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WESTERN PACIFIC PELAGIC FISHERIES IN 1990

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PREFACE

The pelagic management unit species (PMUS), composed of billfish, mahimahi, ono (wahoo), and sharks, are managed by a fishery management plan prepared by the Western Pacific Regional Fishery Management Council (WPRFMC). Currently, tunas are not managed in the western Pacific, but they are a major component of the pelagic landings. This report is a summary of the current status of the major pelagic fisheries in Hawaii and the foreign albacore longline fishery operating out of American Samoa. All information is based on commercial landings data. Although recreational and subsistence fisheries are important in the western Pacific and may comprise a substantial amount of the actual total landings of some pelagic species, comprehensive data on recreational fisheries in Hawaii are nonexistent. Excerpts from this report were provided for the annual report on the PMUS fisheries prepared by the WPRFMC's plan monitoring team.

CONTENTS

INTRODUCTION

This report examines Hawaii's domestic pelagic fisheries and imports in 1990 and the foreign albacore longline fishery operating out of American Samoa for 1985-89. The scientific names of relevant species are in Table 1. The most prominent pelagic fisheries in Hawaii are the longline fishery, the troll and handline fishery (mostly small boats), and the aku fishery (live bait pole-and-line fishery targeting skipjack tuna). The longline and troll and handline fisheries are responsible for landing most of the pelagic management unit species (PMUS). The longline fishery primarily targets tunas and swordfish; the troll and handline fishery lands a variety of PMUS and tunas. Landings by the aku boat fishery are substantial, with skipjack tuna dominating the catch and PMUS being insignificant. The PMUS are also caught incidentally by bottomfish vessels in the Northwestern Hawaiian Islands (NWHI), but landings are low compared to the longline and troll and handline fisheries.

Four major pelagic fisheries operate out of Pago Pago, American Samoa: foreign tuna longliners targeting albacore; foreign tuna longliners targeting bigeye and yellowfin tunas (sashimi longliners); purse seiners, composed mainly of U.S. flag vessels fishing for skipjack tuna (but also catching a substantial amount of yellowfin tuna); and U.S. surface trollers fishing for albacore. Fish are also transshipped to American Samoa from other ports. A substantial portion of the bycatch landed by the foreign longline fisheries is composed of PMUS. Albacore longliners off-load all of their catch to the canneries, while sashimi longliners off-load only a portion to the canneries and transship most of their catch to other destinations (primarily Japan).

HAWAII'S DOMESTIC PELAGIC FISHERIES

Recent Developments

Hawaii's longline fleet has grown substantially since 1987. More vessels from the Gulf of Mexico and the west coast, as well as a few swordfish boats from the east coast, entered the longline fishery in 1990. Tunas are the traditional target species of longliners operating in the western Pacific, but techniques used to target swordfish became widespread throughout the fleet in 1990. Most of the swordfish and some yellowfin tuna are being exported to the U.S. mainland along with high grade bigeye tuna which are also exported to Japan. This longline fishery is described in some detail in a later section.

Federal regulations 50CFR685 require longline vessel owners and operators in the U.S. Pacific region to have a federal longline permit. The issuance of federal longline permits and logbooks was implemented in November 1990; 140 permits were issued and 173 logbooks were collected by the end of 1990. Emergency federal regulations (implemented in April 1991) initiating a moratorium on U.S. longline vessels fishing in Hawaii require longliners to meet additional criteria to obtain a limited entry permit. The impact of those regulations will be reviewed in next year's annual report on the pelagic fisheries in the Western Pacific.

Scientific observers were placed on swordfish longline vessels intending to fish within 50 miles of the NWHI to investigate allegations of interactions with the endangered monk seal (*Monachus schauinslandi*) as well as interactions with other protected species (Dollar et al. 1991). No interactions with monk seals were observed, but interactions with whales, turtles, and seabirds were witnessed. Vessel operations and catch information were also collected by the observers. The 50-mile NWHI area was closed to longlining entirely in May 1991.

The rapid growth of Hawaii's pelagic fishery is largely due to the increased activity of the longline fishery. This growth in the longline fishery has also been the center of controversy. Certain aspects of the fishery expansion have been perceived by some as negative; for example, some believe the expansion has resulted in reduced local abundance of fish and lower prices. Strong evidence of local fish depletion has not been found (Boggs 1991). However, increases in the volume of fish sold have not resulted in lower annual prices for pelagic fish; the longline fishery has created a consistent and varietal supply of products at the retail level and has opened up export markets for Hawaii's pelagic fishery.

The "conflict" which began in 1989 between small boats fishing for pelagic species and longliners fishing near the main Hawaiian Islands (MHI) still persists. Before the recent rapid expansion of the longline fleet, longliners fished within sight of land (June 1950; Otsu 1954; Shomura 1959; Hida 1966; Yoshida 1974; Honda 1985; Kawamoto et al. 1989). Lack of compliance with a 1989 "gentlemen's agreement" establishing a voluntary 20-mile buffer zone near the MHI led the WPRFMC to create a federally mandated 50- to 75-mile longline exclusion zone. Domestic longline gear conflicts also occurred amongst the longliners themselves and with the foreign drift gill-netters. Reports of longliners cutting each other's gear and setting it adrift occurred where several boats fished the same area. Gear conflicts (propeller fouling and gear entanglement) between U.S. longline vessels and foreign monofilament driftnets occurred in international waters north of Hawaii.

Data Sources and Problems

The estimates herein of Hawaii's pelagic landings are derived from the National Marine Fisheries Service (NMFS) wholesale market monitoring program which samples landings in Hawaii's fresh fish markets. Landings, when necessary, have been adjusted to whole weights to account for processing (e.g., gilled and gutted, headed and gutted, shark bites). The sample data cover a portion of the entire market, mainly landings from Oahu and the island of Hawaii. To provide estimates of Hawaii's total commercial landings, the sample data are "scaled" to market-wide quantities through raising factors. The raising factors range from 1.1 to 2.8, depending on the coverage of the sample and the type of fishing gear. Although market structure has changed during this period, no recent statistical base is available to verify or revise the raising factors. Therefore, NMFS landings and revenue estimates in all of the figures and tables must be considered provisional and used with care.

Data from the Hawaii Division of Aquatic Resources (HDAR) on the 1990 commercial landings in Hawaii were incomplete when this report was prepared. Data have been reported by the HDAR on landings of tunas and PMUS (Table 2) and landings by gear type for 1970-89 (Fig. 1A). Considerable differences exist between the commercial landings of major pelagic species reported by HDAR and NMFS. The HDAR data are from monthly catch reports submitted by licensed commercial fishermen; NMFS estimates of pelagic landings are compiled from a wholesale market sampling program. Neither source of data is completely adequate. The HDAR data are subject to underreporting, particularly by the longline segment of the pelagic fishery; NMFS estimates are based on old extrapolation factors.

The differences between NMFS and HDAR data can be examined in reference to 1989 landings. The HDAR data indicate that the pelagic fisheries landed 12 million lb in 1989; NMFS estimates 17.6 million lb, a 47% difference. The largest difference is in the longline fishery, where HDAR data indicate only 4.3 million lb were landed, compared to the NMFS estimate of 9.8 million lb (Fig. 1B). Since NMFS directly samples a very large percentage (probably over 75%) of longline landings, its estimate appears to be more reliable. The differences between HDAR figures and NMFS estimates are greatest in the landings of bigeye tuna and swordfish.

The problem with the HDAR data also can be seen in Figure 1C, where reported longline landings dropped substantially in 1979 and 1980, representing a change in data reporting practices by most of the longline fleet. The problem of underreporting by the longline fleet continued until 1989 when the HDAR began a concerted effort to resolve the problem. The HDAR reported landings were substantially closer to NMFS estimates in 1989 than in 1987-88. The NMFS sampling does not discriminate between trolling and handline gear types, but differences exist between NMFS estimates of combined landings and HDAR reports for those categories. The HDAR figures indicate total landings by the troll and handline fishery equaled 4 million lb in 1989, compared to the NMFS estimate of 4.7 million lb, only a 18% difference. By applying the HDAR ratios for 1989 to each of the major species, the differences in catch by gear type and species composition can be shown (cf. Fig. 2).

Estimates of Landings and Revenue

The estimates of Hawaii's pelagic landings are grouped into general pelagic categories; i.e., PMUS, tunas, and other pelagic species. Hawaii's pelagic landings and revenue are summarized by major species in Tables 3 and 4. Estimates of landings and revenue have been rounded to the nearest 100,000; therefore, landings of <50,000 lb and revenue of <$50,000 are not significant and not included in summary totals. Revenue in the following is presented as nominal and inflation-adjusted (1990) values. Inflation-adjusted revenue takes into account the increase in the Honolulu consumer price index during 1987-90.

Total commercial landings of all pelagic fishes in 1990 increased to 18.7 million lb, worth $37.4 million (Fig. 3A). The PMUS landings and revenue increased dramatically in 1990 to 8.3 million lb, valued at $12.8 million (Fig. 3B). This represented a 36% increase in landings and a 62% increase in revenue over 1989 estimates. Swordfish and mahimahi accounted for most of the increase in PMUS landings. Swordfish landings increased 5.7 times over 1989 landings. Landings of blue marlin, striped marlin, and other billfish peaked in 1989 (Fig. 4A). Mahimahi landings increased threefold since 1988 (Fig. 4B). Ono landings decreased 200,000 lb while shark landings increased from negligible amounts to 200,000 lb during the 1987-90 period.

Total landings of tunas actually decreased for the third consecutive year. Tuna landings were 22% lower than the 1988 landings (Fig. 5A). Nominal tuna revenues remained about the same from 1988-90. The decline in tuna landings is directly attributable to the decrease in skipjack tuna landings which have fallen 70% since 1988 (Fig. 5B). Bigeye tuna is the only major tuna species that showed a steady increase, while yellowfin tuna landings varied over the 1987-90 period. Albacore landings were relatively low in comparison to the other tuna species and declined 43% since 1988.

Landings by Gear Type

The major gear types in Hawaii's pelagic fisheries are grouped into three categories: longline; troll and handline; and other gear types. Since troll and handline techniques vary widely in targeting pelagic species and result in substantially different catch compositions, they could not be differentiated and thus were combined into one category. Other gear types include aku boats, distant-water trollers (albacore trollers), and various fleets in the NWHI (primarily bottomfish and lobster vessels).

The number of longline vessels increased from 37 in 1987 to 138 in 1990 (Fig. 6A). Longliners targeted tunas during 1988-89, but a portion of the fleet began targeting swordfish in the winter of 1989. Exploratory fishing trips targeting swordfish have shown large concentrations of fish within the range of many longline vessels. Ten vessels fished for swordfish in 1989. The techniques for targeting swordfish became widespread throughout the longline fleet in 1990; about 20 vessels targeted swordfish at various times during the year. Additional vessels entered Hawaii's longline fishery in 1990: vessels from the yellowfin tuna fishery in the Gulf of Mexico and swordfish longliners from the east coast.

Swordfish are delivered as fresh, iced products which are dressed (headed, gutted, and finned). Almost all of the swordfish are shipped to the U.S. mainland market, and reports indicate that Hawaii has become a major supplier to mainland wholesale outlets in such areas as Los Angeles and San Francisco on the west coast and New York and Boston on the east coast (J. Kaneko, Hawaii Seafood Co., Honolulu, Hawaii., September 1991).

Changes in relative landings by gear type were apparent in 1990. Longline and troll and handline landings increased while other gear type landings decreased. Catch composition by gear type also changed dramatically in 1990: Swordfish accounted for a major percentage of the longline catch, whereas mahimahi landings increased substantially for trollers and handliners (Tables 5-6).

Longline landings increased more sharply than revenue in 1987-90: Landings were 3.3 times higher, and nominal revenue 2.8 times higher (Fig. 6B). In 1990, longline landings totaled 13.0 million lb with a net worth of $28.6 million. Longline landings of PMUS in 1990 were 6.3 times higher than in 1987 (Fig. 7A). Swordfish, which were once caught only incidentally, were responsible for the dramatic increase in PMUS landings. Striped and blue marlin landings increased substantially over the 4-year period (2.2 and 8.0 times higher, respectively). Mahimahi and shark landings increased in 1987-89 but only represent a small portion of the longliners' catch. With the exception of 1989, ono landings showed little change. Longline tuna landings in 1990 were 2.3 times higher than in 1987 (Fig. 7B). Bigeye tuna dominated the longline tuna landings, increasing almost twofold from 1987 through 1990. Yellowfin tuna landings have increased 4.2 times since 1987. Albacore landings peaked in 1988 and have decreased since.

Troll and handline landings decreased from 1987 to 1990 (Fig. 8A). Revenue followed the same pattern as landings, decreasing in 1987-89 and remaining about the same in 1990 (4.1 million lb with a net worth $6.6 million). PMUS landings by the troll and handline fishery fluctuated (Fig. 8B). The two major components of PMUS landings by troll and handline are blue marlin and mahimahi. Ono and striped marlin landings were generally low. The tuna landings declined dramatically during 1989-90 (Fig. 8C). Decreased catches of yellowfin tuna, the major component of the tuna landings, were directly related to the decline in tuna landings by troll and handline vessels. Bigeye tuna landings have increased and are becoming a more important component of the troll and handline fishery. Landings of skipjack tuna by troll and handline vessels have not changed much since 1987.

Landings by the aku boats decreased dramatically; the decrease was directly related to declining aku boat activity and poor catch rates. A high percentage of trips had no landings in 1990 (Fig. 9A). Some fishermen commented that 1990 was the worst year in recent times. Aku landings declined 75% since 1988 (Fig. 9B). Average catch per trip (aku only), as well as the average catch per trip of large aku, decreased more than 50% from 1988 (Fig. 9C).

With the exception of ono which were caught by bottomfishing vessels in transit to and from fishing grounds, other gear types account for negligible PMUS landings.

Allocation of Species by Gear Types

Much of the controversy in Hawaii's pelagic fisheries involves the conflict between expanded and increased landings by the longline fleet, which "infringes" on the troll and handline fishery. Although this report compares the allocation of species by gear types, no statistically significant relationship between increased landings in the longline fishery and decreased landings in the troll and handline fisheries has yet been found (Boggs 1991). Based on total landings by gear type, longline landings increased steadily, troll and handline decreased gradually, and aku boat landings peaked in 1988 and decreased dramatically in 1988-90 (Fig. 10A).

Longline PMUS landings have increased since 1987 and have risen dramatically during the past 2 years (Fig. 10B). Most of the increase was due to swordfish landings, although marlin landings increased also. Almost all PMUS landed by the troll and handline category were caught by trollers, with almost none caught by handliners. The change in troll and handline PMUS landings was moderate in comparison to longline PMUS landings.

Blue marlin landings peaked in 1989 and declined in 1990 (Fig. 11A). Most of the increase in 1989 and 1990 resulted from landings by longliners. Longline landings of blue marlin exceeded those of trollers in 1990. Striped marlin landings increased dramatically in 1988, rose slightly in 1989, and remained about the same in 1990 (Fig. 11B). Most striped marlin were caught by longliners, and the increase between 1987 and 1990 is because of the longliners. Although longline landings of mahimahi increased during 1988-90 (Fig. 12A), troll and handliners still accounted for most of the mahimahi landings. Ono landings varied during 1988-90 (Fig. 12B); with the exception of 1989, trollers and handliners landed more ono than did longliners.

The greatest changes in tuna landings were the increases experienced by longliners and the decreases experienced by aku boats (Fig. 13A). Tuna landings by troll and handliners dropped sharply in 1989 and were about the same in 1990. Most of the increase in bigeye tuna landings was due to longline landings, but bigeye tuna landings by trollers and handliners increased also (Fig. 13B). Total landings of yellowfin tuna looked stable, but the landings by gear type have changed considerably during the past 4 years (Fig. 14A). Trollers and handliners landed more yellowfin tuna in 1987 and 1988, but longline catches increased steadily overtaking trollers and handliners in 1989 and 1990.

Skipjack tuna landings have decreased drastically since 1988. However, the aku boat fishery has continued to have much higher landings than the other fisheries (Fig. 14B). Troll and handline landings of skipjack tuna changed little during the 4-year period.

Size of Catch by Gear Types

Longline gear is used to target large tunas (Sakagawa et al. 1987) and swordfish (Berkeley et al. 1981). Size of catch was summarized for longliners and trollers and handliners operating out of Honolulu (Table 7). Since only larger fish have tended to be shipped from the outer islands to Honolulu's market, the outer-island catches were not included in the size summaries. Size summaries for swordfish and albacore were produced for longline catches only, although they have been caught by trollers incidentally.

The mean size of swordfish caught by longliners increased from 1988 to 1990. Catches of small swordfish being released or discarded (Dollar et al. 1991) may have caused the increase in mean size. The mean size of blue marlin has increased for both gear types from 1988 through 1990, and blue marlin caught by trollers were larger than those caught by longliners. Slightly larger striped marlin were landed by trollers, while longliners landed larger mahimahi (except in 1990) and ono. Longliners caught much larger bigeye and yellowfin tunas than did trollers and handliners, and the mean size of yellowfin tuna increased for both gear types during 1987-90. Mean size of albacore caught by longliners was about 60 lb. The mean size of skipjack tuna caught by trollers and handliners ranged from 8.9 to 13.6 lb.

Weight-frequency histograms were produced for swordfish, blue and striped marlins, and bigeye and yellowfin tunas. Longline-caught swordfish were predominantly small in 1987-88 when tunas were the primary target species. In 1989-90, the size distribution of swordfish larger than 100 lb gradually tapered off with no definite modes (Fig. 15). Blue marlin histograms typically had one mode for both gear types (Fig. 16). The size distribution between gear types showed a sharper peak and a dominant mode of smaller fish for longliners (Fig. 16). Striped marlin histograms usually had a bimodal distribution for both gear types, with a stronger mode of smaller fish caught by longliners (Fig. 17). The modes for striped marlin were about the same for both gear types in 1988-89. Bigeye tuna histograms for longliners showed a unimodal (1987) or bimodal distribution (1988-90) (Fig. 18A). The size distribution of troll and handline bigeye tuna catches were concentrated within the first three to five increments, with weak secondary modes of larger fish in 1988-90 (Fig. 18B). Yellowfin tuna histograms for longliners showed a bimodal (1987 and 1990) or trimodal (1988 and 1989) distribution (Fig. 19A). Most troll and handline yellowfin tuna catches were concentrated within the first four to five increments, followed by a flat or weak distribution of larger fish (Fig. 19B).

Market Prices for Pelagic Species

The market prices (ex-vessel) of pelagic species during 1987-90 are shown in Table 8. Some factors which may affect prices are supply, demand, size, and quality. Since most of the swordfish are exported, prices depend on factors outside the Hawaii market. Swordfish prices in Hawaii are affected by domestic production (mostly east coast and Hawaii longliners) and foreign imports (primarily from Brazil, Canada, Chile, and Mexico). Usually when the volume of fish is large, prices decrease. But in times of high demand, such as Christmas and New Year's Day, tuna prices in Hawaii tend to increase despite increased supply. The seasonality of skipjack and yellowfin tunas increases their supply during the summer months. Size also may affect the price of fish. Tuna prices generally increase with fish size, but the opposite is true for blue marlin. Very large blue marlin are usually less valuable per pound than the average-sized ones. Fishing methods and handling techniques can affect quality of the catch. The longline method has a lower incidence of burnt tuna syndrome (BTS) than troll and handline methods. Techniques have been developed to reduce BTS (Nakamura et al. 1987) and preserve the freshness of the catch (Yoshimura Industries Co. Ltd., 1987). However, the duration of a trip (especially with longliners) may cause the "freshness" of the catch to deteriorate. Average price summaries do not account for the previously mentioned factors.

With the exception of mahimahi and sharks, most PMUS prices changed little in 1987-89 (Table 8). The volume of mahimahi landings seemed to influence the prices for this species. In 1988 when landings were low, the average price was at its highest. In contrast, landings of mahimahi peaked in 1990 but had the lowest prices for the 1987-90 period. Prices for sharks followed the same pattern; as landings increased, prices decreased.

Tuna market prices changed little during the 4-year period. Bigeye tuna prices peaked in 1987, whereas yellowfin tuna prices peaked in 1989. Skipjack tuna prices have been affected by landings, prices have increased steadily since landings peaked in 1988.

In a comparison of prices obtained by gear type, trollers and handliners usually got slightly higher prices than longliners for striped marlin and mahimahi while longliners got better prices for bigeye and yellowfin tunas. Compared to trollers and handliners, longliners averaged $1.10-1.60/lb more for bigeye tuna and $0.82-1.09/lb more for yellowfin tuna.

HAWAII'S IMPORTS

Fishery products imported to Hawaii from foreign countries are summarized by the NMFS Southwest Region (SWR) Market News Service. These data originate from the inspection program of the U.S. Food and Drug Administration (FDA) in Hawaii. The Market News report summarizes imported fishery products entered (but not necessarily cleared) by the FDA in Hawaii. Most pelagic seafood imports are aggregate weights and do not differentiate between product forms such as fresh versus frozen or degree of processing (e.g., round, gilled-gutted, fillets, loins,). However, the majority of the mahimahi imports are frozen fillets, and most of the large tunas are fresh--gilled and gutted. Although the data summaries from the SWR are broken down by species, they are incomplete because lots entering the United States that are worth less than $1,000 are not monitored. These summaries do not account for imported pelagic fishery products which are shipped from other U.S. Customs districts to Hawaii or imports being transshipped to other U.S. Customs districts bypassing Honolulu Customs.

Pelagic imports increased steadily in 1987-89 and declined slightly in 1990 (Fig. 20A). In 1990, 5.3 million lb of pelagic seafood were imported to Hawaii. Imports of PMUS declined 24% to 2.9 million lb. Most of these PMUS imports were mahimahi from Taiwan (Fig. 20B) and ono from Japan.

Imports of tunas have increased 177% to 2.4 million lb in 1990. Yellowfin tuna constituted the largest component of the tuna imports, followed by skipjack and bigeye tunas (Fig. 20C). Almost all skipjack tuna imports were from Japan. Indonesia has supplied most of the bigeye and yellowfin tunas, but imports from Fiji increased tremendously in 1990.

The NMFS Market News does not provide prices for imported seafood. However, if average prices for tuna and other imported pelagic species from the NMFS wholesale market monitoring program were applied, the 1990 imports of fresh and fresh-frozen pelagics and tuna (excluding frozen mahimahi and similar products) would be worth about $3.6 million (2.7 million lb).

FISHERIES SUPPORTING CANNERIES IN AMERICAN SAMOA

The NMFS SWR has a sampling program in American Samoa which now concentrates on the off-loading of U.S. purse seiners. However, the sampling program also collects data from the foreign albacore longliners off-loading their catches in American Samoa. Longline logbooks are voluntarily maintained by vessel captains or are transcribed from the ship's log by NMFS personnel. Capture dates, rather than landing dates (for which complete data are available), are used to avoid disclosure of confidential information on landings. Because of the delay between capture and landing, the compilation of annual catches also is delayed. The most current annual summaries available are for 1989.

The number of albacore longliners off-loading in American Samoa increased slightly in 1989 to 96 vessels (Fig. 21A). The number of trips remained about the same (187 trips in 1989). Most of the albacore longline vessels were of Taiwanese and South Korean nationality with one vessel from Tonga. In addition to albacore longliners, foreign sashimi vessel activity decreased from 52 vessels in 1988 to 21 vessels in 1989. Although sashimi vessels are quite active, their landings amount to less than 2% in comparison to landings by albacore longliners.

Total landings by albacore longliners decreased 47% from 1987 to 1989. Landings decreased from 37,790 metric tons (t) in 1987 to 20,020 t in 1989 (Fig. 21B). The PMUS landings varied substantially (ranging from 3,130 t in 1987 to 1,790 t in 1988) but were low in comparison to tunas. The PMUS landings made up 10.3% of the total landings in 1989. Billfish accounted for most of the PMUS landings, with blue marlin being the largest component (Fig. 22A). Combined landings of spearfish and sailfish (range, 130-200 t in 1985-89) were similar to swordfish and ono landings. Sharks and ono also were landed by longliners; however, no records were available for mahimahi landings. Much of the decline in total landings has been attributed to decreased landings of tuna (34,460 t in 1987 to 17,790 t in 1989). Tunas made up 90% of the total landings in 1989; albacore comprised 84% of the tuna landings, followed by yellowfin and bigeye tunas, respectively (Fig. 22B).

The average catch per trip for the longline vessels off-loading in American Samoa declined 17% in 1989 (Fig. 22C). The average catch per trip of PMUS was static and quite low in comparison to tunas. Tunas, mainly albacore, were responsible for the decrease in average catch per trip.

DISCUSSION

Pelagic Fisheries in Hawaii

The landings and revenue generated by longliners have become increasingly important to Hawaii's pelagic fisheries. The rapid growth of the longline fishery in Hawaii continues in 1991. Studies on the financial and economic aspects of longline vessel operations would be useful to assess the long-term viability of this fishery in Hawaii.

Most of the publicity concerning Hawaii's pelagic fisheries concerns the conflict between local trollers and longliners. Public meetings have been organized by these trollers to express their concerns. Part of their argument is that catch rates have decreased in recent years, which appears to be true. However, as pointed out earlier, the causal link between longline landings and troll and handline catch rates has not been established (Boggs 1991). Furthermore, no detailed and accurate catch, effort, economic, or operational data are being collected on the troll and handline fishery. A data collection system for troll and handline fishermen, particularly for the non-market fishermen, would be useful in determining catch and effort in this fishery.

The longline swordfish fishery expanded rapidly. Most of the product is exported from Hawaii through several dealers. The logbook system provides good information on catch (number and species of fish) and effort by area only, as well as some data collected through anecdotal conversations with fishermen; however, monitoring the volume of landings, composition and size of catch, and the revenue generated by the fishery is incomplete. Since swordfish are under the Pelagic Fishery Management Plan, a mandated landings and revenue data collection system would greatly help in monitoring the swordfish fishery.

Hawaii's Imports and Exports

The importing of pelagic species has become increasingly important as a source for pelagic fish products. Though the weights of imports are compiled by the NMFS SWR Market News Service, the product form is not always noted, and the unit or aggregate prices are lacking. The approximation of import prices based on wholesale market monitoring is not very satisfactory. Therefore, we suggest the product form and value of the shipment be included in the Market News Service summaries.

Although the air export of fresh fish to the U.S. mainland and foreign destinations has become quite common, the amount and value of fish exported from Hawaii are currently not being monitored. The revenue generated by pelagic exports could be assesed more accurately by monitoring sales receipts of local dealers who export pelagic fish.

Foreign Albacore Longline Fishery in American Samoa

The foreign albacore longline fishery operating out of American Samoa produces substantial amounts of PMUS and tunas. The coverage of longline landings through reports of cannery landings is adequate, but collection of the catch and effort data from this fishery has declined substantially. Since the focus of the field sampling station in American Samoa is the data collection from U.S. purse seine vessels, this has decreased the manpower and time necessary to contact longline vessel operators and collect logbook information. Collection of catch and effort logs dropped from 75% of all trips in 1987 to 52% in 1989. Logbook collections in 1990 decreased to 32% in the second quarter (complete year data not yet available). Additional personnel are needed to increase the collection of logbooks if sampling rates are to be maintained. These are some of the areas where improvements can be made to increase the quality and quantity of fisheries data from Hawaii and American Samoa.

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Table 1.--Major pelagic species observed at the Honolulu market.

Common name	Scientific name
Pelagic Management Unit Species	
Blue marlin	*Makaira mazara*
Striped marlin	*Tetrapturus audax*
Broadbill swordfish	*Xiphias gladius*
Shortbill spearfish	*T. angustirostris*
Black marlin	*M. indica*
Indo-Pacific sailfish	*Istiophorus platypterus*
Mahimahi	*Coryphaena hippurus*
Ono (wahoo)	*Acanthocybium solandri*
Blue shark	*Prionace glauca*
Mako shark (short-fin)	*Isurus oxyrinchus*
Mako shark (long-fin)	*I. paucus*
Oceanic whitetip shark	*Carcharhinus longimanus*
Thresher shark	*Alopias superciliosus*
Tiger shark	*Galeocerdo cuvieri*
Tunas	
Bigeye tuna	*Thunnus obesus*
Yellowfin tuna	*T. albacares*
Albacore	*T. alalunga*
Skipjack tuna (Aku)	*Katsuwonus pelamis*
Kawakawa	*Euthynnus affinis*
Frigate tunas	*Auxis* spp.

Table 2.--Commercial landings of tunas and pelagic management unit species (PMUS) in Hawaii in 1970-89, based on reports from the Hawaii Division of Aquatic Resources. Data were compiled by NMFS; revenue and price are in U.S. dollars.

Year	Total pounds	Pounds sold	Revenue	Price
		Tunas		
1970	8,570,864	8,538,721	2,521,349	0.30
1971	14,722,479	14,676,336	3,856,064	0.26
1972	12,298,194	12,234,433	4,210,312	0.34
1973	11,992,229	11,911,670	4,552,543	0.38
1974	9,073,006	8,988,206	4,419,982	0.49
1975	7,282,803	7,069,071	4,426,543	0.63
1976	12,230,228	12,039,974	6,383,612	0.53
1977	10,511,584	10,333,550	6,946,560	0.67
1978	10,122,105	9,951,631	8,578,067	0.86
1979	8,942,065	8,779,867	8,080,179	0.92
1980	6,935,193	6,769,273	6,608,032	0.98
1981	7,250,912	7,108,833	7,143,823	1.00
1982	5,455,399	5,348,533	5,735,581	1.07
1983	5,508,537	5,307,565	6,564,019	1.24
1984	6,090,388	5,915,748	6,582,983	1.11
1985	4,772,340	4,608,843	6,194,289	1.34
1986	6,629,135	6,381,245	7,537,929	1.18
1987	7,726,981	7,424,612	9,766,111	1.32
1988	7,023,338	6,812,921	9,881,803	1.45
1989	8,673,519	8,468,365	17,219,796	2.03
		PMUS		
1970	734,103	660,420	365,322	0.55
1971	477,730	354,892	235,943	0.66
1972	469,765	337,264	250,980	0.74
1973	435,382	304,425	238,285	0.78
1974	527,240	391,471	269,570	0.69
1975	601,297	460,845	337,003	0.73
1976	741,110	562,496	486,514	0.86
1977	903,682	733,543	714,649	0.97
1978	1,095,094	901,044	889,359	0.99
1979	996,101	836,165	984,982	1.18
1980	1,084,159	945,180	1,232,551	1.30
1981	1,107,125	966,736	1,365,872	1.41
1982	1,026,111	911,711	1,489,232	1.63
1983	1,062,298	968,379	1,783,742	1.84
1984	1,053,652	957,523	1,921,690	2.01
1985	1,144,611	1,071,922	2,339,650	2.18
1986	1,622,596	1,524,472	2,902,862	1.90
1987	1,854,390	1,730,917	3,248,005	1.88
1988	1,696,260	1,570,396	2,809,179	1.79
1989	3,538,764	3,381,506	5,673,297	1.68

Table 3.--Species composition of pelagic landings (x 1,000) in Hawaii, 1987-90. Estimates are based on the shoreside monitoring program of the National Marine Fisheries Service.

Species	1987	1988	1989	1990
Pelagic Management Unit Species				
Swordfish	<50	<50	600	3,400
Blue marlin	900	1,000	1,900	1,400
Striped marlin	700	1,300	1,500	1,400
Other billfish	300	300	400	100
Mahimahi	1,000	500	1,100	1,500
Ono (wahoo)	500	400	400	300
Sharks	<50	100	200	200
Total PMUS	3,400	3,600	6,100	8,300
Tunas				
Bigeye tuna	1,900	3,000	3,700	4,000
Yellowfin tuna	3,400	4,000	3,300	3,700
Albacore	300	700	600	400
Skipjack tuna (aku)	3,700	4,400	3,500	1,300
Total tunas	9,300	12,100	11,100	9,400
Other pelagics	200	200	400	400
Total pelagics	12,900	15,900	17,600	18,100

Table 4.--Nominal value of Hawaii's pelagic landings by species (x $1,000), 1987-90. Estimates are based on the shoreside monitoring program of the National Marine Fisheries Service.

Species	1987	1988	1989	1990
	Pelagic Management Unit Species			
Swordfish	<50	<50	1,100	6,000
Blue marlin	900	900	1,400	1,000
Striped marlin	900	1,500	1,600	1,900
Other billfish	500	500	400	200
Mahimahi	2,200	1,700	2,300	2,800
Ono (wahoo)	1,100	1,100	1,000	800
Sharks	100	100	100	100
Total	5,700	5,800	7,900	12,800
	Tunas			
Bigeye tuna	6,700	9,800	11,600	12,900
Yellowfin tuna	6,200	7,600	6,600	7,900
Albacore	300	900	700	600
Skipjack tuna (aku)	4,200	4,800	5,100	2,300
Total tunas	17,400	23,100	24,000	23,700
Other pelagics	300	300	400	500
Total pelagics	23,400	29,200	32,300	37,000

Table 5.--Hawaii's pelagic landings (x 1,000 lb) by gear type, 1987-90. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service.

	Pelagic management unit species							Tunas				
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Mahi-mahi	Ono	Sharks	Bigeye tuna	Yellowfin tuna	Albacore	Skipjack tuna	Other pelagics
Longline												
1987	<50	100	600	200	<50	100	<50	1,800	600	300	<50	200
1988	<50	200	1,100	200	<50	100	100	2,700	1,300	700	<50	200
1989	600	800	1,300	300	200	200	200	3,100	2,200	600	<50	400
1990	3,400	800	1,300	100	400	100	200	3,400	2,500	400	<50	400
Troll and Handline												
1987	<50	800	100	100	1,000	300	<50	100	2,700	<50	200	<50
1988	<50	800	200	100	500	200	<50	300	2,400	<50	400	<50
1989	<50	1,100	200	100	900	200	<50	600	1,100	<50	500	<50
1990	<50	600	100	<50	1,100	200	<50	600	1,200	<50	300	<50
Other Gear Types												
1987	0	<50	<50	<50	<50	100	<50	<50	100	0	3,500	<50
1988	0	<50	<50	<50	<50	100	<50	<50	300	<50	4,000	<50
1989	0	<50	<50	<50	<50	<50	0	0	<50	0	3,000	<50
1990	0	<50	<50	<50	<50	<50	0	0	<50	<50	1,000	<50

Table 6.--Hawaii's pelagic revenue (x $1,000) by gear type, 1987-90. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service.

	Pelagic management unit species							Tunas				
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Mahi-mahi	Ono	Sharks	Bigeye tuna	Yellowfin tuna	Albacore	Skipjack tuna	Other pelagics
						Longline						
1987	100	100	800	400	100	200	100	6,500	1,500	300	<50	300
1988	100	200	1,200	400	100	200	100	9,200	3,300	900	<50	300
1989	1,100	600	1,400	300	400	400	100	10,600	5,100	700	<50	400
1990	6,000	700	1,700	200	600	200	100	11,800	6,200	600	<50	500
						Troll and Handline						
1987	<50	800	100	100	2,100	600	<50	200	4,400	<50	300	<50
1988	<50	700	300	100	1,600	600	<50	600	3,700	<50	400	<50
1989	<50	800	200	100	1,900	500	<50	1,000	1,500	<50	600	<50
1990	<50	400	200	<50	2,200	600	<50	1,100	1,600	<50	500	<50
						Other Gear Types						
1987	0	<50	<50	<50	<50	300	<50	<50	300	<50	3,900	<50
1988	0	<50	<50	<50	<50	300	<50	<50	600	<50	4,400	<50
1989	0	<50	<50	<50	<50	100	0	0	<50	<50	4,500	<50
1990	0	<50	<50	<50	<50	<50	0	0	100	<50	1,800	<50

Table 7.--Mean size of catch (in pounds) by gear type, 1988-89.

Species	Longline				Troll and handline			
	1987	1988	1989	1990	1987	1988	1989	1990
Pelagic Management Unit Species								
Swordfish	129.3	119.2	131.1	147.6	--	--	--	--
Blue marlin	161.4	157.3	164.7	198.4	212.1	181.6	185.7	243.3
Striped marlin	66.2	56.9	61.5	61.5	67.3	60.3	67.9	74.8
Mahimahi	21.1	20.0	23.0	18.7	18.8	17.2	19.9	19.1
Ono (wahoo)	33.3	31.9	34.6	36.0	19.5	21.1	20.9	21.9
Tunas								
Bigeye tuna	76.3	83.2	77.0	79.8	19.6	28.9	34.0	25.3
Yellowfin tuna	81.9	102.5	103.7	121.9	27.6	31.5	35.4	51.6
Albacore	62.3	59.7	62.0	61.2	--	--	--	--
Skipjack tuna (aku)	--	--	--	--	8.9	11.1	13.6	10.6

Table 8.--Nominal prices ($/lb) by species in Hawaii's market and in the longline and troll and handline fisheries, 1987-90. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service.

	Pelagic management unit species							Tunas			
Year	Swordfish	Blue marlin	Striped marlin	Other billfish	Mahi-mahi	Ono	Sharks	Bigeye tuna	Yellowfin tuna	Albacore	Skipjack tuna
					Market						
1987	---	1.02	1.43	---	2.30	2.74	1.45	3.56	1.86	1.61	1.14
1988	---	0.90	1.11	---	3.19	2.76	1.05	3.20	1.96	1.36	1.11
1989	2.19	0.87	1.08	0.93	2.31	2.50	0.82	3.33	2.23	1.31	1.49
1990	2.17	0.92	1.38	1.23	1.97	2.52	0.57	3.33	2.19	1.48	1.85
					Longline						
1987	---	1.22	1.36	---	2.25	2.89	1.50	3.63	2.57	0.88	---
1988	---	0.85	1.08	---	2.79	2.69	1.08	3.35	2.50	1.34	---
1989	2.33	0.87	1.02	1.04	2.31	2.27	0.62	3.51	2.45	1.31	---
1990	2.19	0.94	1.04	1.29	1.66	2.56	0.56	3.57	2.54	1.48	---
					Troll and Handline						
1987	---	0.99	0.92	---	2.35	2.47	---	2.53	1.70	---	1.22
1988	---	0.92	1.23	---	3.23	2.77	---	1.94	1.64	---	1.21
1989	---	0.88	2.26	---	2.32	2.70	---	2.06	1.63	---	1.50
1990	---	0.94	1.49	---	2.08	2.48	---	1.97	1.45	---	1.92

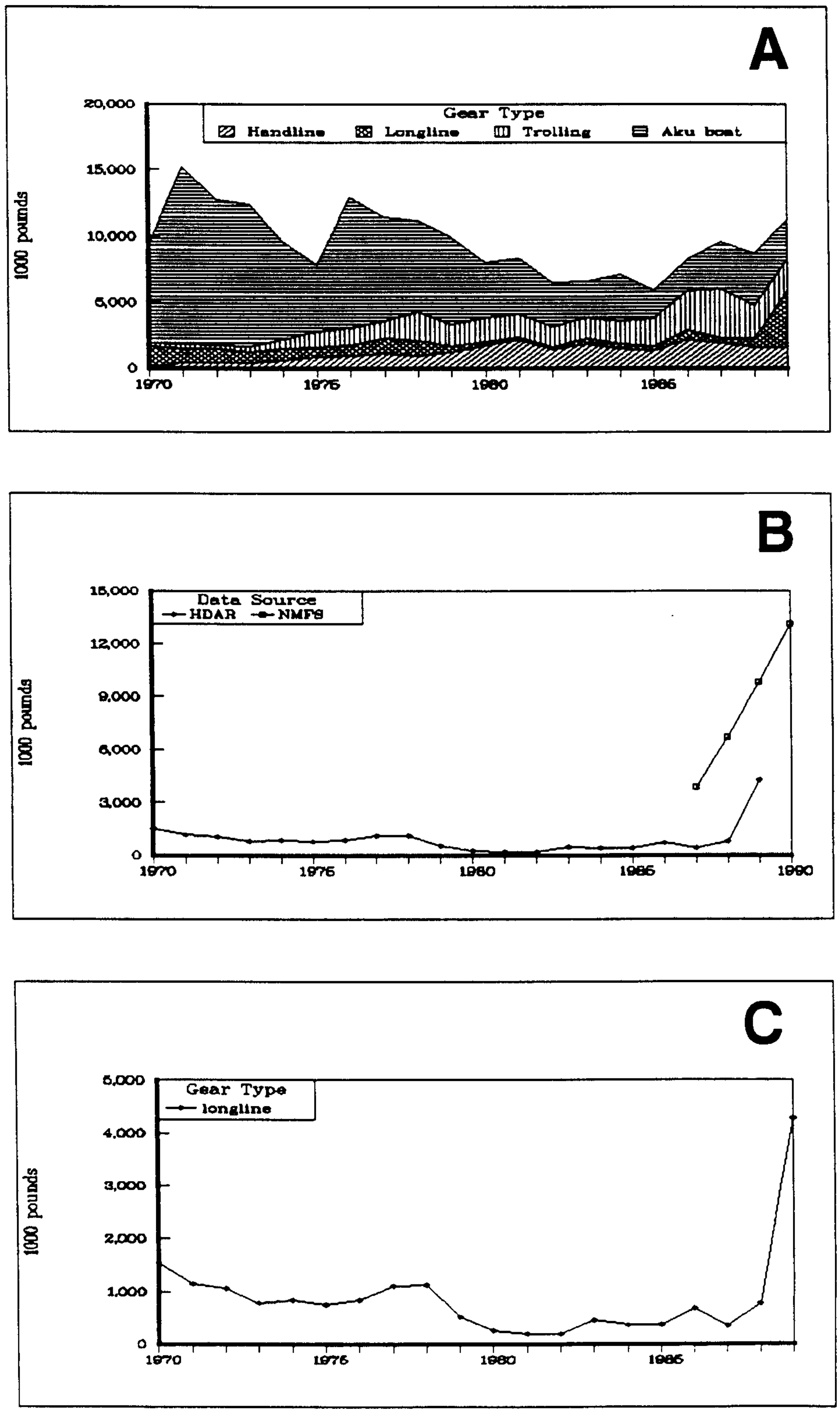


Figure 1.--(A) Landings by gear type based on HDAR data, (B) comparison of HDAR and NMFS estimates of longline landings, and (C) HDAR estimates of longline landings, 1970-1989.

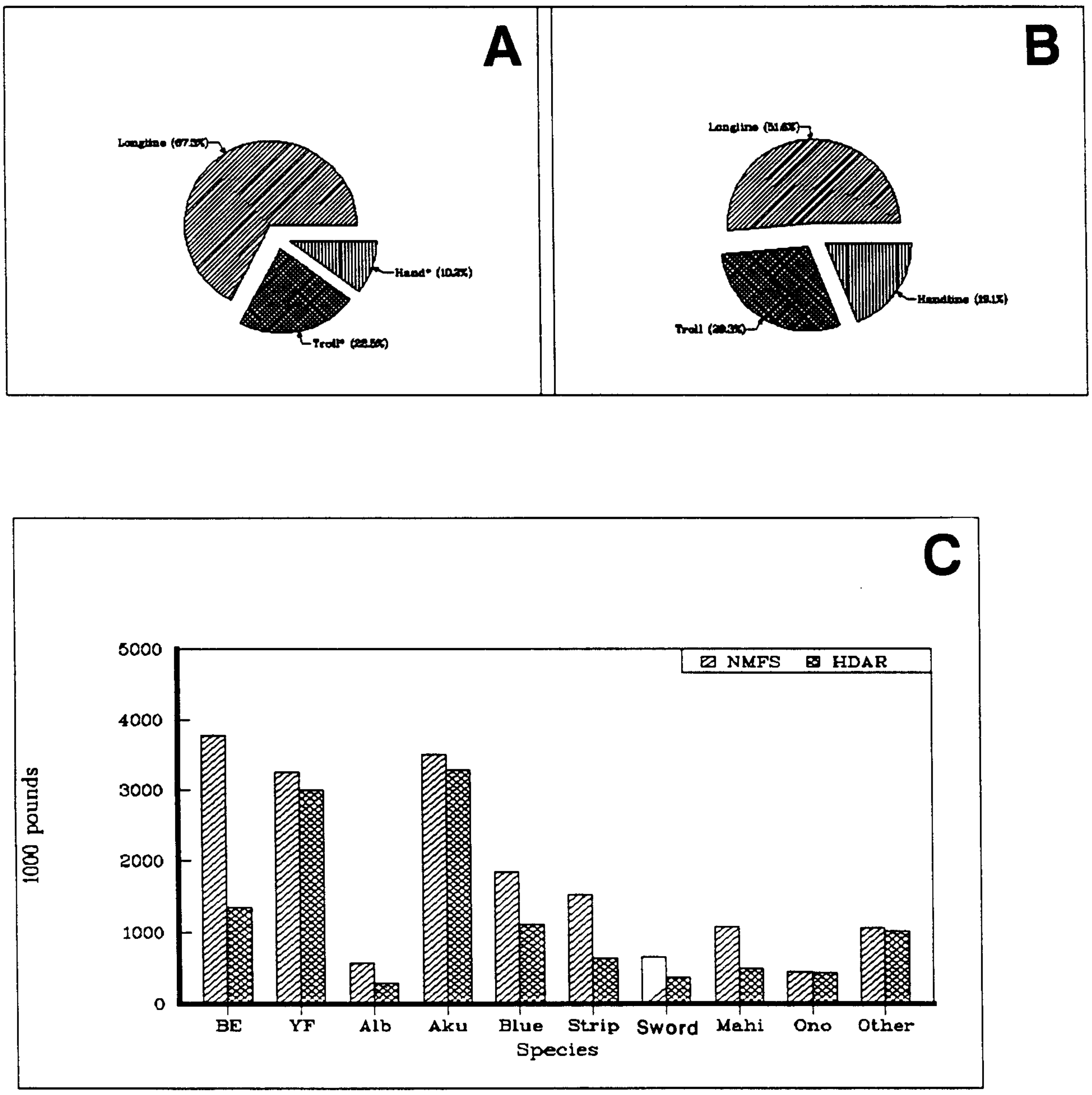


Figure 2.--(A) NMFS pelagic landings by gear type, (B) HDAR pelagic landings by gear type, and (C) comparison of HDAR landing figures and NMFS estimates of total pelagic landings by species, 1989.

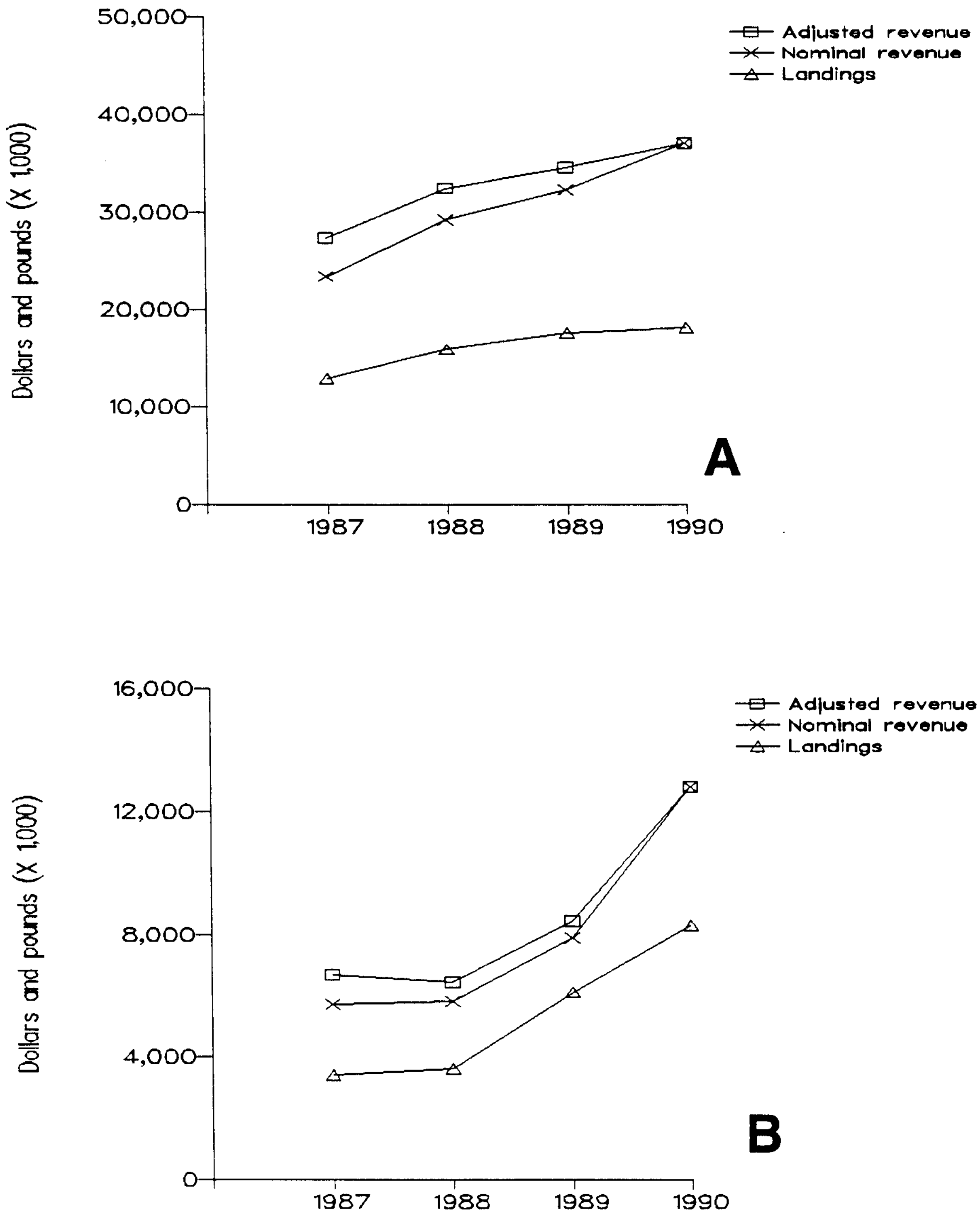
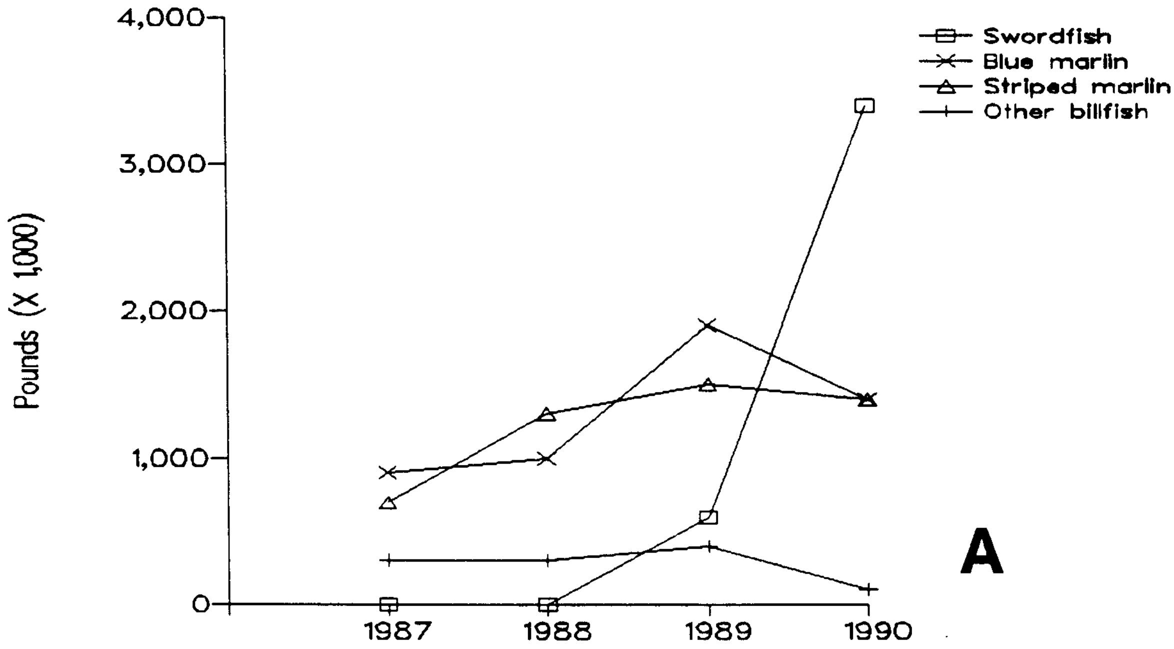


Figure 3.--Hawaii's landings by (A) total pelagic fishes and (B) pelagic management unit species, 1987-90.



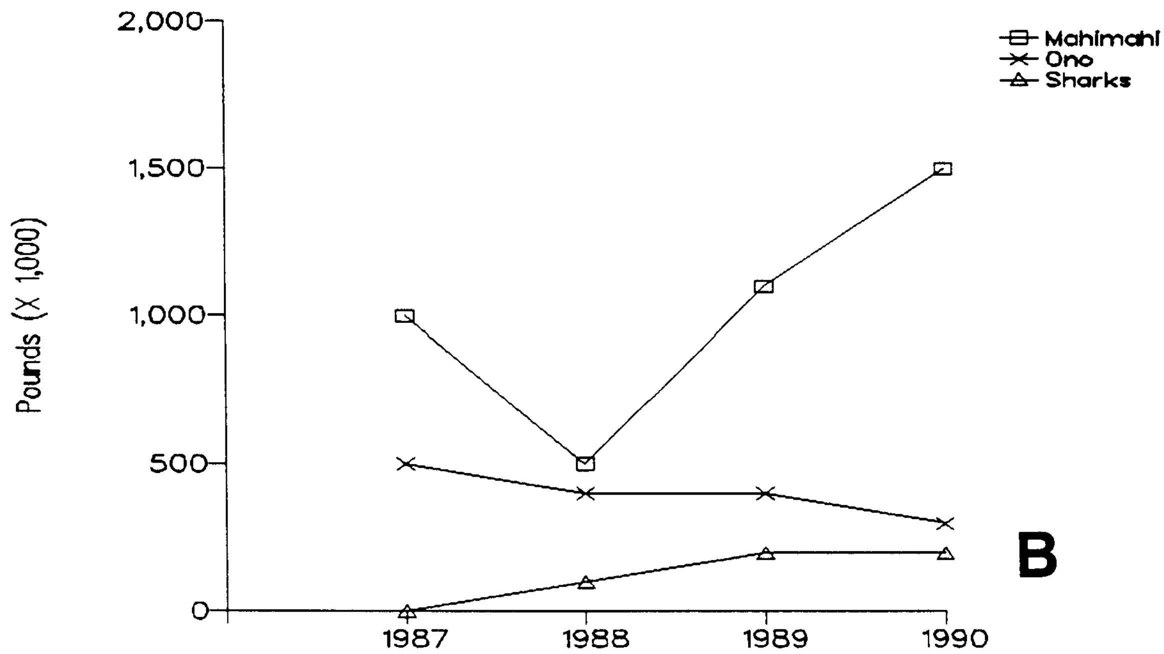


Figure 4.--Composition of pelagic management unit species in Hawaii, 1987-90: (A) billfish and (B) other pelagic management unit species.

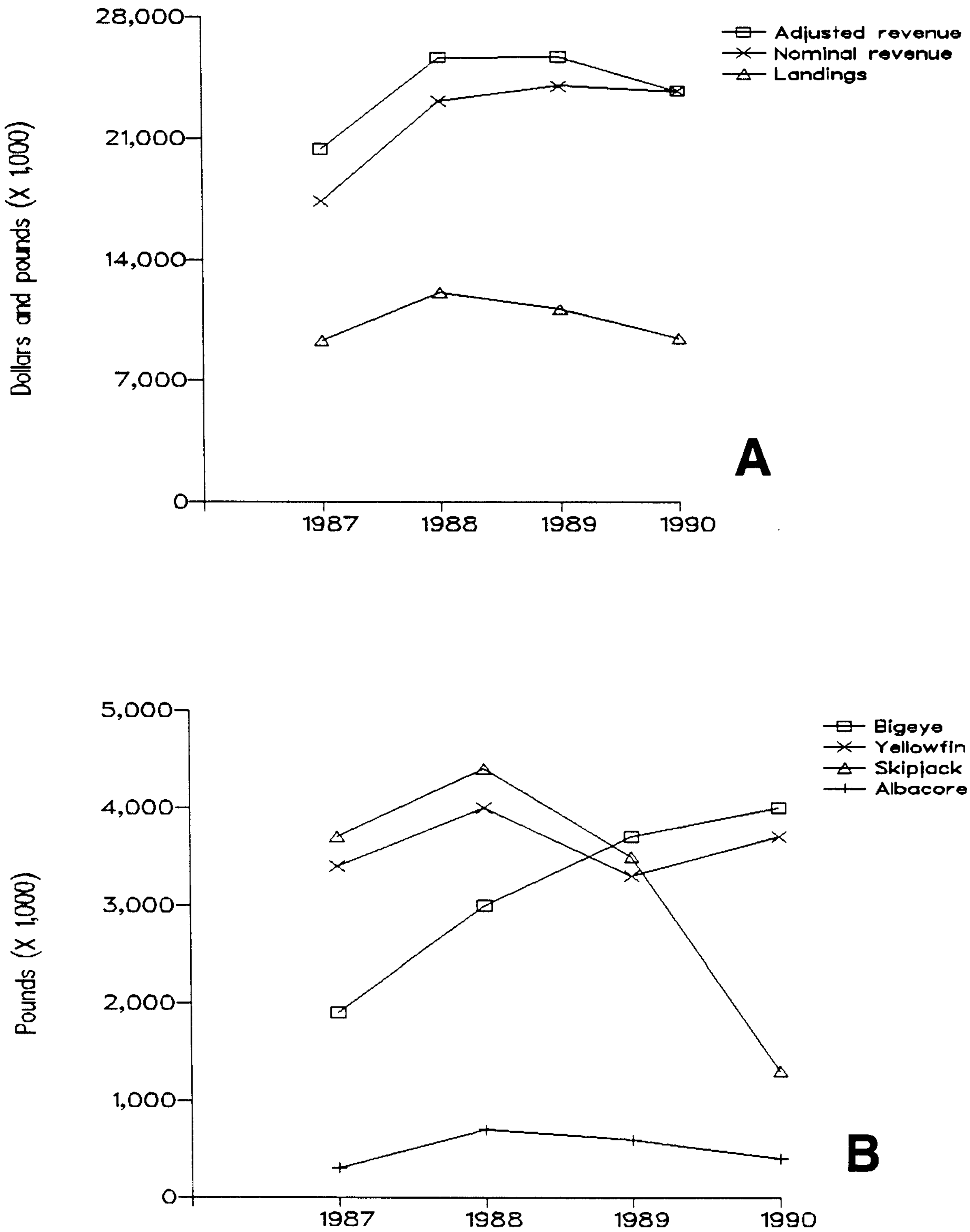
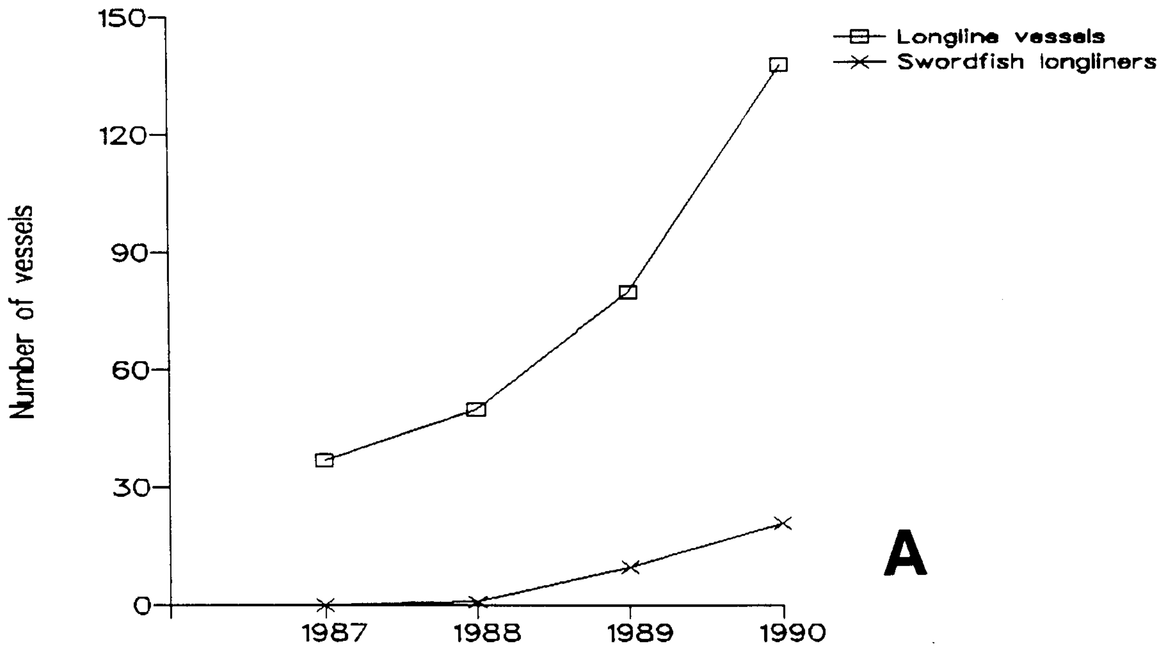


Figure 5.--Hawaii's tuna (A) landings and revenue and (B) species composition, 1987-90.



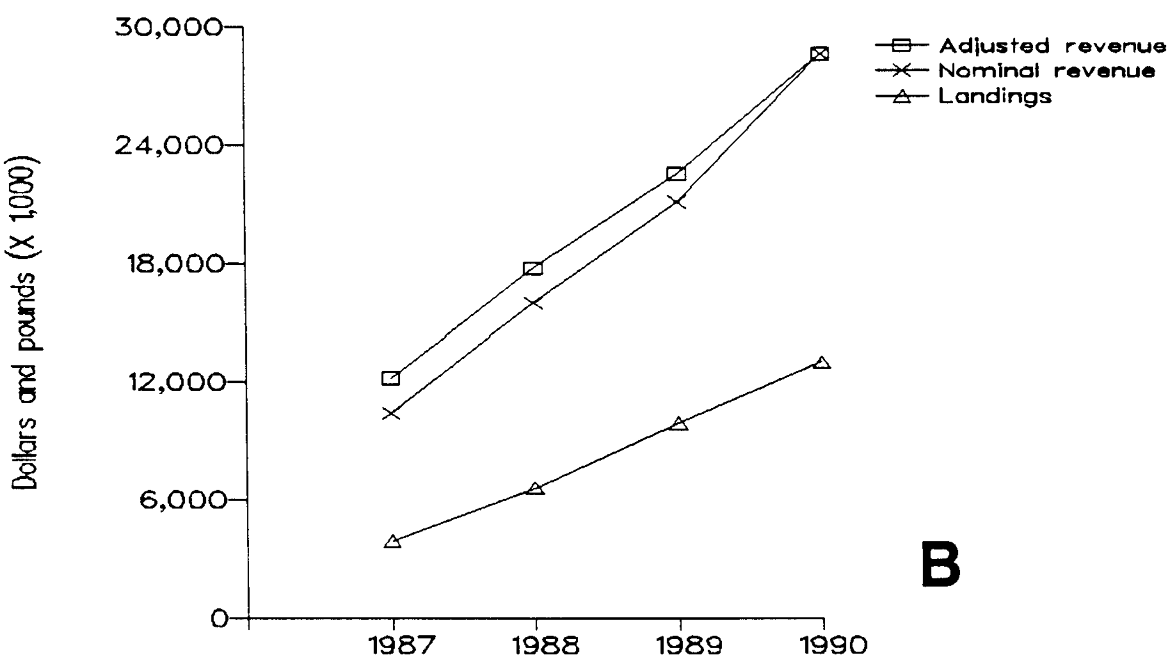


Figure 6.--Longline (A) vessel activity and (B) landings and revenue in Hawaii, 1987-90.

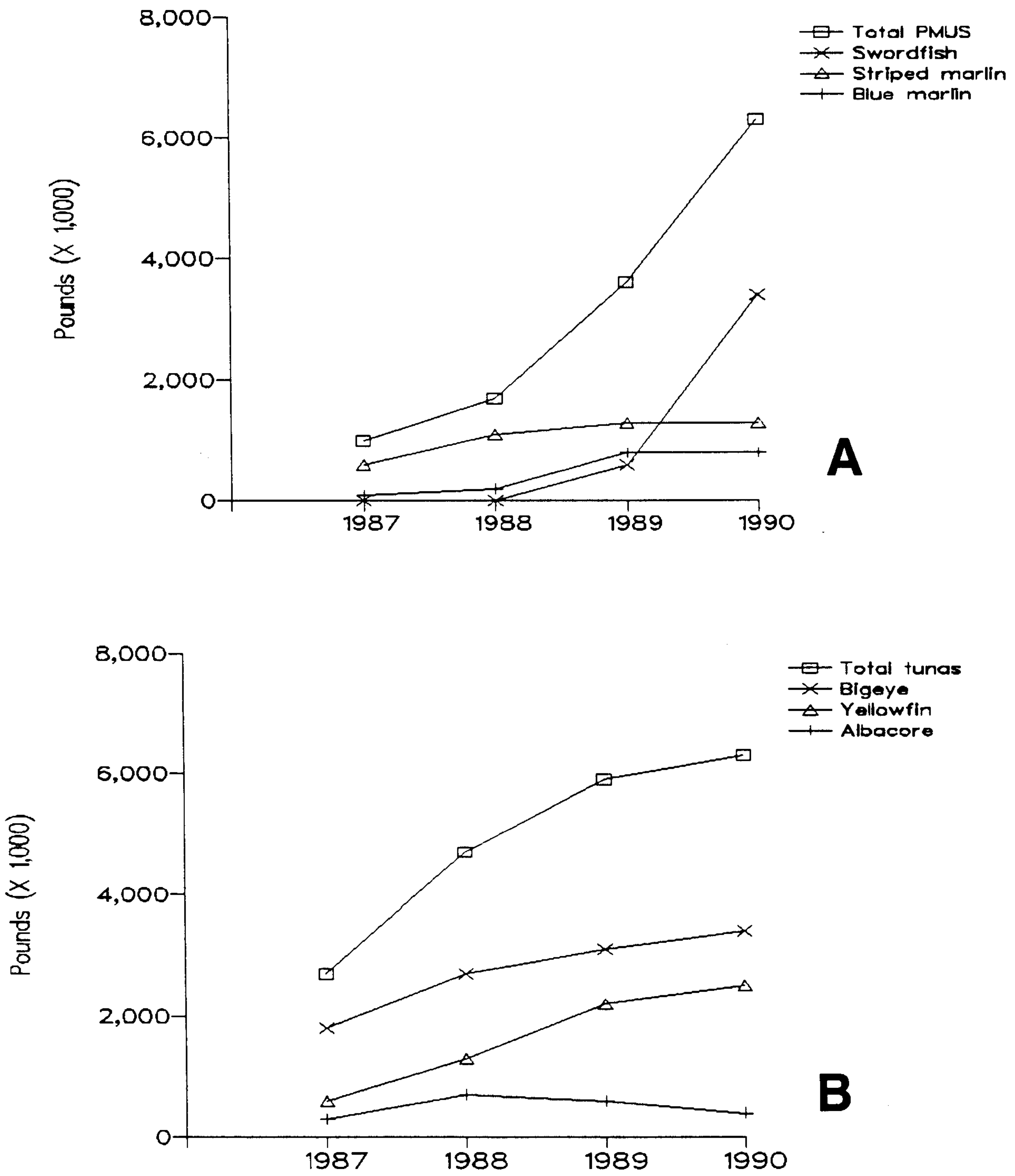


Figure 7.--Landings of (A) billfishes, and (B) tunas in Hawaii, 1987-90 (PMUS = Pelagic management unit species).

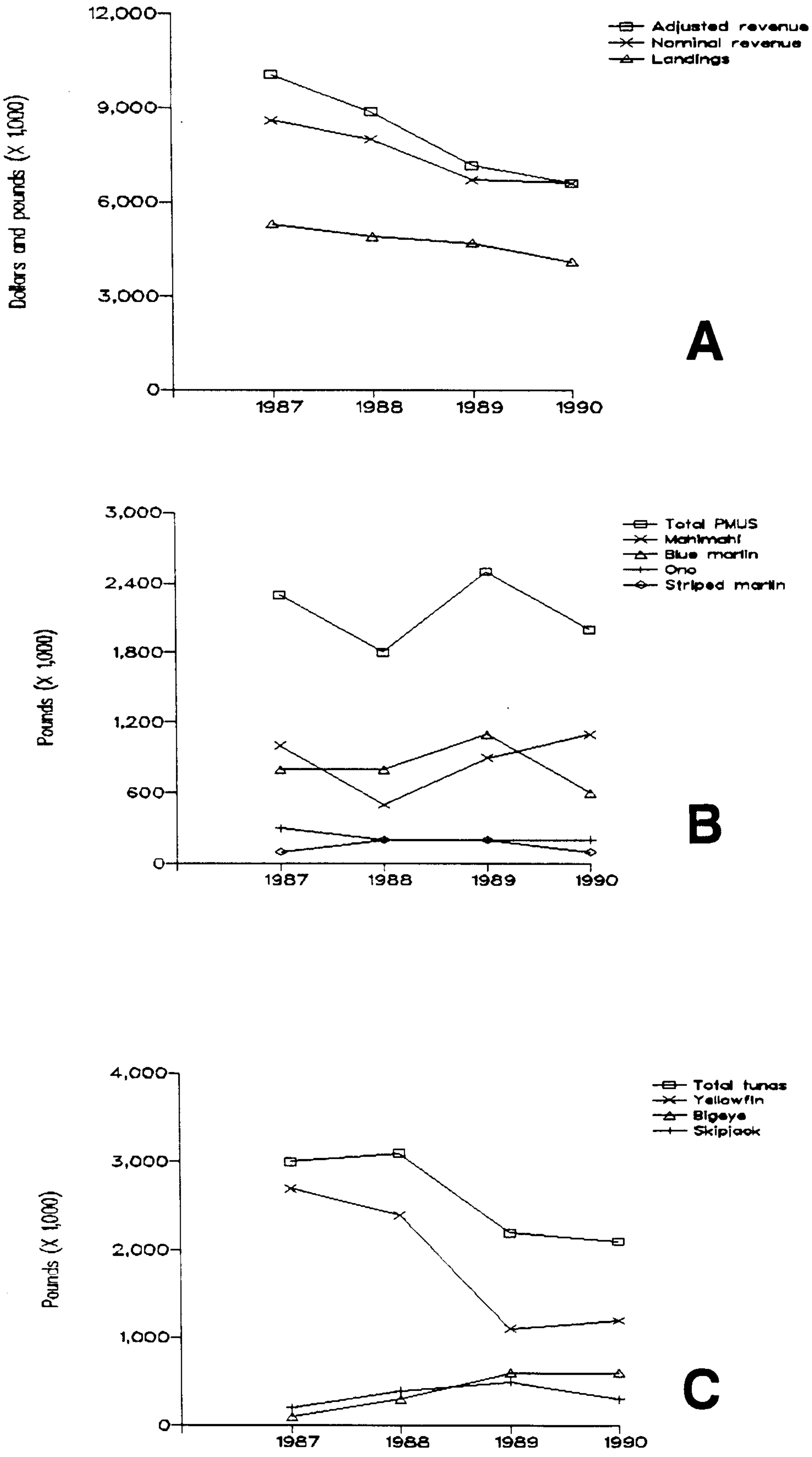


Figure 8.--Hawaii's troll and handline (A) landings and revenue, (B) PMUS landings, and (C) tuna landings (PMUS = pelagic management unit species).

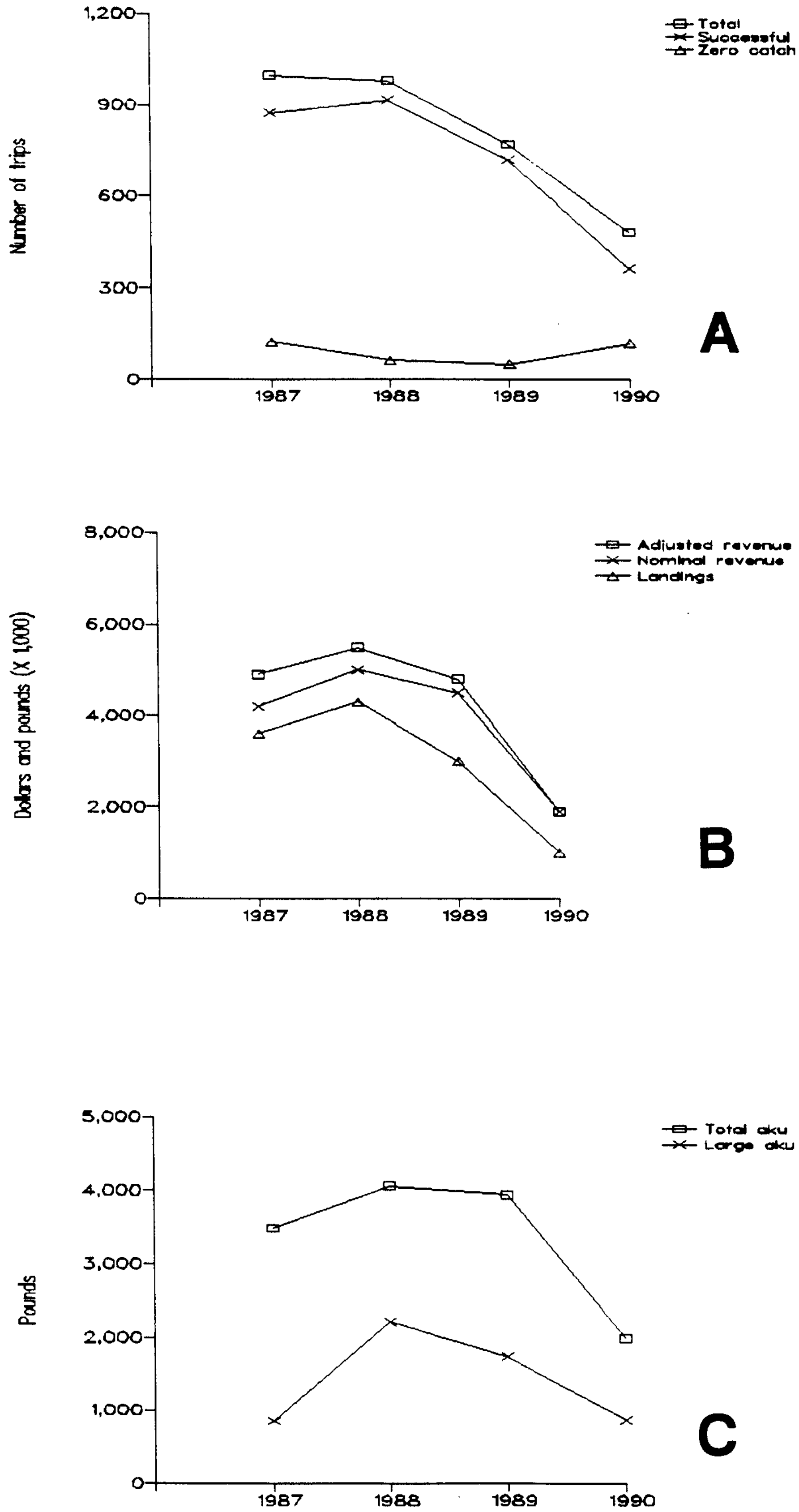
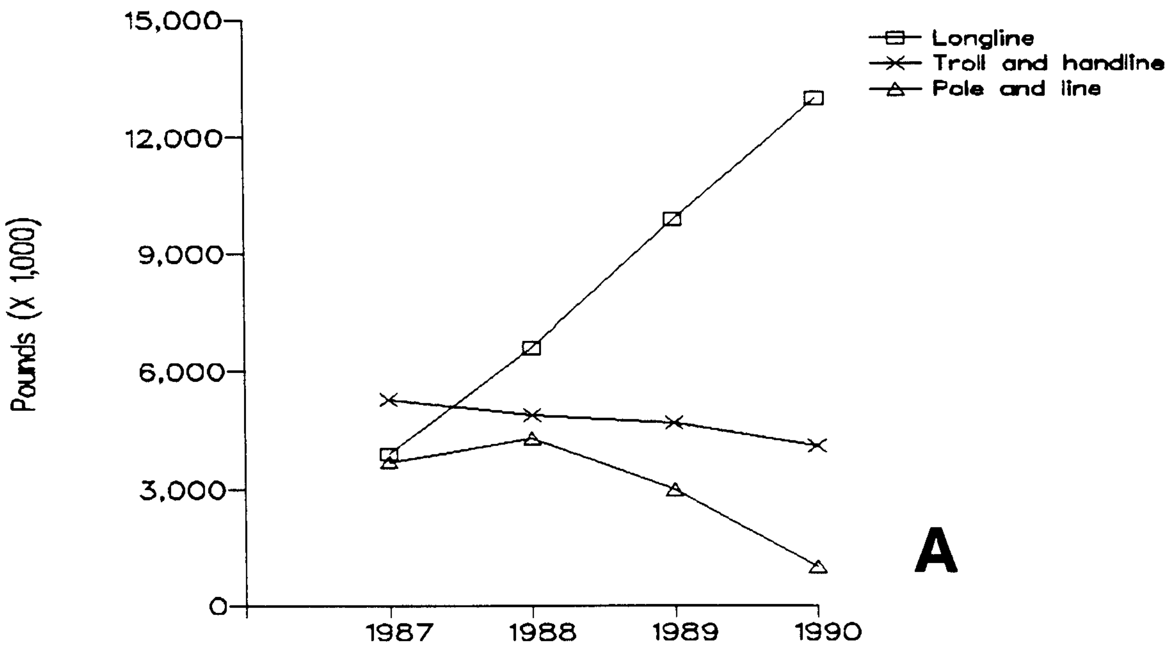


Figure 9.--Hawaii's aku boat (A) activity, (B) landings and revenue, and (C) average catch per trip, 1987-90.



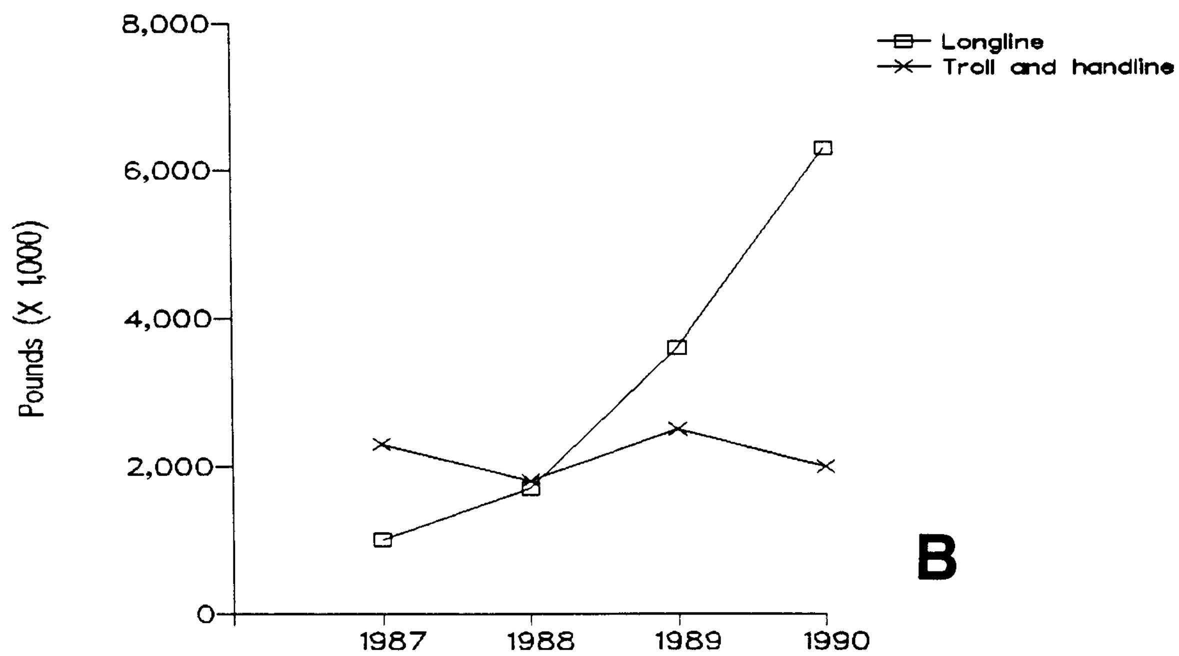


Figure 10.--(A) Total landings by gear type and (B) PMUS landings by gear type (PMUS = pelagic management unit species).

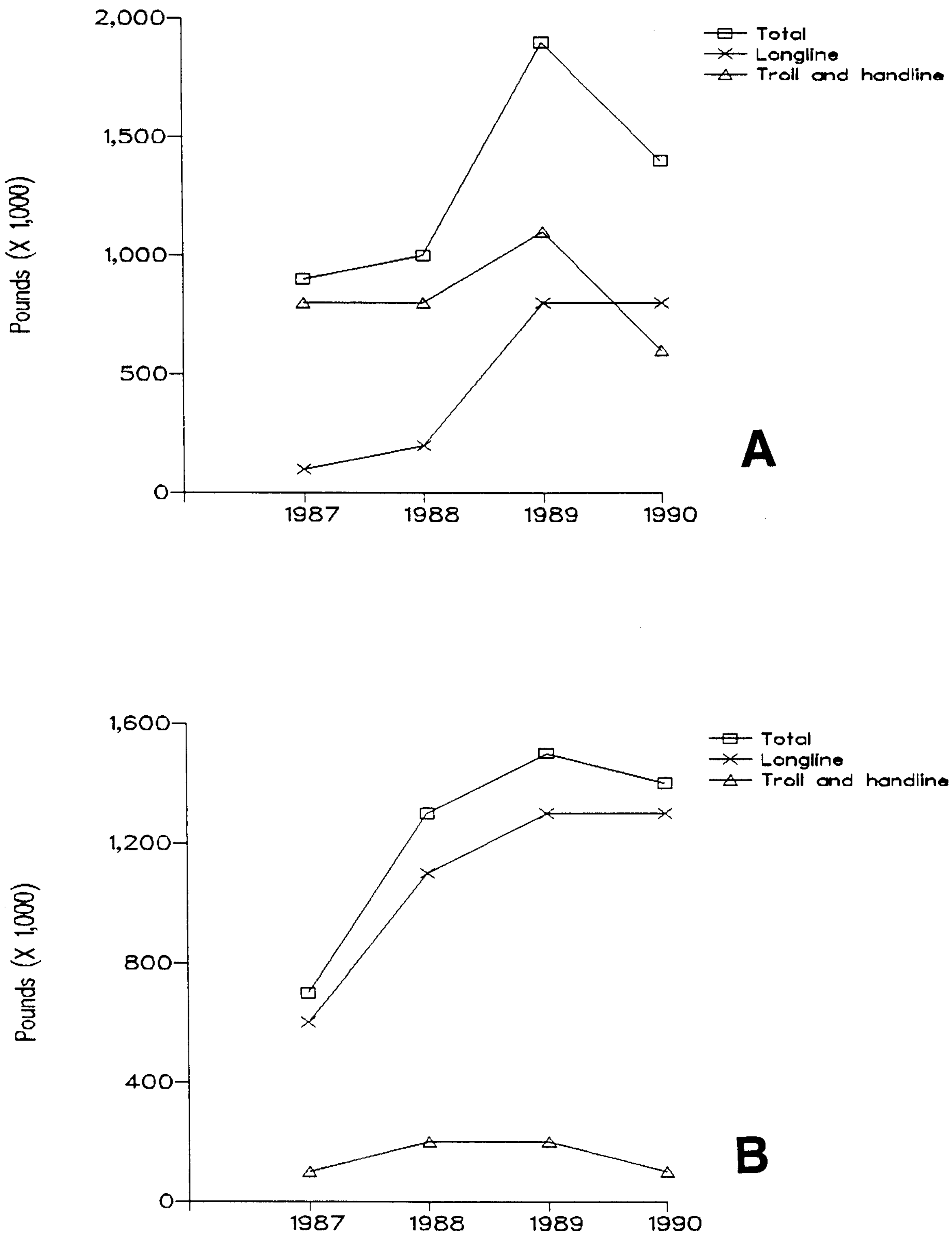


Figure 11.--Hawaii's (A) blue marlin and (B) striped marlin landings by gear type.

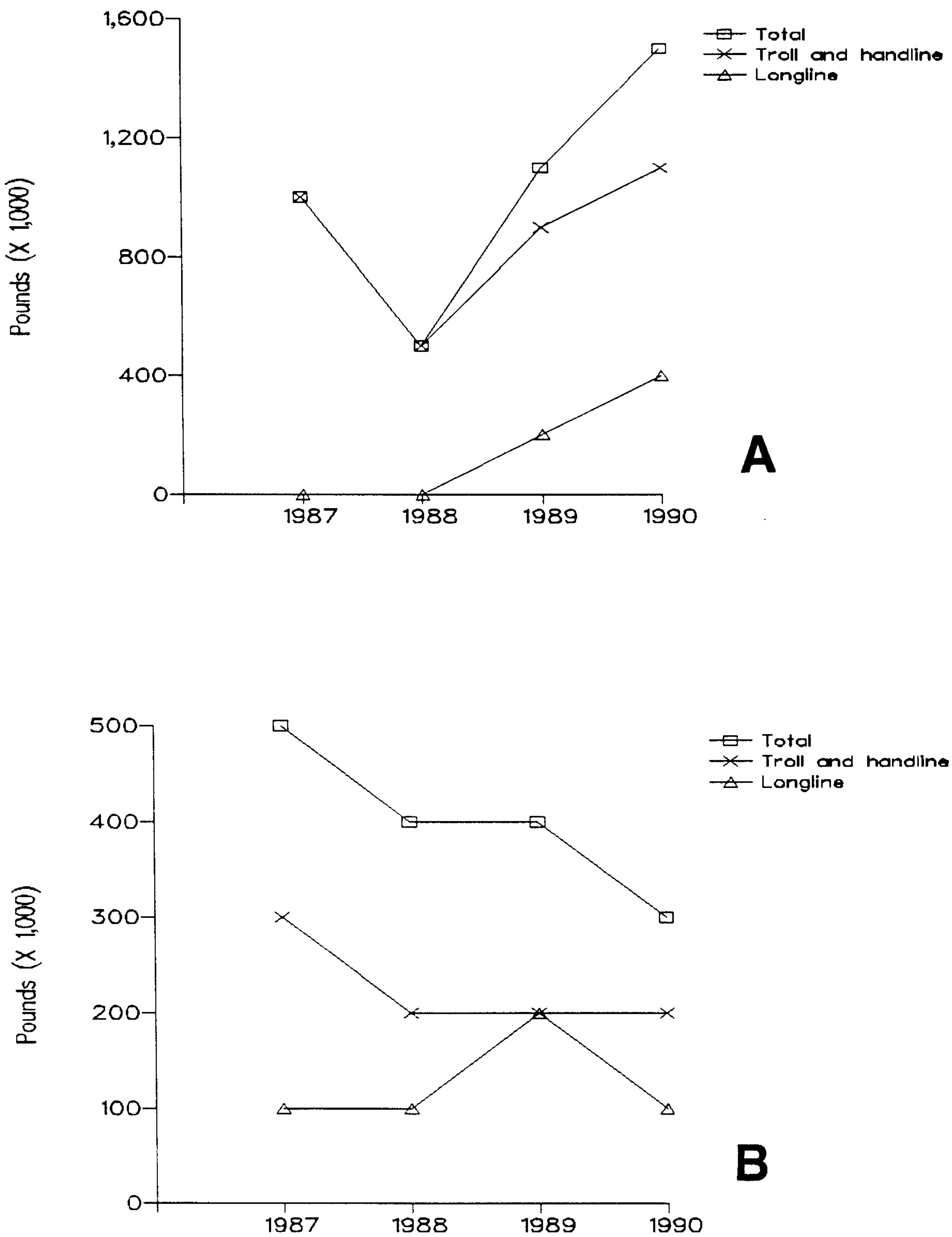


Figure 12.--Hawaii's (A) mahimahi and (B) ono landings by gear type.

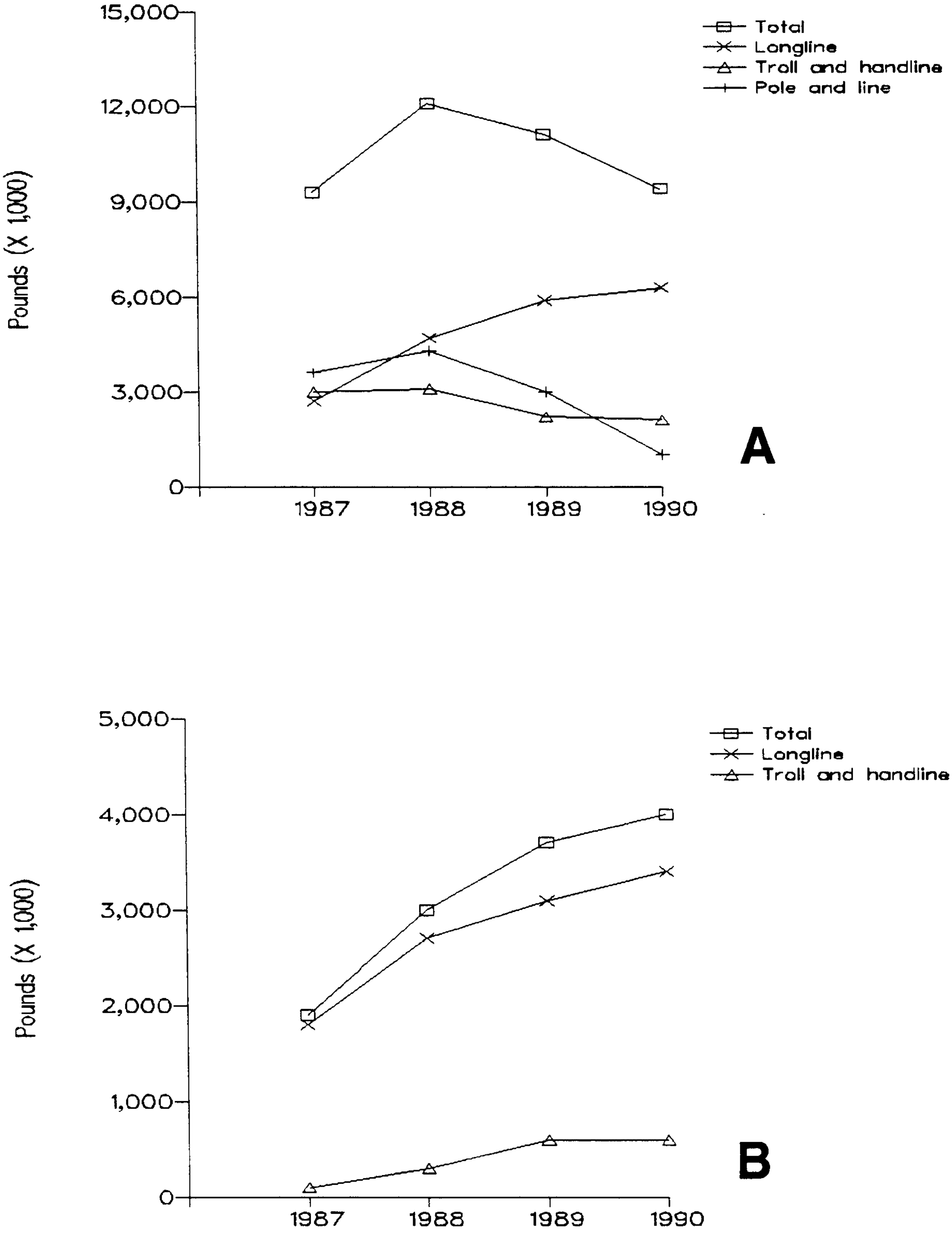


Figure 13.--(A) Tuna landings and (B) bigeye tuna landings by gear type.

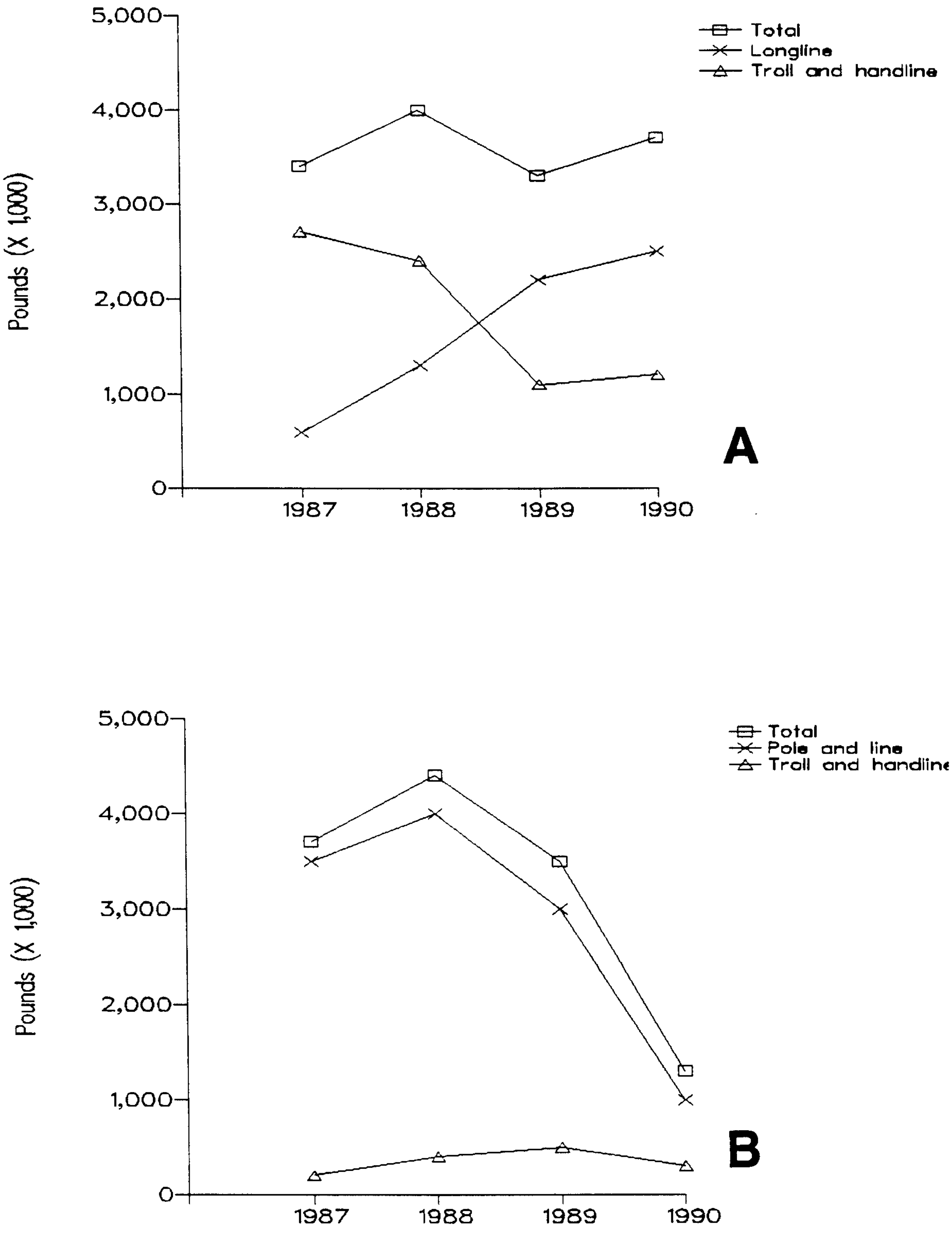


Figure 14.--Landings of (A) yellowfin tuna and (B) skipjack tuna by gear type.

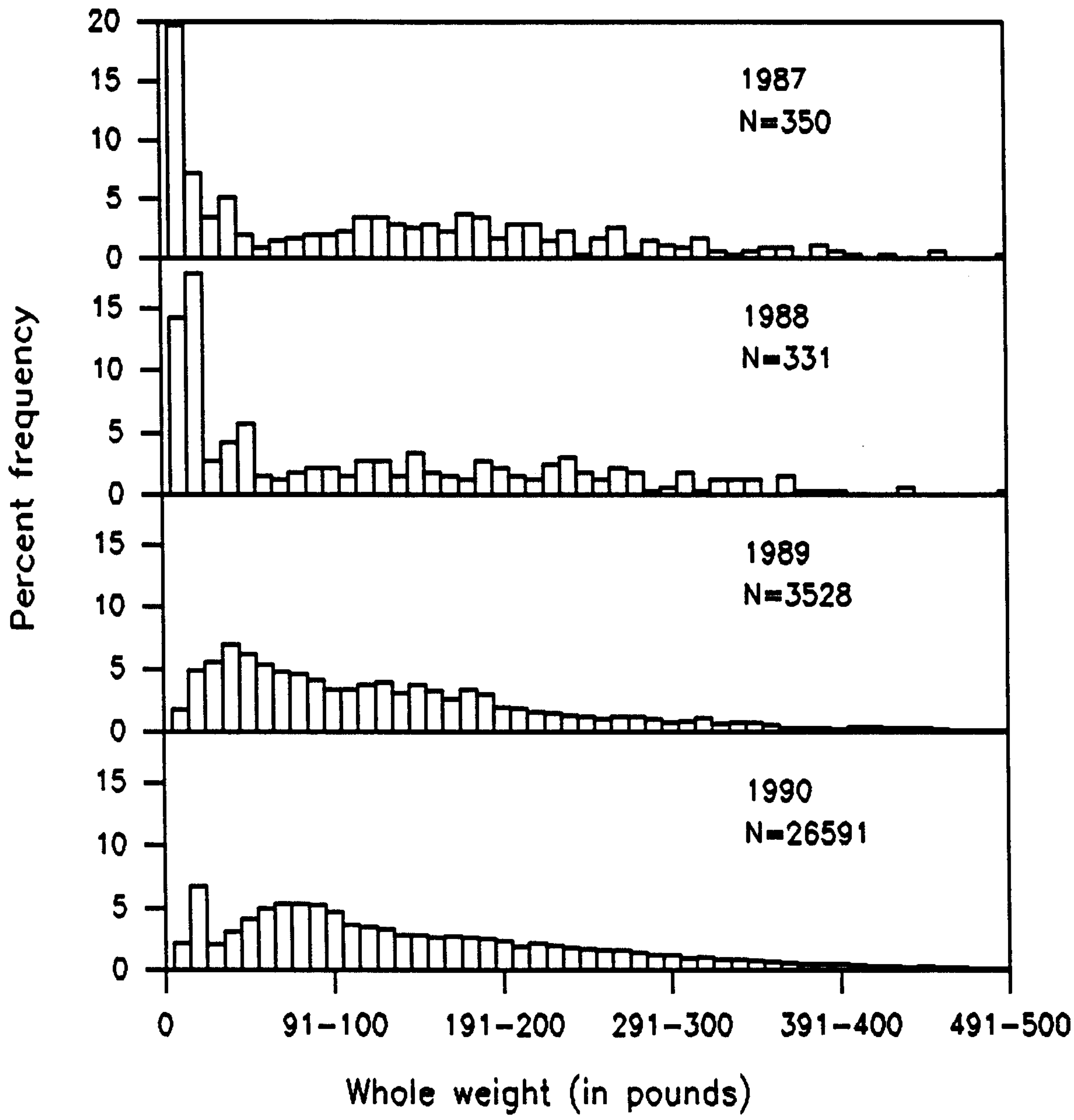


Figure 15.--Weight-frequency histograms of longline-caught swordfish, 1987-90.

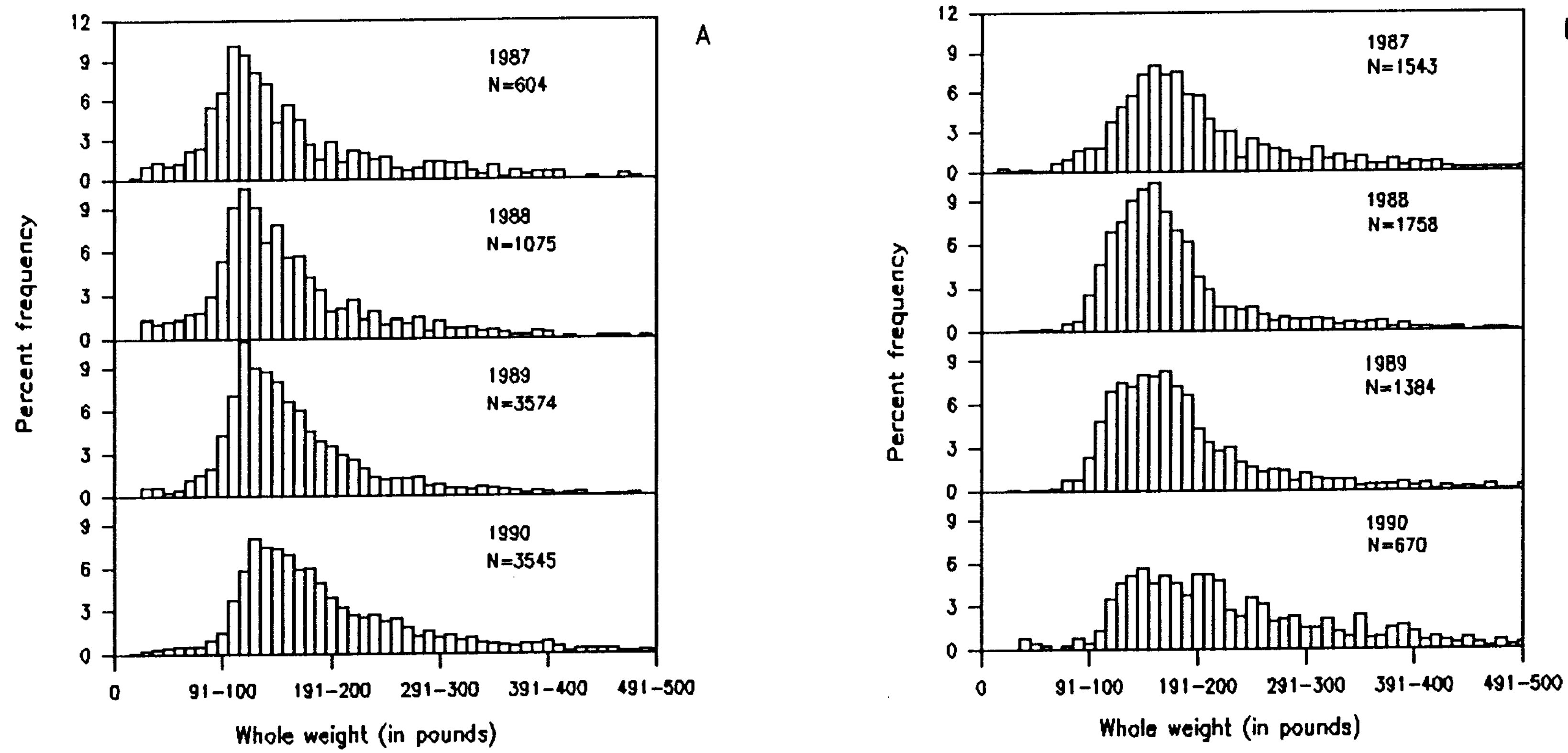


Figure 16.--Weight-frequency histograms of blue marlin for (A) longline and (B) troll and handline, 1987-90.

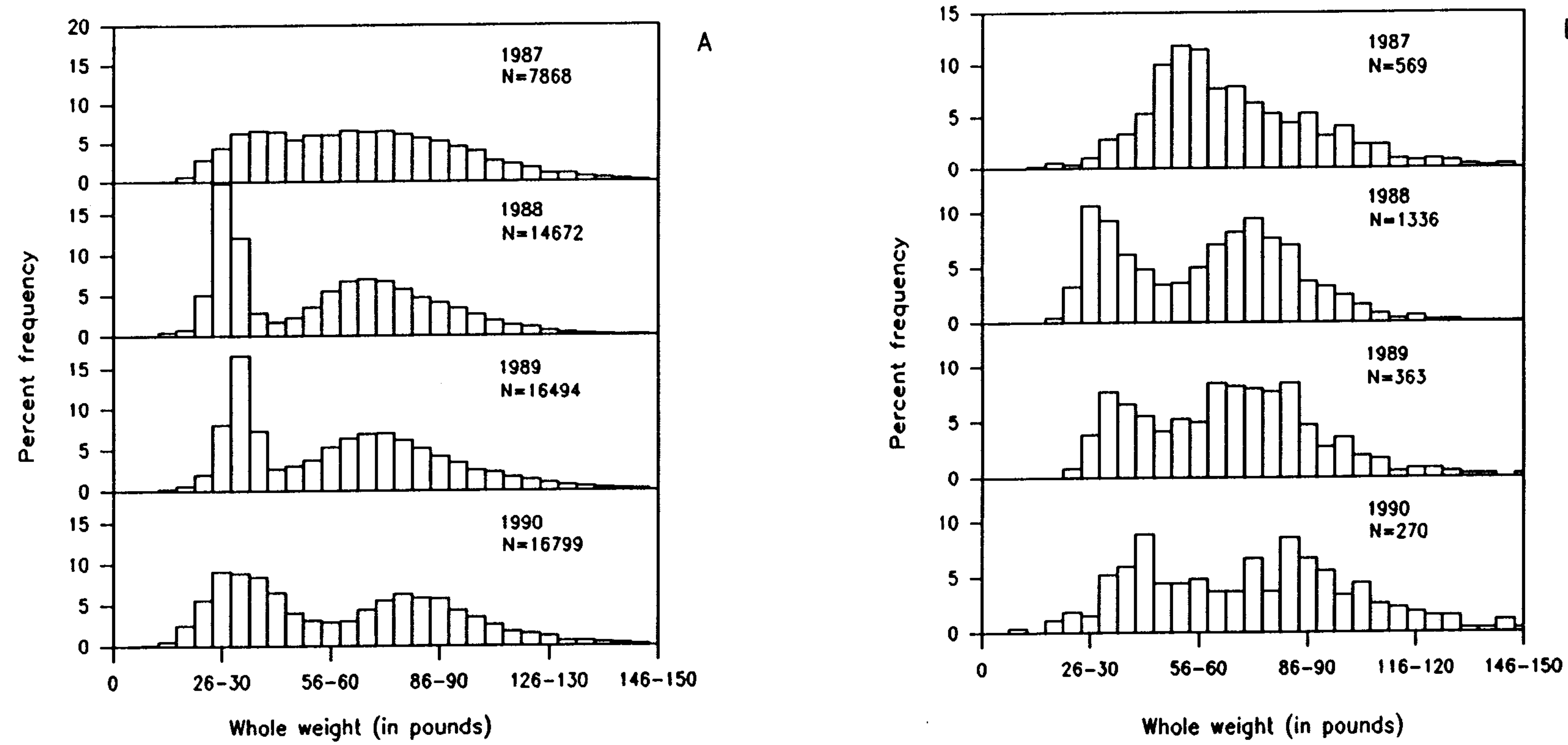


Figure 17.--Weight-frequency histograms of striped marlin for (A) longline and (B) troll and handline, 1987-90.

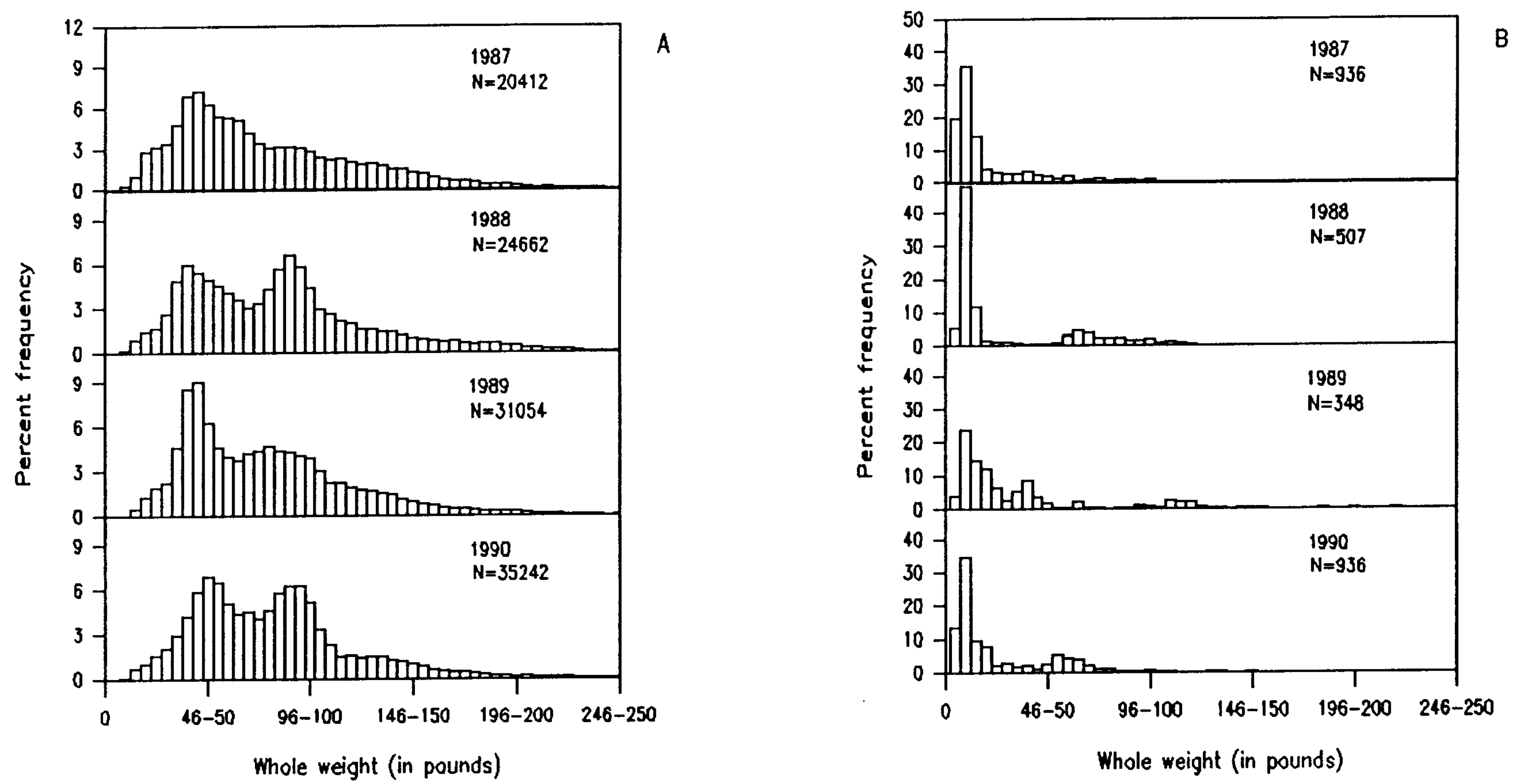


Figure 18.--Weight-frequency histograms of bigeye tuna for (A) longline and (B)troll and handline, 1987-90.

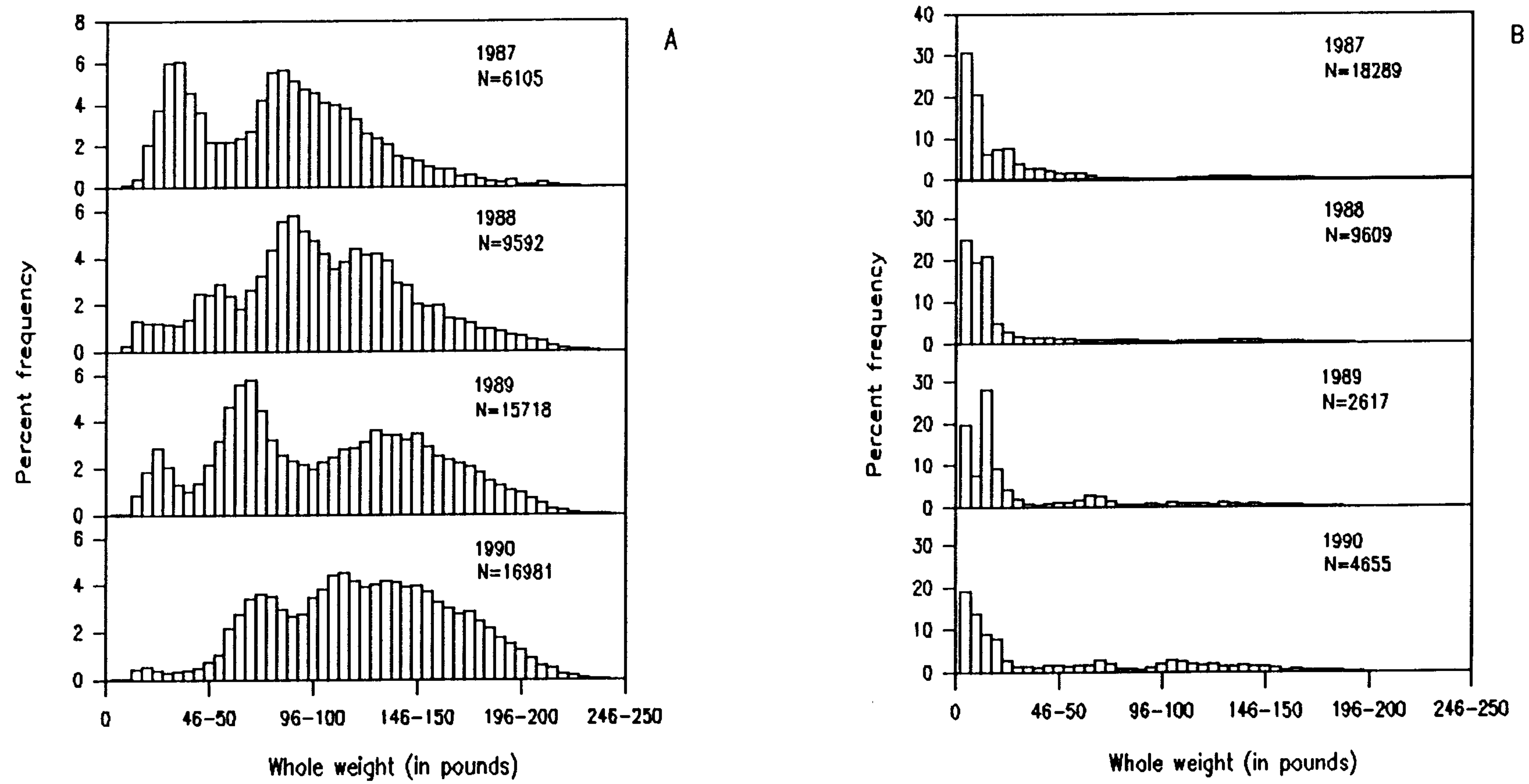


Figure 19.--Weight-frequency histograms of yellowfin tuna for (A) longline and (B) troll and handline, 1987-90.

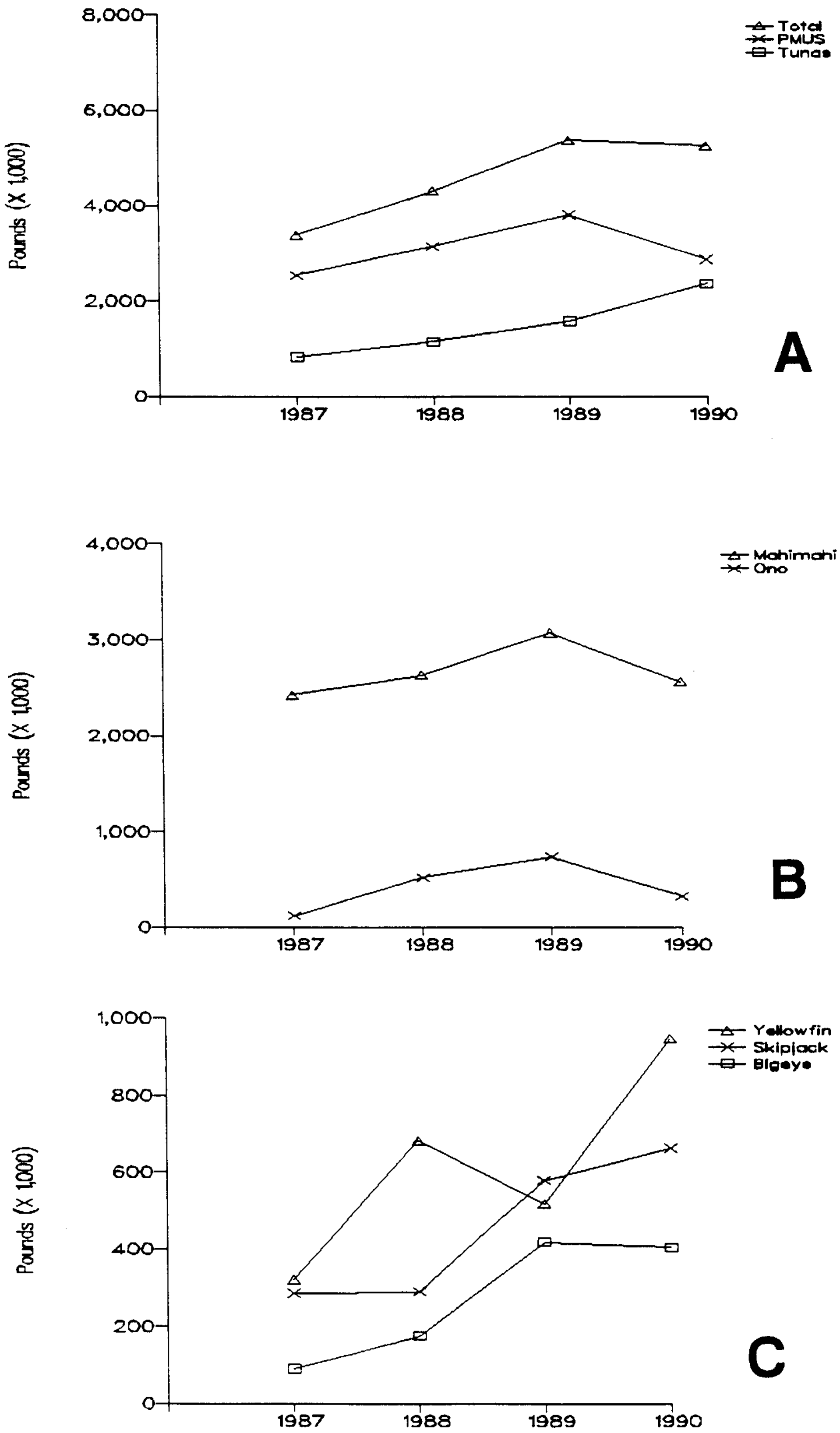


Figure 20.--Hawaii's imports by (A) category, (B) PMUS, and (C) tunas (PMUS = pelagic management unit species).

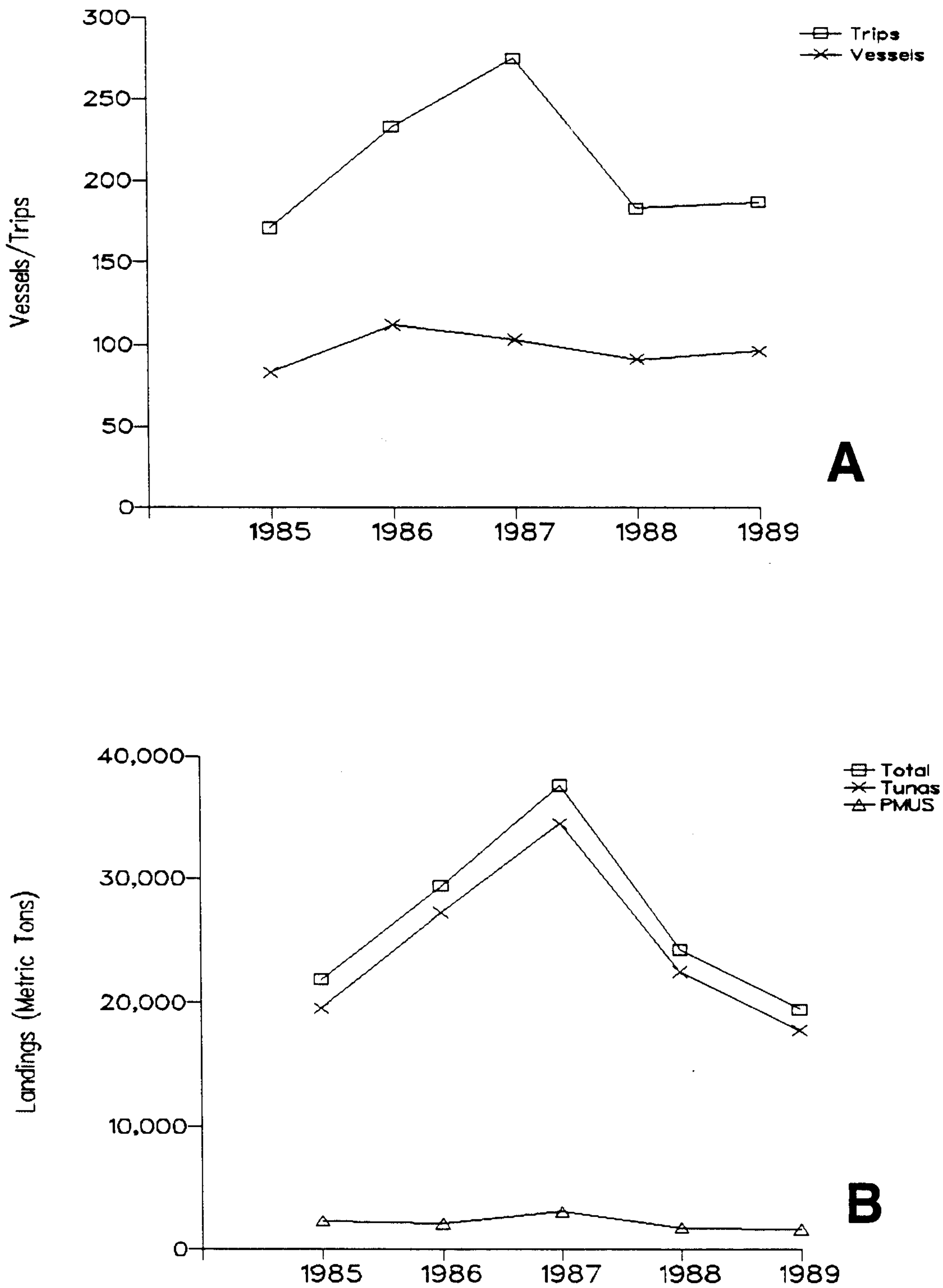


Figure 21.--American Samoa foreign longline (A) vessel activity and (B) landings, 1985-89 (PMUS = Pelagic management unit species).

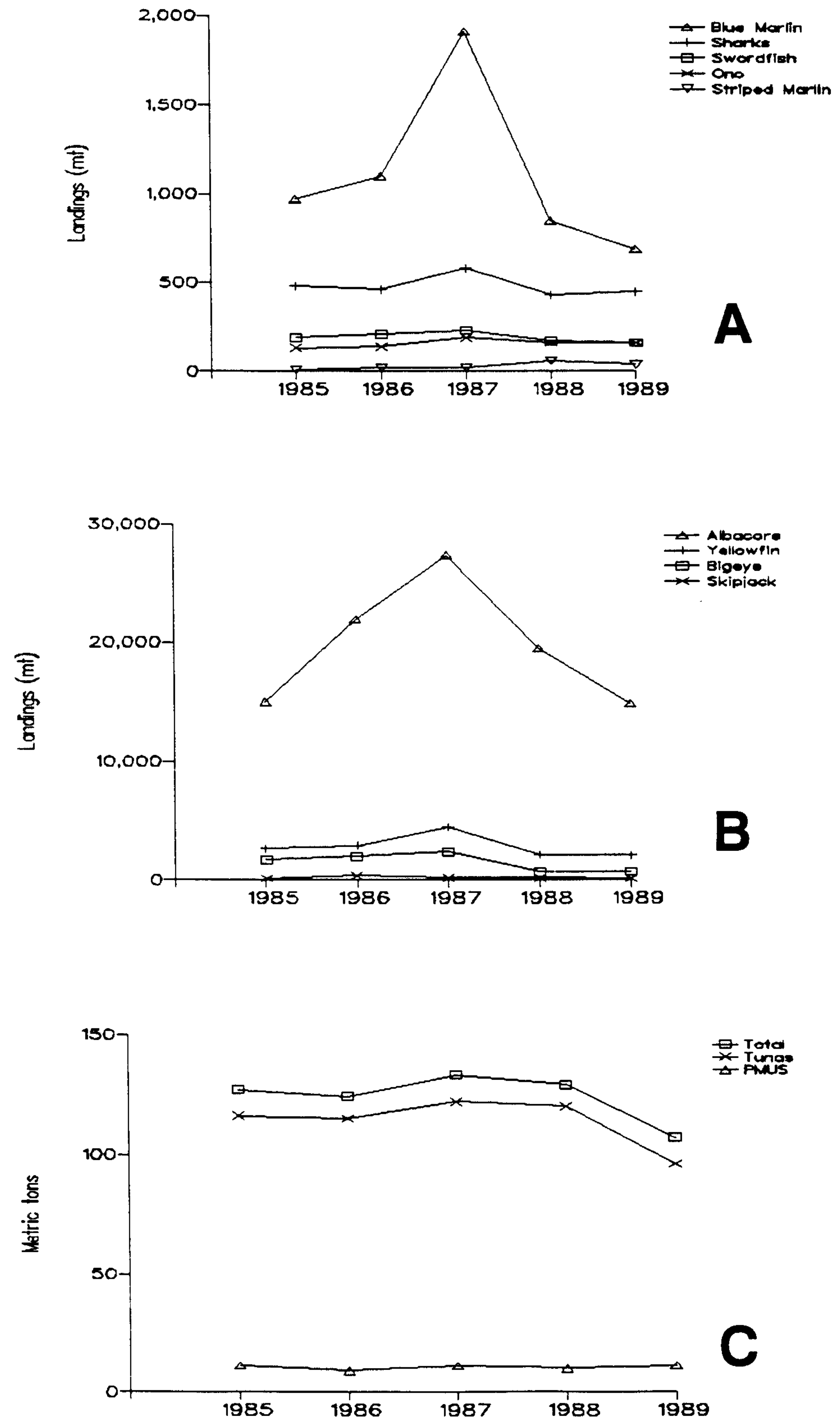


Figure 22.--(A) PMUS composition, (B) tuna composition, (C) average catch per trip of longliners in American Samoa, 1985-89 (PMUS = Pelagic management unit species).