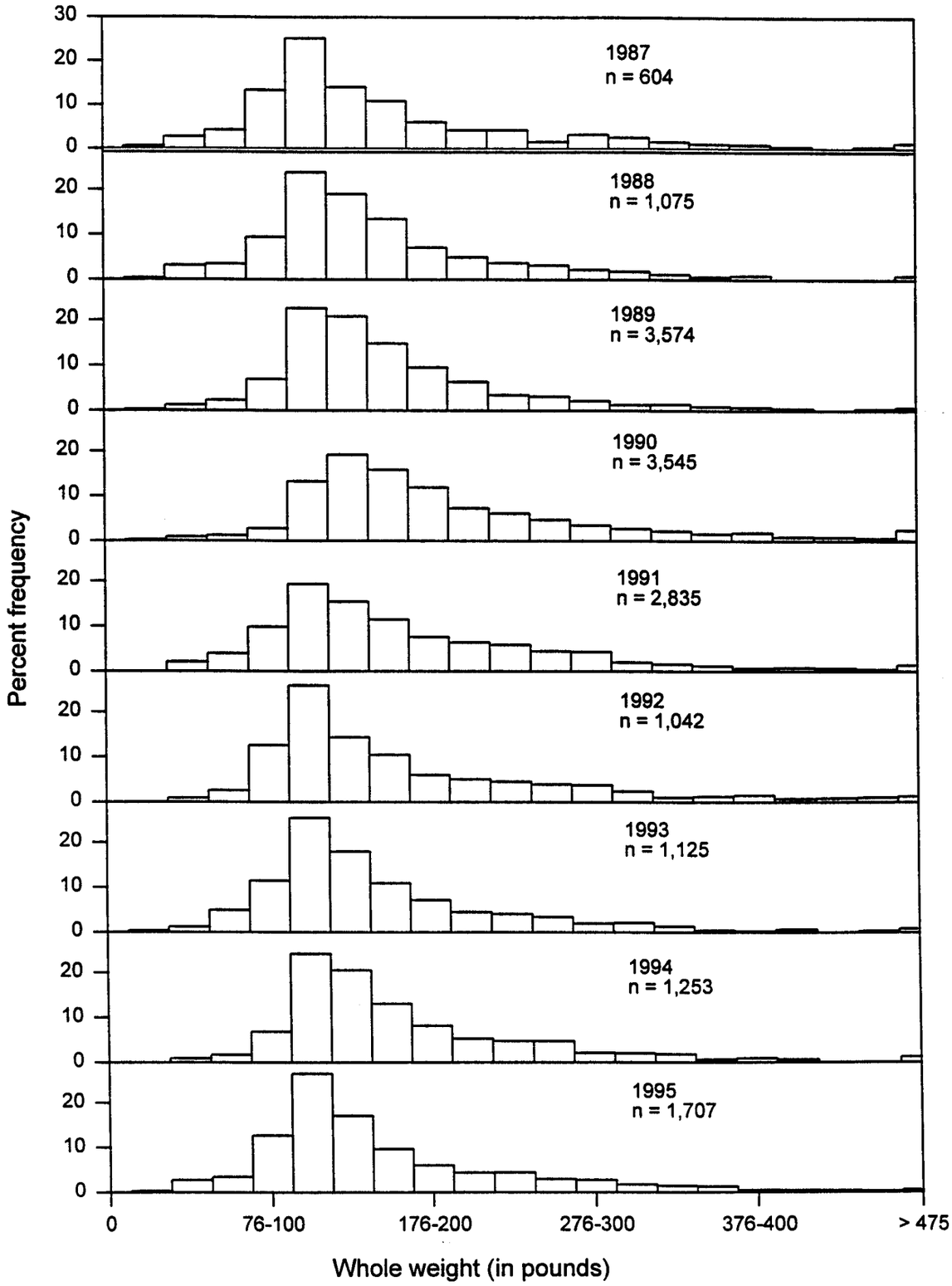


Figure 12.--Blue marlin weight-frequency histograms, 1987-95.

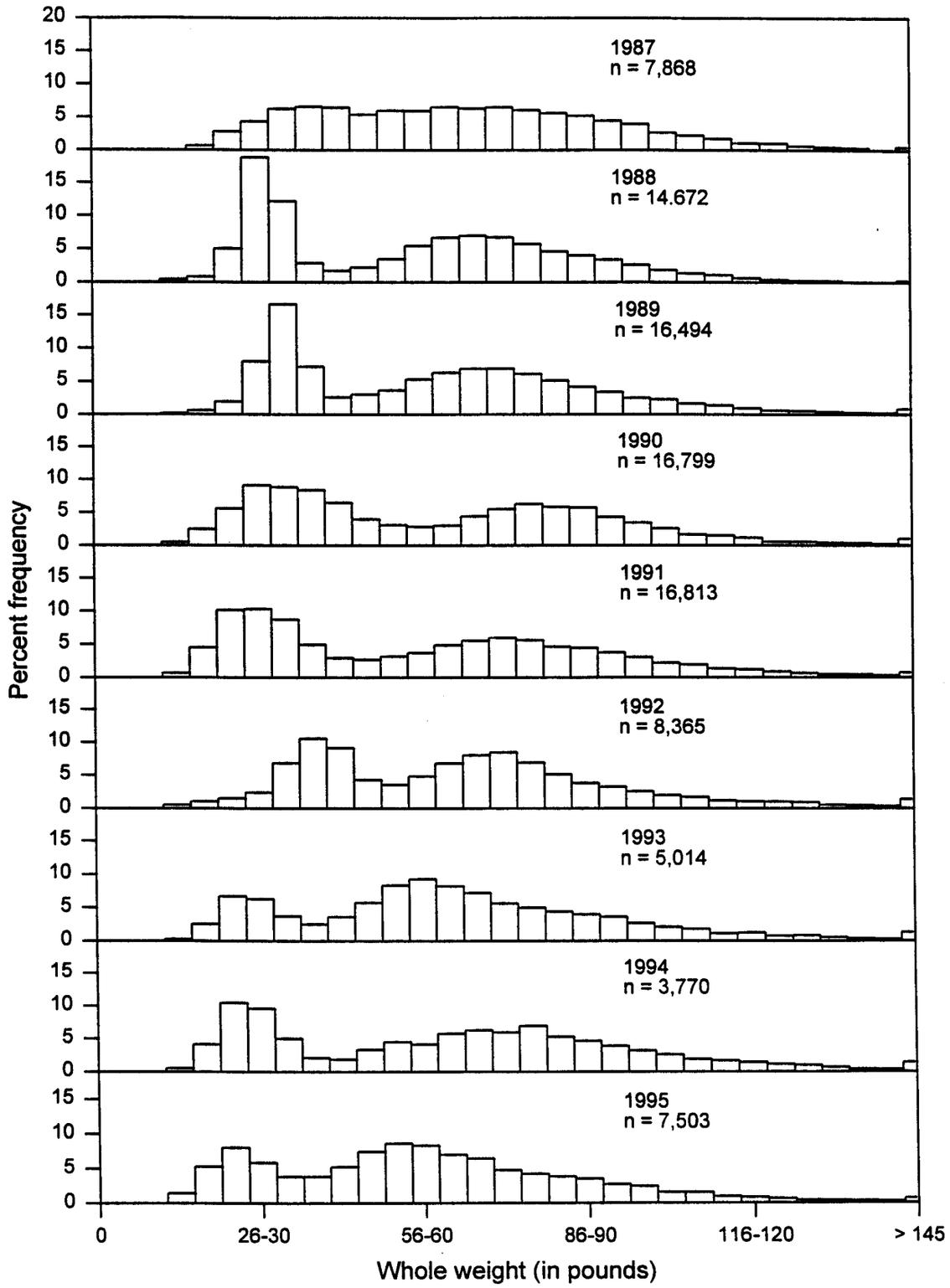


Figure 13.--Striped marlin weight-frequency histograms, 1987-95.

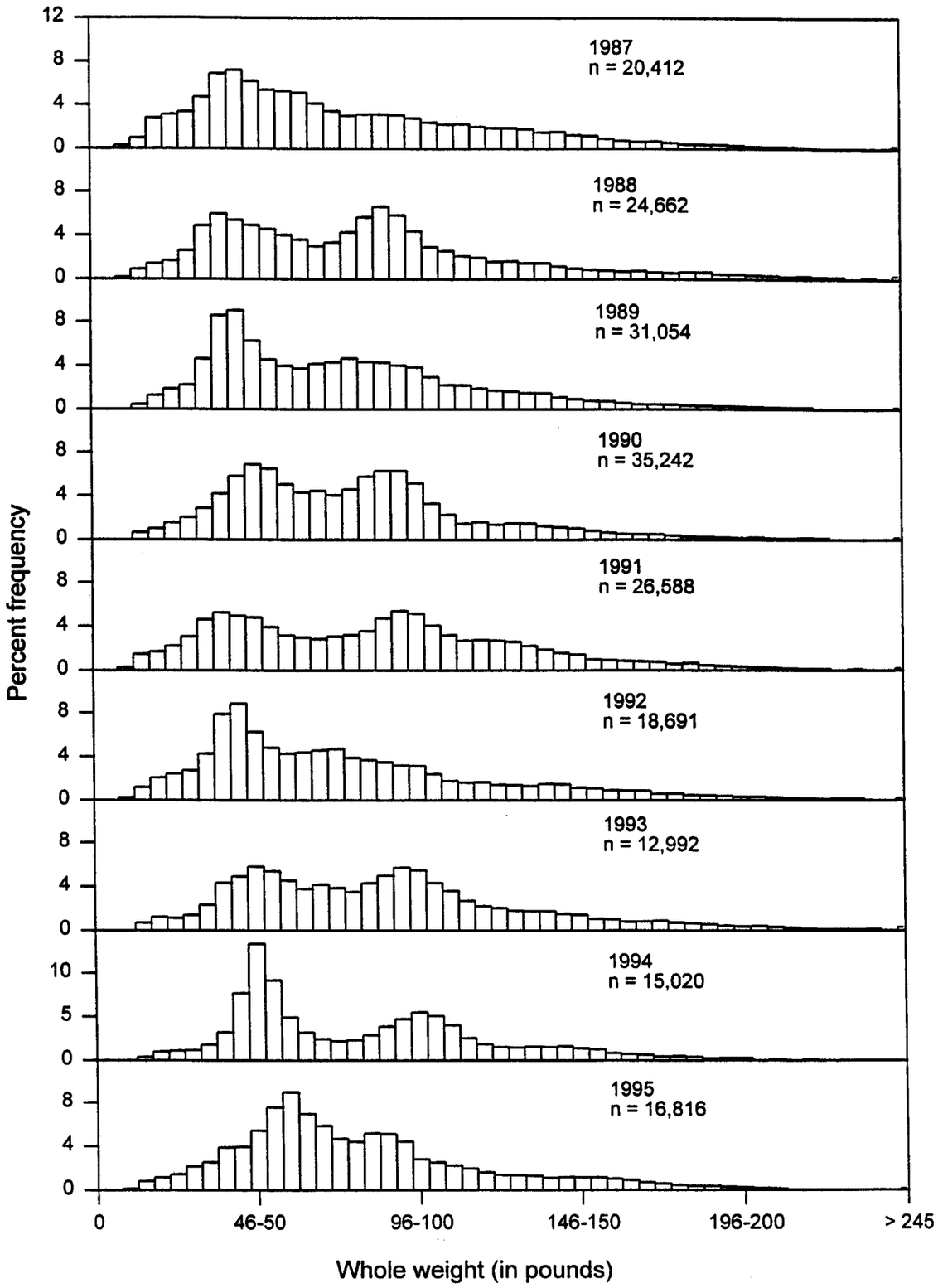


Figure 14.--Bigeye tuna weight-frequency histograms, 1987-95.

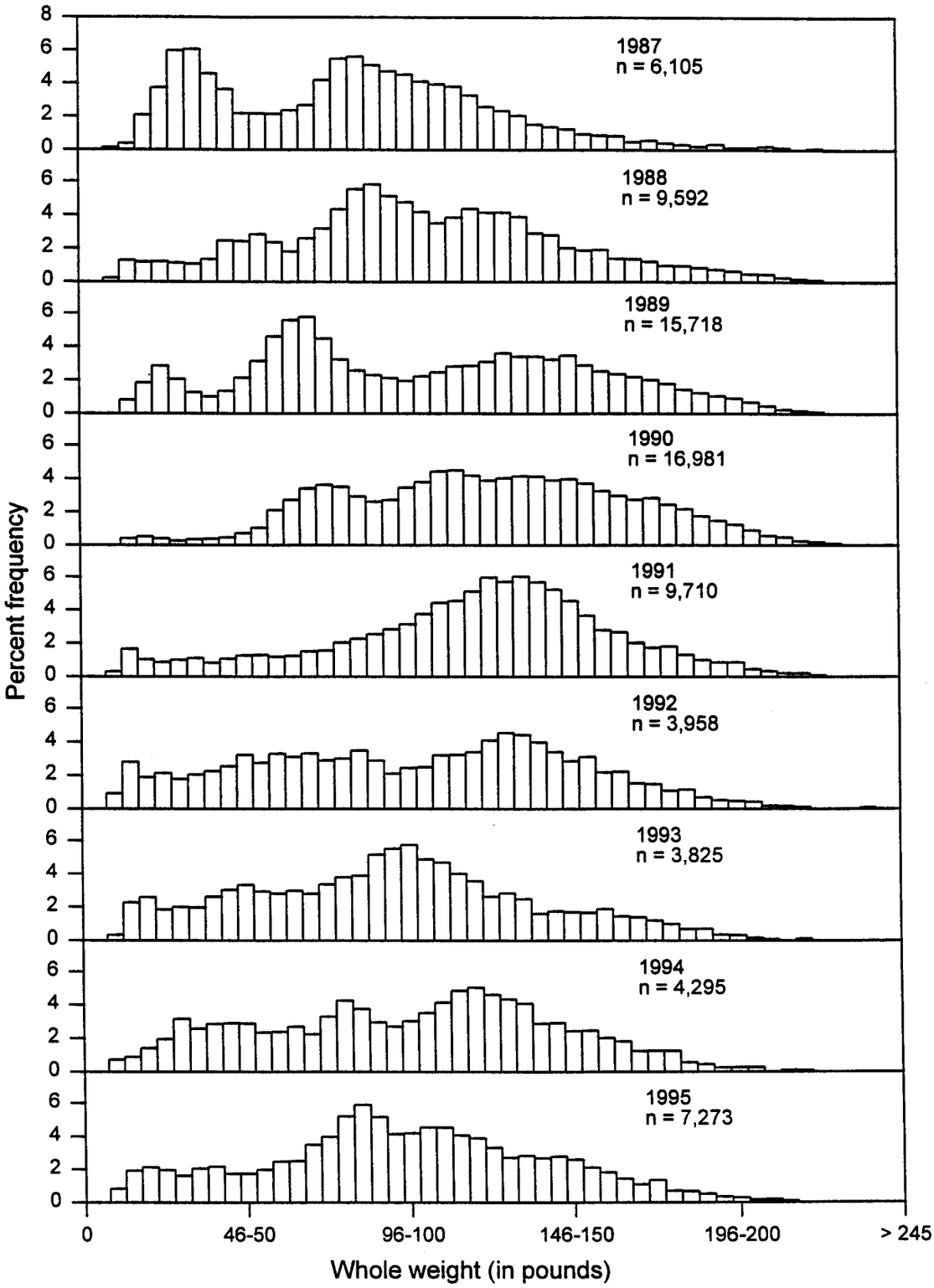


Figure 15.--Yellowfin tuna weight-frequency histograms, 1987-95.

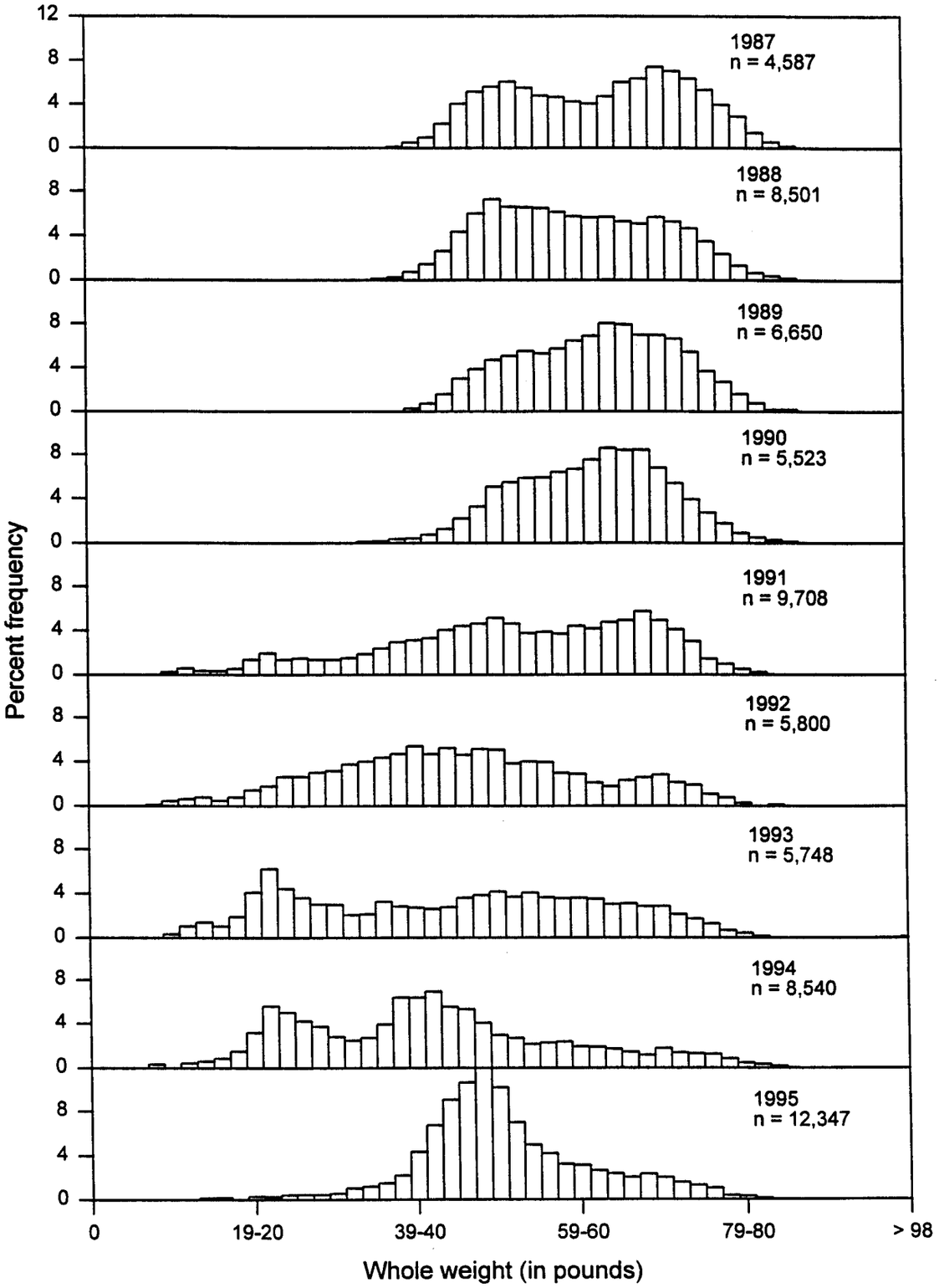


Figure 16.--Albacore weight-frequency histograms, 1987-95.

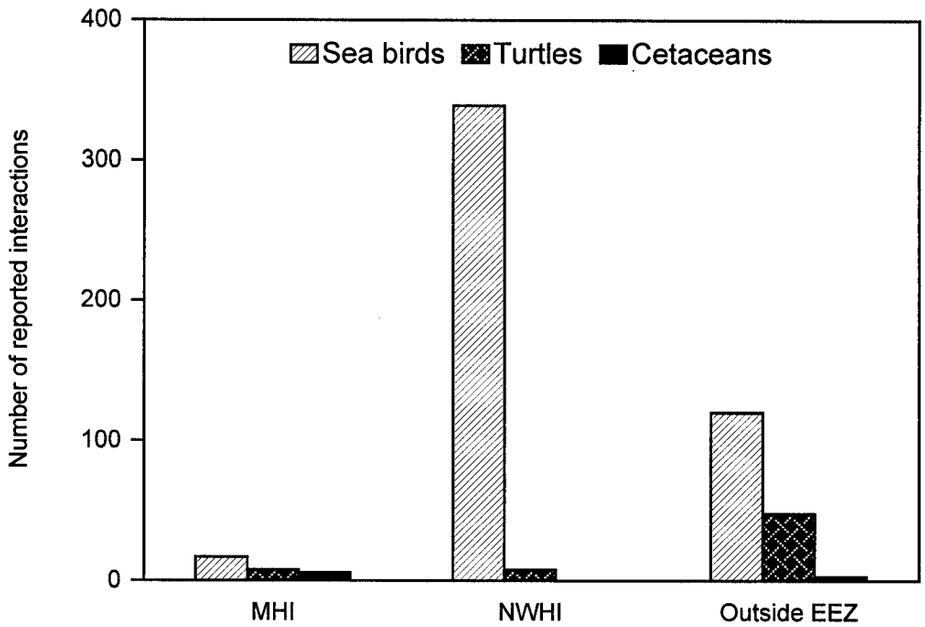


Figure 17.--Reported interactions with protected or endangered species by area, 1995.