Southwest Fisheries Science Center
Administrative Report H-92-15

WESTERN PACIFIC PELAGIC FISHERIES IN 1991

Russell Y. Ito

Honolulu Laboratory
Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
2570 Dole Street, Honolulu, Hawaii 96822-2396

December 1992

PREFACE

The pelagic management unit species (PMUS), composed of billfishes, mahimahi, ono (wahoo), and sharks, are managed by a fishery management plan prepared by the Western Pacific Regional Fishery Management Council (WPRFMC). Tunas are a major component of the pelagic landings in the western Pacific region and will be included as PMUS in 1992. This report is a summary of the current status of the major pelagic fisheries in Hawaii in 1991 and the foreign albacore longline fishery based in American Samoa in 1990. All information is based on commercial fishing data. Although recreational and subsistence fisheries are important in Hawaii and may comprise a substantial amount of the actual total landings, data on these fisheries 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 pelagic seafood imports in 1991, and the foreign albacore longline fishery operating out of American Samoa in 1990. The scientific names of relevant species are listed in Table 1. The most prominent pelagic fisheries in Hawaii are the longline fishery, the troll and handline fishery (mostly small boats), and the pole-and-line fishery (live bait fishery targeting skipjack tuna). Most of the pelagic management unit species (PMUS), which are primarily comprised of billfish, mahimahi, and ono, are caught by the longline and the troll and handline fisheries. The longline fishery primarily targets swordfish and large tunas; the troll and handline fishery lands a variety of PMUS and tunas. Pole-and-line fishery tuna landings are substantial, but its PMUS landings are insignificant. The PMUS and tunas are also caught incidentally by bottomfish vessels in the Northwestern Hawaiian Islands (NWHI) but are not landed in substantial amounts.

Four distant-water fisheries operate out of Pago Pago, American Samoa: foreign tuna longliners targeting albacore; foreign tuna longliners targeting bigeye and yellowfin tuna (sashimi vessels); purse seiners composed mainly of U.S. flagged vessels fishing for skipjack (but also catching a substantial amount of yellowfin tuna); and U.S. surface albacore trollers. A substantial amount of the longline bycatch landed by the foreign longliners is composed of PMUS. Albacore longliners off-load most of their catch to the canneries, while sashimi longliners off-load only a portion of theirs to the canneries and transship most of their catch to other destinations (primarily Japan). Information on the two U.S. distant-water fisheries is compiled by the La Jolla Laboratory of the Southwest Fisheries Science Center (SWFSC). Information on domestic (local) fisheries in American Samoa is available from the National Marine Fisheries Service (NMFS) Western Pacific Fishery Information Network (WPACFIN) program (Hamm et al. 1992).

HAWAII'S DOMESTIC PELAGIC FISHERIES

Recent Developments

The expansion of the Hawaii longline fishery subsided in 1991 because of a moratorium enacted by the WPRFMC in April 1991. The moratorium restricts new entrants to Hawaii's longline fishery until April 1994. Nonetheless, because of appeals and late permit submissions, the number of active longline vessels increased from 138 vessels in 1990 to 140 vessels in 1991 (Dollar 1991). The new entrants included a few of the NWHI lobster vessels (N = 4) displaced by the closure of the lobster fishery in 1991 (Dollar 1991) and a number of east coast and gulf coast vessels which met specific entry criteria set by the WPRFMC.

Area restrictions surrounding the main Hawaiian Islands (MHI) were implemented in June 1991. The buffer zone (75 miles around Oahu and Kauai and 50 miles around the remaining MHI) has

reduced direct gear conflicts between troll and handline boats with longline vessels. However, many tuna longline fishermen complained about the size of the area closure. They claimed that productive areas for tunas surrounding the MHI were restricted and that they are now forced to fish in areas where catch rates are low. Because of the hardship faced by the longline fishermen, the WPRFMC decided in 1992 to modify the MHI area closure. This modification will allow longline vessels to fish closer to the MHI during the four winter months (October through January). Most swordfish longliners fish far north of the Hawaiian Islands and are not as adversely affected by this area closure as the tuna longliners.

Despite the longline moratorium, this is the fourth consecutive year Hawaii's pelagic landings and revenue (all gears) have increased, reaching an all-time high in 1991. The increase in pelagic and PMUS landings and revenue is directly caused by the increase in longline-caught swordfish. The pole-and-line fishery recovered from a historic low in 1990, while the troll and handline fisheries showed slightly increased catches in 1991.

Data Sources and Problems

Hawaii's pelagic landings and revenue are summarized by major categories (Table 2-4) and species (Table 5-7). Estimates of landings and revenue are rounded to the nearest 100,000; therefore, landings of less than 50,000 lb and revenue of less than $50,000 are not specified. The estimates of Hawaii's pelagic landings are grouped into general categories; i.e., PMUS, tunas, and other pelagics. Revenue is presented as nominal and inflation-adjusted (1991) value. Inflation-adjusted revenue takes into account the increase in the Honolulu consumer price index (CPI) during 1987-91. Average price is reported as ex-vessel price based on whole weights.

These estimates are prepared by the NMFS Fishery Monitoring and Economics Program (FMEP). FMEP, in conjunction with the State of Hawaii's Division of Aquatic Resources (HDAR), samples landings from Hawaii's wholesale fish markets. NMFS also collects federally mandated logbooks from the Hawaii-based domestic longline vessels (Dollar and Yoshimoto 1991). When necessary, individual fish weights have been adjusted to whole weights to account for the degree of processing (e.g., gilled and gutted, headed and gutted, shark bitten). The sample data cover a substantial portion of the entire market, mainly most of the longline and pole-and-line landings and some of the troll and handline 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 3.3, depending on the coverage of the sample and the type of fishing gear.

With the implementation of the U.S. western Pacific domestic longline logbook program late in 1990, we anticipated using longline logbook **number of fish kept** as the basic monitoring unit, with market monitoring providing estimates of average weight per fish. Total landings would be constructed from the product of these following two figures:

Total landings (weight) = number kept (logbook) * average weight (samples).

However, to provide continuity, market monitoring was maintained throughout 1991 to obtain detailed data on almost all (approximately 87%) estimated longline landings.

Comparison of these two methods of estimating total landings (weight) is shown in Table 8. The first column is estimated from logbook numbers kept and average sampling weights. The second column is estimated from total weights from market monitoring. The estimate from market monitoring is the choice for final estimate. The primary reason for choosing the market monitoring estimate, instead of the estimate based on logbook number kept, which might have been preferable, is made clear in Table 9. The first column indicates the number kept as actually recorded in the logbooks. The second number is a rough correction to resolve species misidentification problems for blue and striped marlin, and a correction for number of sharks kept (in some cases vessels identified sharks killed and dumped as kept).[1] The third column is an estimate of the number kept from market monitoring. In most cases the differences are small, except in the case of "other pelagics" (opah, walu, etc.). The longline logbook does not specify the individual species which could be covered under "other pelagics," and therefore many are not logged by the longline crews.

Finally, the marketing strategy for the troll and handline fishery has changed substantially during this period. This change may have affected the representation of the NMFS and HDAR market sample, and the resulting estimates may not be entirely indicative of true changes, because no recent statistical base is available to verify the raising factors. Therefore, NMFS landings and revenue estimates on the troll and handline fishery (Tables 3, 4, 6, and 7) must be considered provisional and used with care.

Estimates of Landings and Revenue

Total estimated commercial landings of all pelagic fishes in 1991 increased to 26.8 million lb, worth $54.3 million (Fig. 1A).

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[1] Both corrections are based on information obtained from market monitoring.

This represented a 51% increase in landings and a 40% increase in revenue. The PMUS landings and revenue increased dramatically to 16.0 million lb, with an ex-vessel value of $29.5 million (Fig. 1B). Swordfish, which increased 136% to 9.9 million lb, accounted for a majority of the increase in PMUS landings (Fig. 2A). Blue marlin landings decreased slightly while striped marlin and other billfish increased. Mahimahi landings increased 50% to 2.1 million lb (Fig. 2B). Ono landings increased, while shark landings (composed mainly of thresher and mako sharks) remained about the same.

Estimated tuna landings and revenue increased to 10.3 million lb with a ex-vessel revenue of $24.1 million in 1991 (Fig. 3A). This represents a 21% and 7% increase in landings and revenue, respectively. With the exception of yellowfin tuna, landings of all major tuna species increased in 1991. Most of the increase in tuna landings was attributable to skipjack tuna landings which more than doubled to 2.6 million lb (Fig. 3B). Bigeye tuna landings increased by 17% to 4.2 million lb while yellowfin tuna landings decreased 15% to 2.8 million lb. Albacore landings, which increased substantially, were relatively low in comparison to the other major tuna species.

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. Tables 3 and 4 summarize landings and revenue by species and gear type. Longliners vary fishing techniques to target either swordfish or tunas (Berkeley 1981, Kawamoto et al. 1989). Although the techniques and catch composition are considerably different between longliners targeting swordfish or tunas, all longliners were grouped into one category. The techniques used by trollers and handliners also vary widely in targeting pelagic species and result in substantially different catch compositions. However, the landings from the two gear types could not be differentiated in the NMFS market monitoring data, and therefore they were combined into one gear category. Other gear types include pole-and-line boats, distant-water trollers (albacore trollers), and various fleets in the NWHI (primarily bottomfish and lobster vessels).

The most substantial increase in landings was experienced by the pole-and-line boats and longliners which increased by 120% and 48%, respectively, in 1991 (Fig. 4A). Troll and handline landings increased a modest 26%. Catch composition for longline and the troll and handline fisheries also changed dramatically in 1991.

The number of active longline vessels increased from 37 in 1987 (Kawamoto et. al. 1989) to 140 in 1991 (Dollar 1991) (Fig. 4B). Longliners originally from the U.S. east coast primarily

target swordfish. There were 17 active east coast vessels in 1991 compared to 8 vessels in 1990. Ninety-eight vessels targeted swordfish at least once in 1991.

Estimated longline landings increased to 19.6 million lb and ex-vessel revenue was $43.7 in 1991 (Fig. 5A). Longline landings of PMUS increased 94% (Fig. 5B). This dramatic increase in PMUS landings was largely due to the increase of swordfish (up to 9.9 million lb with an ex-vessel value of $22.0 million). Blue marlin landings decreased slightly while striped marlin, other billfish, and mahimahi landings increased in 1991. Ono and shark landings showed no change. Longline tuna landings also increased slightly (Fig. 5C). Bigeye tuna, the dominant species of longline tuna landings, increased to 3.5 million lb, while yellowfin tuna landings decreased to 1.6 million lb. Landings of albacore are not as significant in comparison to bigeye and yellowfin tuna landings. A few northern bluefin tuna (*Thunnus thynnus orientalis*) were landed during the winter months. Landings of other pelagics; i.e., moonfish, escolar, and pomfrets (primarily *Taractichthys steindachneri*), increased slightly.

Troll and handline landings were estimated at 4.9 million lb with ex-vessel revenues of $7.8 million in 1991 (Fig. 6A). Estimated PMUS landings by trollers and handliners, which were composed predominantly of mahimahi and blue marlin, increased 40% (Fig. 6B). In comparison, relative landings of ono and striped marlin landings were low. Troll and handline tuna landings increased slightly in 1991 (Fig. 6C) with yellowfin tuna, the major component of troll and handline tuna landings, remaining unchanged. Bigeye tuna and skipjack tuna landings increased slightly. Albacore caught by handliners were not substantial.

Only four of the six remaining pole-and-line boats fished on a regular basis in 1991. Trip activity increased but the fleet was still plagued by a relatively high percentage of zero catch trips (Fig. 7A). 2.2 million lb of skipjack tuna was landed with an ex-vessel value of $2.8 million in 1991 (Fig. 7B). As is typical, landings by the pole-and-line fleet were relatively homogeneous with skipjack tuna comprising more than 95% of the landings. Average skipjack catch per trip and the catch per trip of large skipjack increased to 3,800 lb and 2,300 lb, respectively (Fig. 7C).

Size of Catch

The mean size of the catch and weight-frequency histograms were summarized for longline and Oahu-based troll and handline catches. Usually only larger fish are air freighted from the outer islands to the Honolulu markets, and these catches were not included in the size summaries. Very little handline fishing is conducted on Oahu; therefore, troll and handline (combined) size data represent primarily troll fishing. Weight-frequency

histograms of swordfish were produced only for longline catches. Weight-frequency histograms for blue marlin, striped marlin, bigeye tuna, and yellowfin tuna were produced for both longline and troll and handline gear types. No detailed size measurements were available for pole-and-line catches; therefore, four industry standard size categories were used.

During 1987-88, tunas were the primary species targeted by longliners, and small swordfish were caught incidentally (Fig. 8). With the increased effort towards swordfish, the weight-frequency distribution has changed. Small swordfish, usually abundant during the fall months (Uchiyama and Shomura 1975), are underrepresented in the landings data since they have little or no market value and are often released or discarded by longliners (Dollar et al. 1991). As a result, the relative frequency of small swordfish was less during 1989-91. The relative frequency of larger swordfish (above the 91-100 lb increment) gradually declined, and the mean weight of swordfish decreased slightly in 1991 (Table 10).

The combined Oahu troll and handline data represent mostly troll data, and it appears that blue marlin caught by trollers were slightly larger than those caught by longliners. The histograms show one mode for both gear types, but the longline weight-frequency distribution has a sharper, more pronounced mode at a smaller size (Fig. 9A-B). The average size of blue marlin landed by both gear types decreased in 1991.

Oahu trollers caught slightly larger striped marlin than longliners. Striped marlin size-frequency usually showed a bimodal distribution for both longline and troll gear types, with a stronger mode of smaller fish caught by longliners (Fig. 10 A-B). The mean weight of striped marlin decreased for both gear types in 1991.

The mean size of tunas differed greatly between longline and Oahu troll and handline gear types. Bigeye and yellowfin tunas caught by longline were larger than Oahu troll and handline catches. The size distribution of bigeye and yellowfin tunas for longline catches shows a great proportion of their catch extending over a wide range of increments (Fig 11A and 12A). The size distribution of bigeye and yellowfin tunas for Oahu troll and handline catches was concentrated within the first five increments, sometimes with weak secondary modes of larger fish (Fig 11B and 12B).

The pole-and-line landings of skipjack tuna were recorded by weight categories based on industry standards. Weight categories vary between wholesalers, but generally large skipjack tuna weigh 15 lb or more, medium skipjack tuna weigh between 10 and <15 lb, small skipjack tuna weigh between 5 and <10 lb, and extra small skipjack tuna weigh <5 lb (B. Takenaka, United Fishing Agency, Honolulu, Hawaii, July 1992). Annual weight-frequency includes

the highly seasonal nature of skipjack tuna when pole-and-line fishermen target the higher priced, large skipjack tuna (15+ lb) during the summer months. Large skipjack tuna composed over 40% of the total skipjack tuna landings (by weight), except in 1987 when landings were composed predominantly of medium-sized skipjack tuna (Fig. 13).

Market Prices for Pelagics

Prices for some species are affected greatly by mainland, and foreign (Japan) markets. Most swordfish and some high-grade tunas are exported to the U.S. mainland, while the best grade bigeye tuna and the rarely caught bluefin tuna are exported to Japan. Although Hawaii's reputation as an exporter of high quality tunas and as a major source of swordfish is well established, no data exist on the volume or revenue generated from this export market. People in the industry have indicated to NMFS that longline landings account for most of the pelagic exports.

The average (ex-vessel) prices of pelagic species during 1987-91 are shown in Table 11. The high-priced PMUS are swordfish, mahimahi, and ono. Most market prices for PMUS changed little in 1991. Mahimahi and shark prices varied inversely proportioned to landings. When landings of mahimahi and sharks were lowest, the average prices of these species were at their peak. Market prices for bigeye and yellowfin tunas did not change substantially while skipjack tuna prices increased.

Troll and handliners usually had higher prices than longliners for striped marlin and mahimahi. Prices for blue marlin and ono were mixed between the longline and troll gear types. Longliners received considerably higher prices for bigeye and 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). Although the data summaries from the SWR are broken down by species, they are incomplete because lots of less than $1,000 entering the U.S. are not monitored. The NMFS Market News does not provide the unit price for imported seafood. These summaries do not account for fishery products which are shipped from other U.S. Customs

districts to Hawaii or imports being transshipped to other U.S. Customs districts from Honolulu.

Pelagic imports increased slightly in 1991 (Fig. 14A). Approximately 5.6 million lb of pelagic seafood were imported to Hawaii. Imports of PMUS increased 37%, most of which were mahimahi (3.8 million lb) primarily from Taiwan and ono (135,000 lb) from Japan (Fig. 14B). Imports of tuna decreased 31% to 1.65 million lb in 1991. Yellowfin tuna (809,000 lb) was the largest component, followed by bigeye tuna (364,000 lb), and skipjack tuna (304,000 lb)(Fig. 14C). Most of the skipjack tuna imports were from Japan. Yellowfin and bigeye tunas originate from the Marshall Islands, Fiji, Indonesia, and the Philippines. Increased imports of tunas were observed during the winter months because of the low supply of local tunas in 1991.

If average domestic prices for tunas and other imported pelagic species from the NMFS wholesale market monitoring program were applied, the 1991 imports of fresh and fresh-frozen pelagics (excluding frozen mahimahi and similar products) would be worth about $4.3 million for 1.9 million lbs.

THE FOREIGN ALBACORE LONGLINE FISHERY IN AMERICAN SAMOA

The monitoring program in American Samoa, which is handled by the NMFS SWR, primarily concentrates on U.S. purse seine landings. As time permits, the sampling program also collects data from the foreign albacore longliners off-loading their catches in American Samoa. Longline logbooks are voluntarily submitted by foreign longline vessel captains or are transcribed from the ship's log by NMFS personnel. Estimated dates of capture, rather than landing dates, 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 1990.

The number of albacore longliners off-loading in American Samoa decreased to 88 vessels in 1990 (Fig. 15A). The number of trips also decreased (n = 153). Most of the albacore longliners were Taiwanese and South Korean flagged vessels with one vessel from Tonga. Foreign sashimi longliner activity increased, but landings by these vessels amounted to less than 2% of landings by albacore longliners.

Landings by albacore longliners have decreased 53% since 1987. Total landings decreased 11% to 17,830 metric tons (t) in 1990 (Fig. 15B). PMUS landings were 1048 t. Blue marlin accounted for most of the PMUS landings (Fig 16A). The second largest component was sharks, followed by swordfish and ono, combined landings of sailfish and spearfish (not shown) were of similar magnitude. The decline in PMUS was due to lower landings

of marlins and sharks. Tuna landings have decreased dramatically since 1987 (Fig. 16B). Total tuna landings were 16,745 t with albacore comprising 84%, yellowfin 14%, and bigeye 9% in 1990. The average catch per trip rose 9% in 1990 (Fig. 16C). Although the average catch per trip of PMUS decreased to 6.9 t, the catch per trip of tunas increased to 109.4 t.

DISCUSSION

Pelagic Fisheries in Hawaii

The longline fishery is the largest fishery in Hawaii in terms of landings and ex-vessel revenue. Ex-vessel revenue does not indicate the total economic impact of the fishery. With the recently enacted longline moratorium in effect, the longline fleet is limited to 163 vessels. Some longliners (mostly boats from the Gulf of Mexico) have left the fishery, but there are other vessels still interested (swordfish boats from the east coast and the Gulf of Mexico) in entering the fishery. In order to establish a baseline for future analysis of subsequent changes in the fishery, an economic analysis outlining the input-output linkages of Hawaii's longline fishery is recommended.

Very few if any of the federally permitted longliners from the east coast have left Hawaii. East coast longliners primarily target swordfish. If the moratorium on new entry expires and if the subsequent limited entry plans allow, it is likely that the number of longliners targeting swordfish would expand. Economic analysis on swordfish vessel performance while the moratorium in effect is also recommended.

Local trollers and handliners are concerned about their decreased catch rates with the concurrent expansion of the longline fleet. Their argument has been very influential at public hearings held to consider pelagic fisheries regulations. However, the troll and handline fisheries are the most difficult of all major pelagic fisheries in Hawaii to monitor. Compliance with timely submission of State catch reports and quality control of data must be increased if accurate assessments of this fishery are to be made. Because of changes in the market structure for troll and handline fishery, FMEP recommended to the WPRFMC's pelagic plan monitoring team that HDAR commercial catch reports become the standard time-series for this segment of the fleet. NMFS has also recommended consideration of an ongoing small boat survey for quasi-commercial, subsistence, and recreational troll and handline fisheries in Hawaii to provide information on these segments of the fishery.

Marketing seafood is the critical link to sustaining fisheries in Hawaii. The Hawaii seafood dealers account for employment and income generated from processing and marketing local and imported seafood. Although there is keen interest in

the estimated revenue and employment generated in the marketing sector of the fishing industry, little information is available. A socioeconomic assessment at the wholesale-retail level of seafood marketing is a major task that should be undertaken and updated on a regular basis.

Hawaii's Imports and Exports

Imports of pelagic species have become increasingly important as a source of pelagic fish products. We suggest the product form and value of the shipment be included in the summaries compiled by the NMFS SWR Market News Service. The air export of fresh fish to the U.S. mainland and foreign destinations (Japan) has become quite common and is believed to be an important component of the fishery. Therefore, the amount and value of fish exported from Hawaii by local dealers should also be monitored.

The 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 longliner landings through reports of cannery landings is excellent, but collection of the catch and effort data from this fishery has declined tremendously. Collection of catch and effort logs dropped from 78% of all trips in 1987 to 24% in 1991 (January through November). Additional personnel are needed to resurrect this once successful data collection scheme.

Acknowledgments

I would like to thank the United Fishing Agency, Pacific Island Seafoods and Norpac Fisheries for their cooperation and patience in our data collection effort. I greatly appreciate the assistance of Kurt E. Kawamoto (NMFS), Jo-Anne N. Kushima (HDAR), and the Honolulu Laboratory Fishery Data Management Program in the data collection and processing activities. I would also like to thank Samuel G. Pooley, Christofer H. Boggs, Ray F. Sumida, and Robert A. Skillman for their helpful comments and the Honolulu Laboratory's Scientific Services staff for the preparation of this manuscript.

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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	*Acanthocybium solandri*
Blue shark	*Prionace glauca*
Mako shark (short-fin)	*Isurus oxyrinchus*
Mako shark (long-fin)	*Isurus 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*
Northern bluefin tuna	*T. thynnus orientalis*
Skipjack tuna	*Katsuwonus pelamis*
Kawakawa	*Euthynnus affinis*
Frigate tunas	*Auxis* spp.
Other Pelagics	
Moonfish	*Lampris guttatus*
Escolar (oilfish)	*Lepidocybium flavobrunneum*
Pomfrets	*Bramidae*

Table 2.--Hawaii's pelagic landings (x 1,000 lb) and ex-vessel revenue (x $1,000), 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and the Hawaii Division of Aquatic Resources.

Year	PMUS total	Tuna total	Other pelagics	Total
		Landings		
1987	3,300	9,300	200	12,800
1988	3,700	11,800	200	15,700
1989	6,100	10,700	400	17,200
1990	8,800	8,500	400	17,700
1991	16,000	10,300	500	26,800
		Revenue		
1987	5,700	17,900	300	23,900
1988	5,500	22,400	300	28,200
1989	8,000	23,500	400	31,900
1990	16,400	22,500	600	39,500
1991	29,500	24,100	700	54,300

Table 3.--Landings of Hawaii's pelagic categories (x 1,000 lb) by gear type, 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and the Hawaii Division of Aquatic Resources.

Year	PMUS total	Tuna total	Other pelagics	Total
		Longline		
1987	1,000	2,700	200	3,900
1988	1,800	4,700	200	6,700
1989	3,600	5,900	400	9,900
1990	6,800	5,600	400	12,800
1991	13,200	5,900	500	19,600
		Troll and Handline		
1987	2,200	2,900	0	5,100
1988	1,800	2,800	0	4,600
1989	2,500	1,900	0	4,400
1990	2,000	1,900	0	3,900
1991	2,800	2,100	0	4,900
		Other Gear Types		
1987	100	3,700	0	3,800
1988	100	4,300	0	4,400
1989	0	2,900	0	2,900
1990	0	1,000	0	1,000
1991	0	2,300	0	2,300

Table 4.--Revenue of Hawaii's pelagic categories (x $1,000) by gear type, 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and the Hawaii Division of Aquatic Resources.

Year	PMUS total	Tuna total	Other pelagics	Total
		Longline		
1987	1,700	8,500	300	10,500
1988	2,300	13,400	300	16,000
1989	4,300	16,400	400	21,100
1990	13,000	17,300	600	30,900
1991	25,200	17,800	700	43,700
		Troll and Handline		
1987	3,700	4,700	0	8,400
1988	2,900	4,000	0	6,900
1989	3,600	2,800	0	6,400
1990	3,400	3,300	0	6,700
1991	4,300	3,500	0	7,800
		Other Gear Types		
1987	300	4,700	0	5,000
1988	300	5,000	0	5,300
1989	100	4,300	0	4,400
1990	0	1,900	0	1,900
1991	0	2,800	0	2,800

Table 5.--Hawaii's pelagic landings (x 1,000 lb) and ex-vessel revenue (x $1,000), 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and the Hawaii Division of Aquatic Resources.

	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
						Landings						
1987	100	900	700	100	1,000	500	<50	1,900	3,500	300	3,600	200
1988	100	1,000	1,300	300	500	400	100	3,000	3,900	700	4,200	200
1989	600	1,900	1,500	400	1,100	400	200	3,700	3,300	600	3,100	400
1990	4,200	1,400	1,200	100	1,400	300	200	3,600	3,300	400	1,200	400
1991	9,900	1,300	1,600	500	2,100	400	200	4,200	2,800	700	2,600	500
						Revenue						
1987	200	900	900	300	2,200	1,100	100	6,700	6,200	500	4,500	300
1988	300	800	1,400	400	1,400	1,100	100	9,800	7,100	900	4,600	300
1989	1,200	1,400	1,600	400	2,300	1,000	100	11,600	6,600	700	4,600	400
1990	9,700	1,200	1,600	200	2,900	700	100	12,100	7,800	600	2,000	600
1991	22,000	1,100	1,600	300	3,500	900	100	13,500	6,400	1,000	3,200	700

Table 6.--Hawaii's pelagic landings (x 1,000) by gear type, 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and Hawaii Division of Aquatic Resources.

	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	600	100	<50	100	<50	1,800	600	300	<50	200
1988	100	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	4,200	800	1,100	100	300	100	200	3,000	2,200	400	<50	400
1991	9,900	700	1,400	400	500	100	200	3,500	1,600	700	100	500
					Troll and Handline							
1987	<50	800	100	<50	1,000	300	<50	100	2,700	<50	100	<50
1988	<50	800	200	100	500	200	<50	300	2,300	<50	200	<50
1989	<50	1,100	200	100	900	200	<50	600	1,100	<50	200	<50
1990	<50	600	100	<50	1,100	200	<50	600	1,100	<50	200	<50
1991	<50	600	200	100	1,600	300	<50	700	1,100	<50	300	<50
					Other Gear Types							
1987	<50	<50	<50	<50	<50	100	<50	<50	200	0	3,500	<50
1988	<50	<50	<50	<50	<50	100	<50	<50	300	<50	4,000	<50
1989	0	<50	<50	<50	<50	<50	0	0	<50	0	2,900	<50
1990	0	<50	<50	<50	<50	<50	<50	<50	<50	0	1,000	<50
1991	0	<50	<50	0	<50	<50	<50	<50	100	0	2,200	<50

Table 7.--Hawaii's pelagic ex-vessel revenue (x $1,000) by gear type, 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and Hawaii Division of Aquatic Resources.

	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	200	100	800	200	100	200	100	6,500	1,500	500	<50	300
1988	200	200	1,200	300	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	9,700	700	1,500	200	600	200	100	10,900	5,800	600	<50	600
1991	22,000	500	1,400	300	700	200	100	12,500	4,300	900	100	700
Troll and Handline												
1987	<50	800	100	100	2,100	600	<50	200	4,300	<50	200	<50
1988	100	600	200	100	1,300	600	<50	600	3,200	<50	200	<50
1989	100	800	200	100	1,900	500	<50	1,000	1,500	<50	300	<50
1990	<50	500	100	<50	2,300	500	<50	1,200	1,900	<50	200	<50
1991	<50	600	200	<50	2,800	700	<50	1,000	2,000	100	400	0
Other Gear Types												
1987	<50	<50	<50	<50	<50	300	<50	<50	400	0	4,300	<50
1988	<50	<50	<50	<50	<50	300	<50	<50	600	<50	4,400	<50
1989	0	<50	<50	<50	<50	100	0	0	<50	0	4,300	<50
1990	0	<50	<50	<50	<50	<50	<50	<50	100	0	1,800	<50
1991	0	<50	<50	0	<50	<50	<50	<50	100	0	2,700	<50

Table 8.--NMFS estimates of longline landings, 1991.

Species	Pounds landed (kept)	
	Estimated weight from logbook numbers[a]	Estimated weight from market monitoring[b]
Pelagic Management Unit Species		
Blue[c]	575,746	657,856
Striped[c]	1,243,325	1,420,643
Swordfish	9,297,835	9,879,079
Other billfish	434,241	384,698
Mahimahi	560,760	548,386
Ono	84,939	100,613
Sharks[c]	178,652	236,825
Tunas		
Albacore	686,383	688,484
Bigeye	3,409,939	3,473,732
Yellowfin	1,514,611	1,604,312
Other tuna	84,372	68,197
Other pelagics	292,920	481,675
Total	18,363,724	19,544,501

[a]Estimate based on logbook numbers and market monitoring average weights.

[b]Estimate based on market monitoring only.

[c]Adjustment to number kept.

Table 9.--Longline logbook summaries, 1991.

Species	Logbook number kept (actual)	Adjusted logbook number[a]	Estimated market number[b]	Average market weight
Pelagic Management Unit Species				
Blue[c]	8,459	3,317	3,790	174
Striped[c]	16,994	22,136	25,293	56
Swordfish	61,340	61,340	65,175	152
Other billfish	9,075	9,075	8,040	48
Mahimahi	38,319	38,319	37,473	15
Ono	2,689	2,689	3,185	32
Sharks[c]	4,440	1,202	1,593	149
Tunas				
Albacore	13,201	13,201	13,241	52
Bigeye	39,534	39,534	40,274	86
Yellowfin	12,961	12,961	13,729	117
Other tunas	4,197	4,197	3,392	20
Other pelagics	8,231	8,231	13,535	36
Total	219,440	216,202	228,720	85

[a]Due to species identification errors, the logbook number needed to be adjusted. The total number of blue and striped marlin (25,453) was adjusted to market monitoring proportions. Adjusted shark numbers are for market species only (some sharks were logged as "kept" but in fact were caught but not landed).

[b]Estimated market number = number estimated by market monitoring.

[c]Adjustment to number kept.

Table 10.--Mean size of catch (in pounds) by gear type, 1987-91.

Year	Pelagic management unit species					Tunas			
	Swordfish	Blue marlin	Striped marlin	Mahi	Ono	Bigeye tuna	Yellowfin tuna	Albacore	Skipjack tuna
Longline									
1987	129.3	161.4	66.2	21.1	33.3	76.3	81.9	62.3	--
1988	119.2	157.3	56.9	20.0	31.9	83.2	102.5	59.7	--
1989	131.1	164.7	61.5	23.0	34.6	77.0	103.7	62.0	--
1990	147.6	198.4	61.5	18.7	36.0	79.8	121.9	61.2	--
1991	142.4	172.0	55.8	14.5	31.6	85.5	117.2	53.3	--
Troll and Handline									
1987	--	212.1	67.3	18.8	19.5	19.6	27.6	--	8.9
1988	--	181.6	60.3	17.2	21.1	28.9	31.5	--	11.1
1989	--	185.7	67.9	19.9	20.9	34.0	35.4	--	13.6
1990	--	243.3	74.8	19.1	21.9	25.3	51.6	--	10.6
1991	--	179.2	60.6	13.5	18.8	20.4	26.0	--	14.5

Table 11.--Ex-vessel prices ($/lb) by species in Hawaii's market and in the longline and troll and handline fisheries, 1987-91. Estimates are based on the wholesale marketing monitoring program of the National Marine Fisheries Service and Hawaii Division of Aquatic Resources.

	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	3.00	1.02	1.39	2.30	2.31	2.60	1.45	3.56	1.86	1.57	1.14
1988	2.87	0.84	1.02	1.22	2.73	2.56	1.05	3.33	1.81	1.30	1.14
1989	2.28	0.84	1.10	1.13	2.26	2.47	0.58	3.24	2.14	1.30	1.48
1990	2.32	0.92	1.38	1.23	1.97	2.52	0.57	3.33	2.19	1.48	1.85
1991	2.23	0.90	0.98	0.89	1.70	2.18	0.59	3.22	2.34	1.31	1.29
					Longline						
1987	3.23	1.22	1.36	2.37	2.37	2.89	1.50	3.63	2.57	1.57	0.87
1988	2.96	0.85	1.08	1.70	2.79	2.69	1.08	3.35	2.50	1.34	0.75
1989	2.31	0.87	1.02	1.19	2.31	2.27	0.62	3.51	2.45	1.31	1.06
1990	2.32	0.93	1.39	1.34	1.71	2.63	0.59	3.63	2.58	1.50	1.54
1991	2.23	0.78	0.99	0.87	1.29	2.10	0.60	3.59	2.65	1.30	0.81
					Troll and handline						
1987	2.11	0.99	1.58	2.11	2.32	2.47	0.91	2.53	1.70	1.62	1.24
1988	2.71	0.86	1.06	0.57	2.74	2.50	---	1.88	1.47	1.52	0.94
1989	1.89	0.82	2.19	0.94	2.25	2.59	0.39	1.76	1.48	1.16	1.42
1990	---	1.01	1.04	1.00	2.26	2.38	0.92	2.11	1.77	1.45	2.00
1991	1.48	1.04	0.94	0.98	1.85	2.19	0.46	1.41	1.93	1.43	1.69

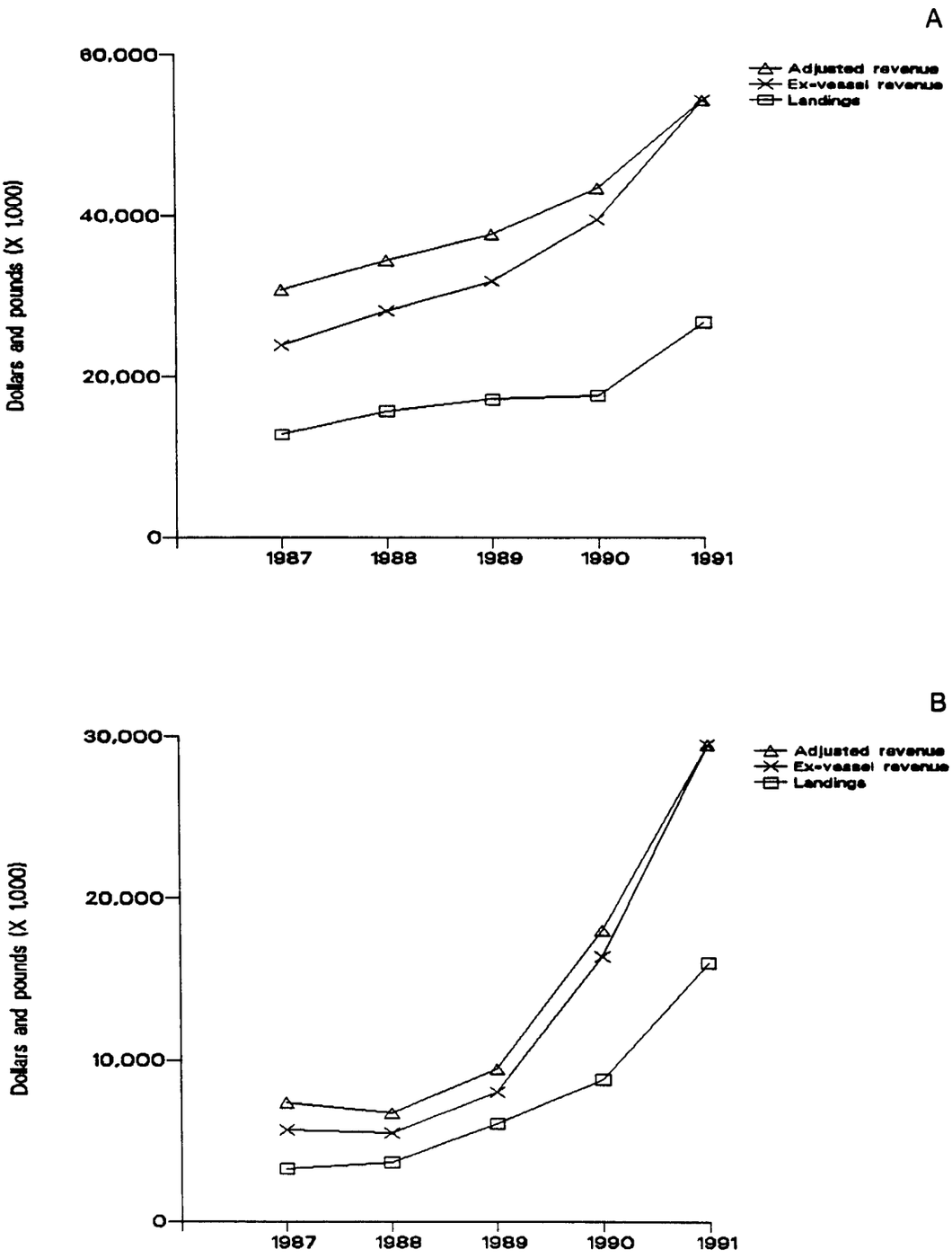

Figure 1.--Hawaii's landings and revenue by (A) total and (B) pelagic management unit species, 1987-91.

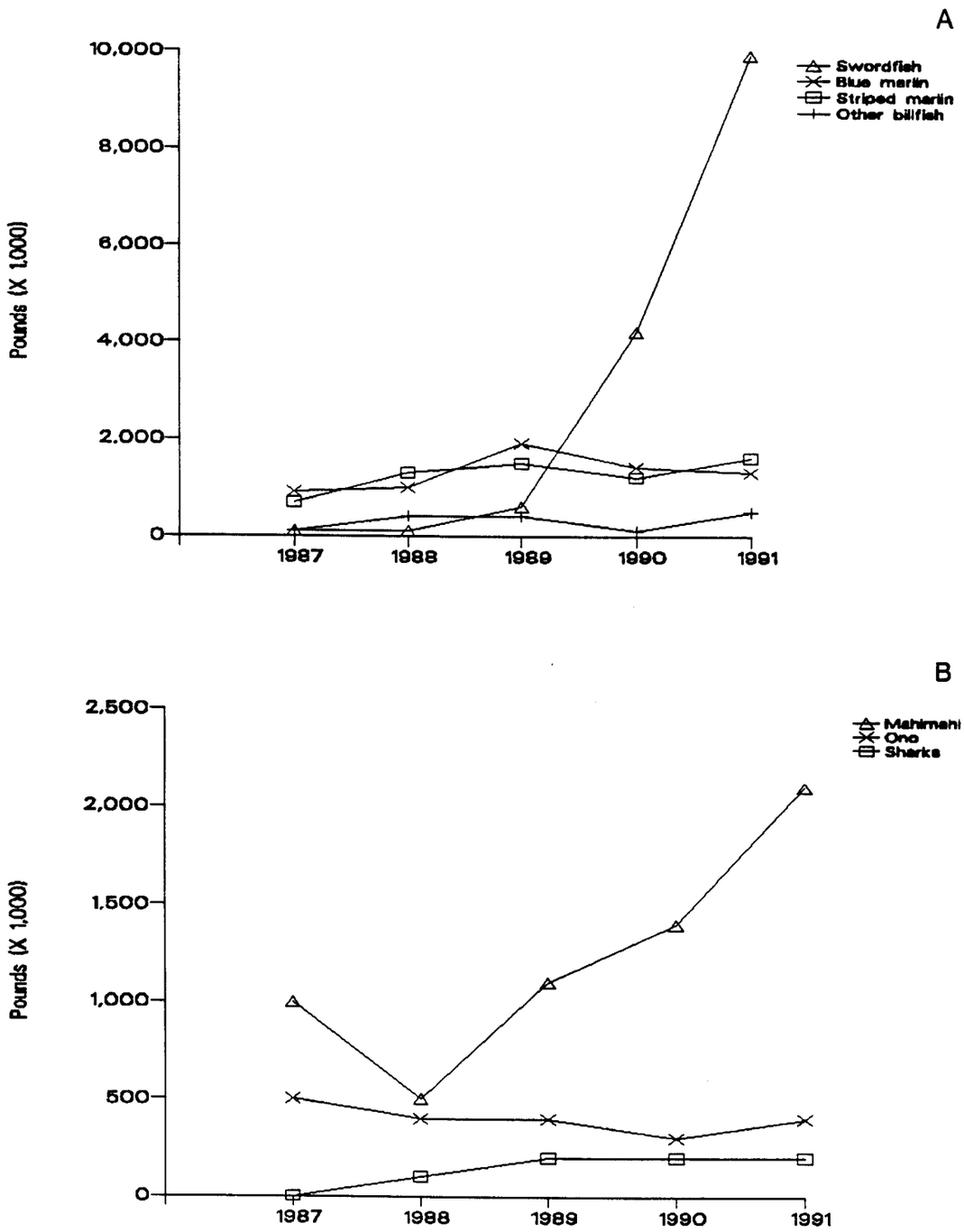

Figure 2.--Composition of (A) billfish and (B) other PMUS in Hawaii, 1987-91 (PMUS = pelagic management unit species).

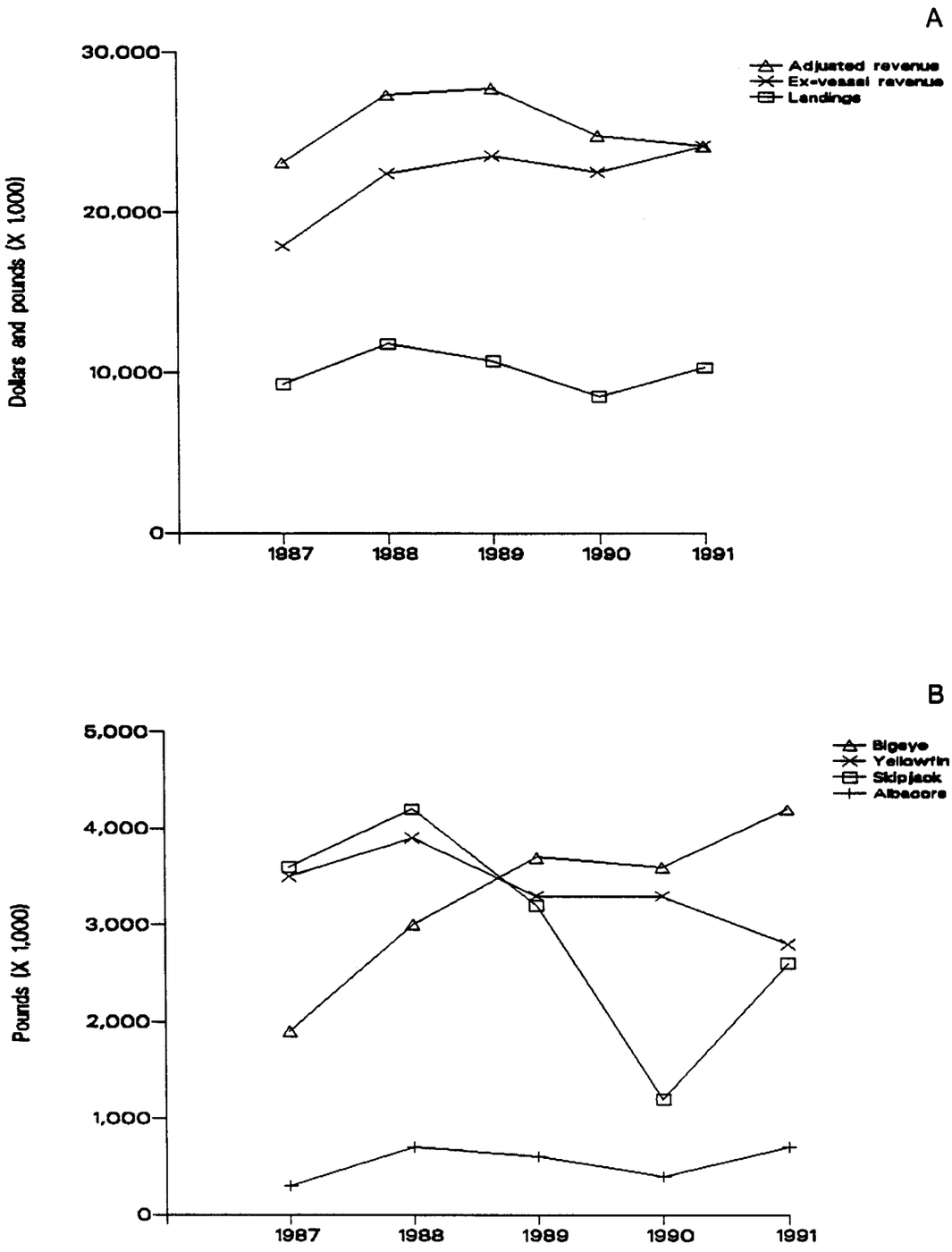

Figure 3.--Hawaii's tuna (A) landings and revenue and (B) species composition, 1987-91.

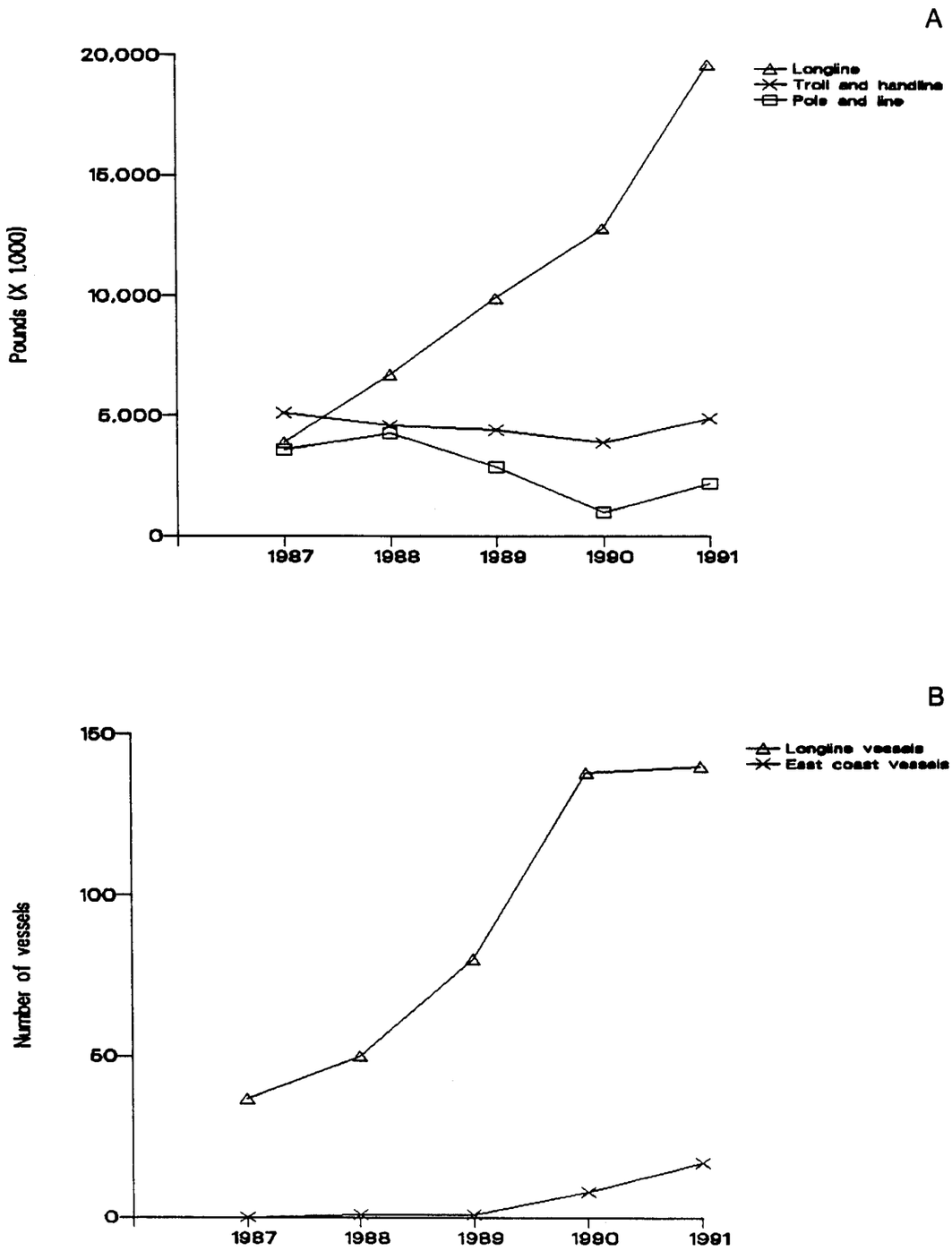

Figure 4.--Hawaii's (A) landings by gear type and (B) number of longline vessels, 1987-91.

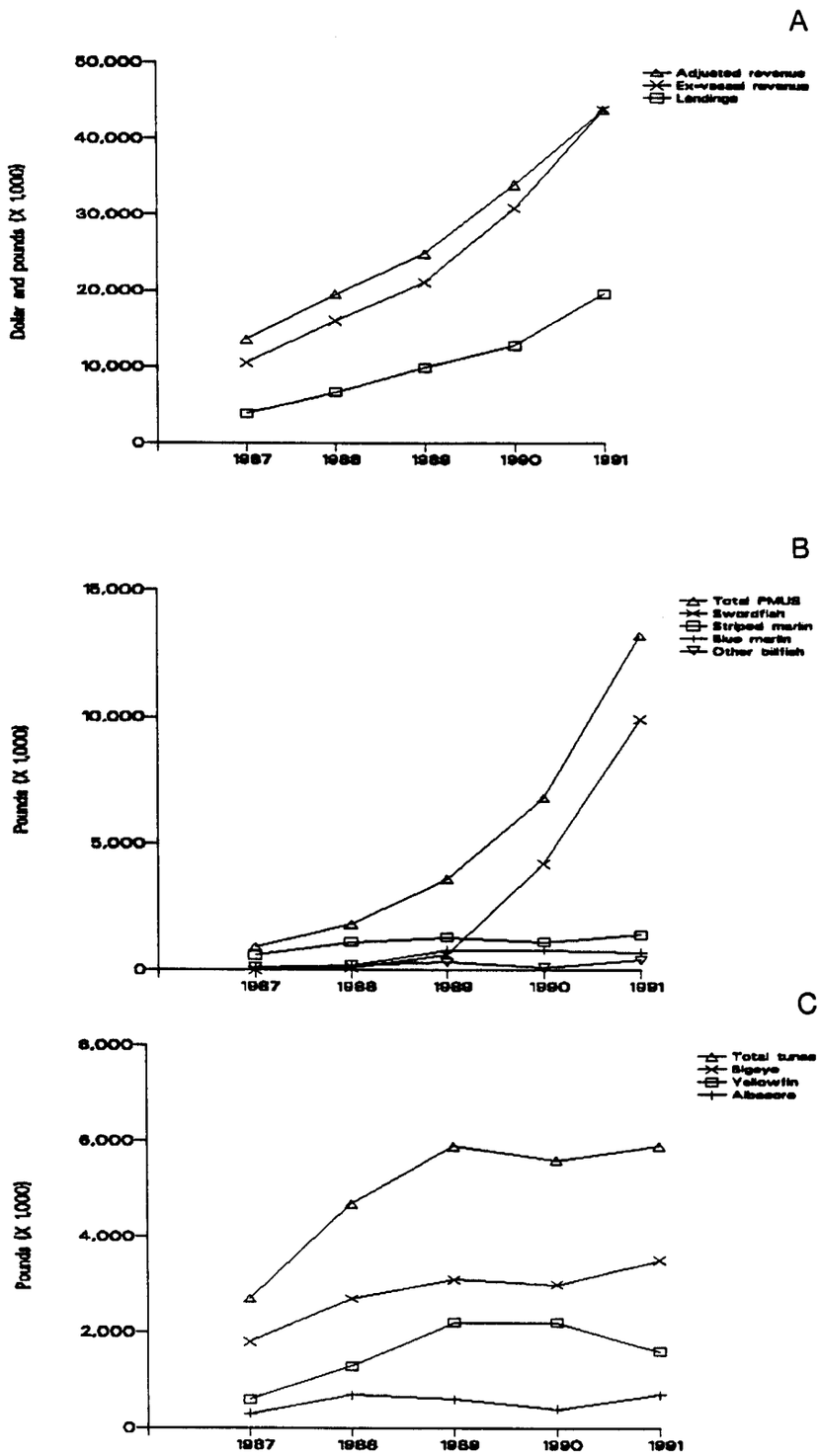

Figure 5.--Hawaii's longline (A) landings and revenue, (B) PMUS landings, and (C) tuna landings, 1987-91; (PMUS = pelagic management unit species).

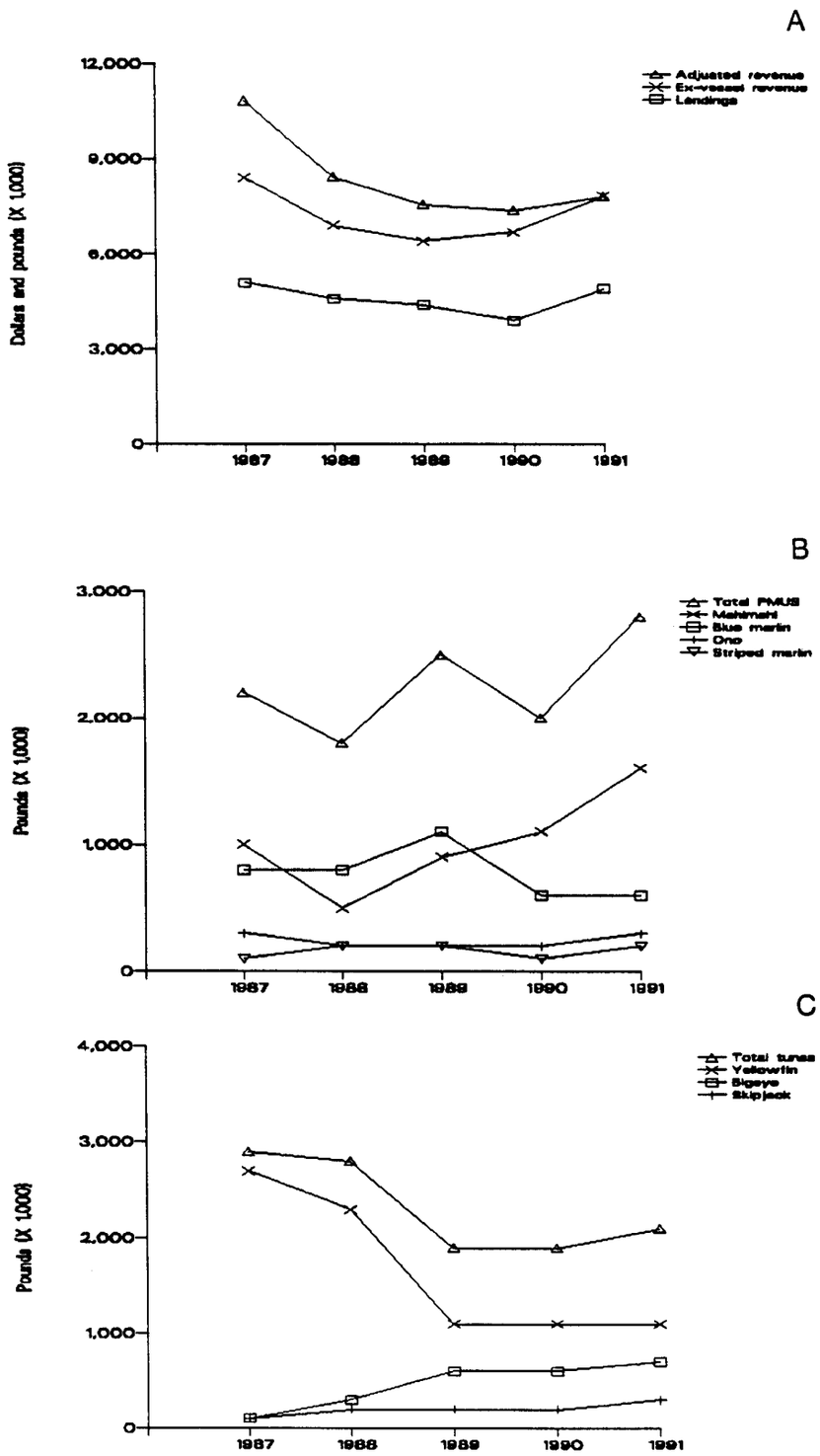

Figure 6.--Hawaii's troll and handline (A) landings and revenue, (B) PMUS landings, and (C) tuna landings (PMUS = pelagic management unit species).

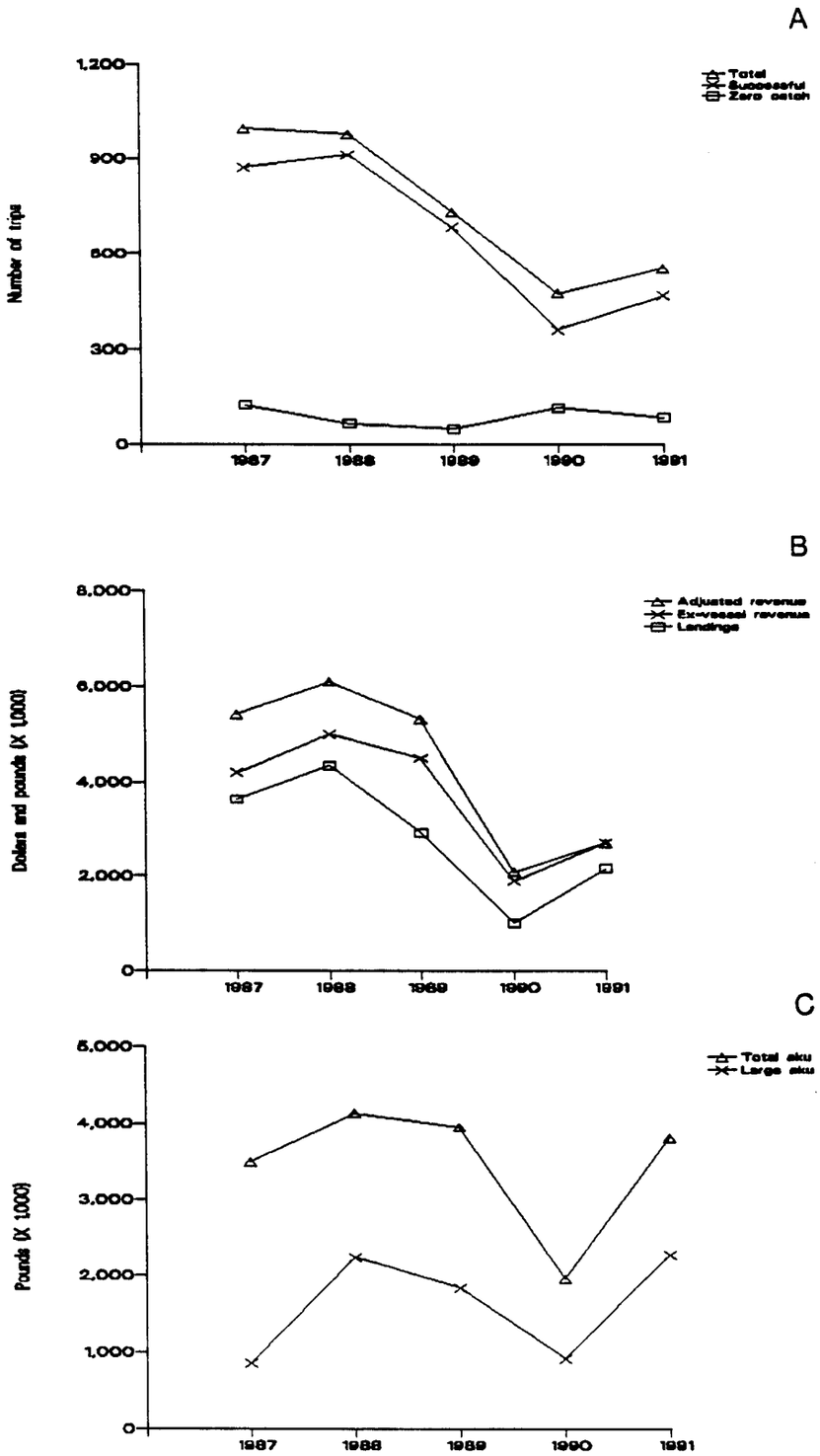

Figure 7.--Hawaii's pole and line (A) vessel activity, (B) landings and revenue, and (C) average catch per trip, 1987-91.

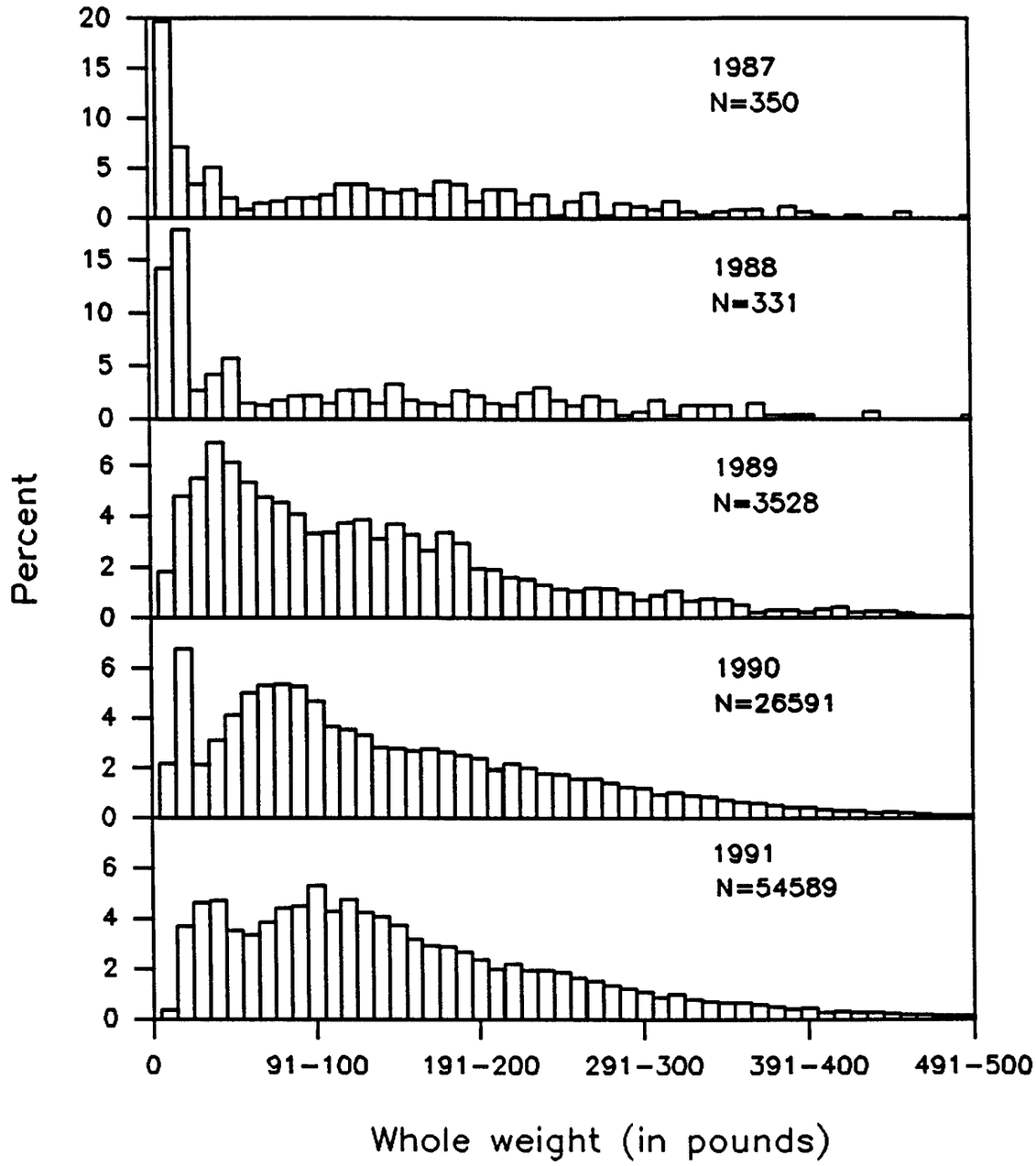

Figure 8.--Weight-frequency histograms of longline caught swordfish, 1987-91.

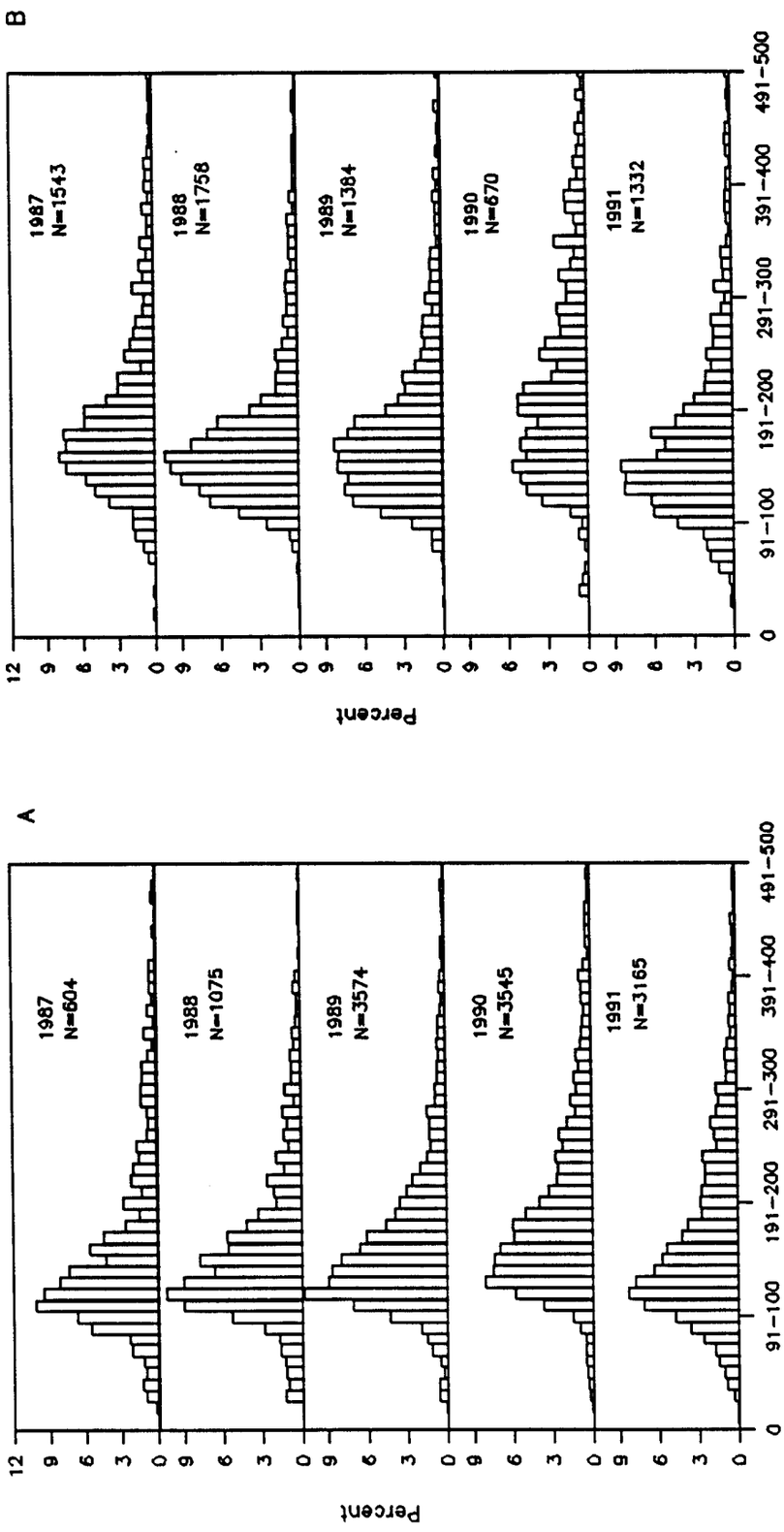

Figure 9.--Weight-frequency histograms of blue marlin for (A) longline and (B) troll and handline, 1987-91.

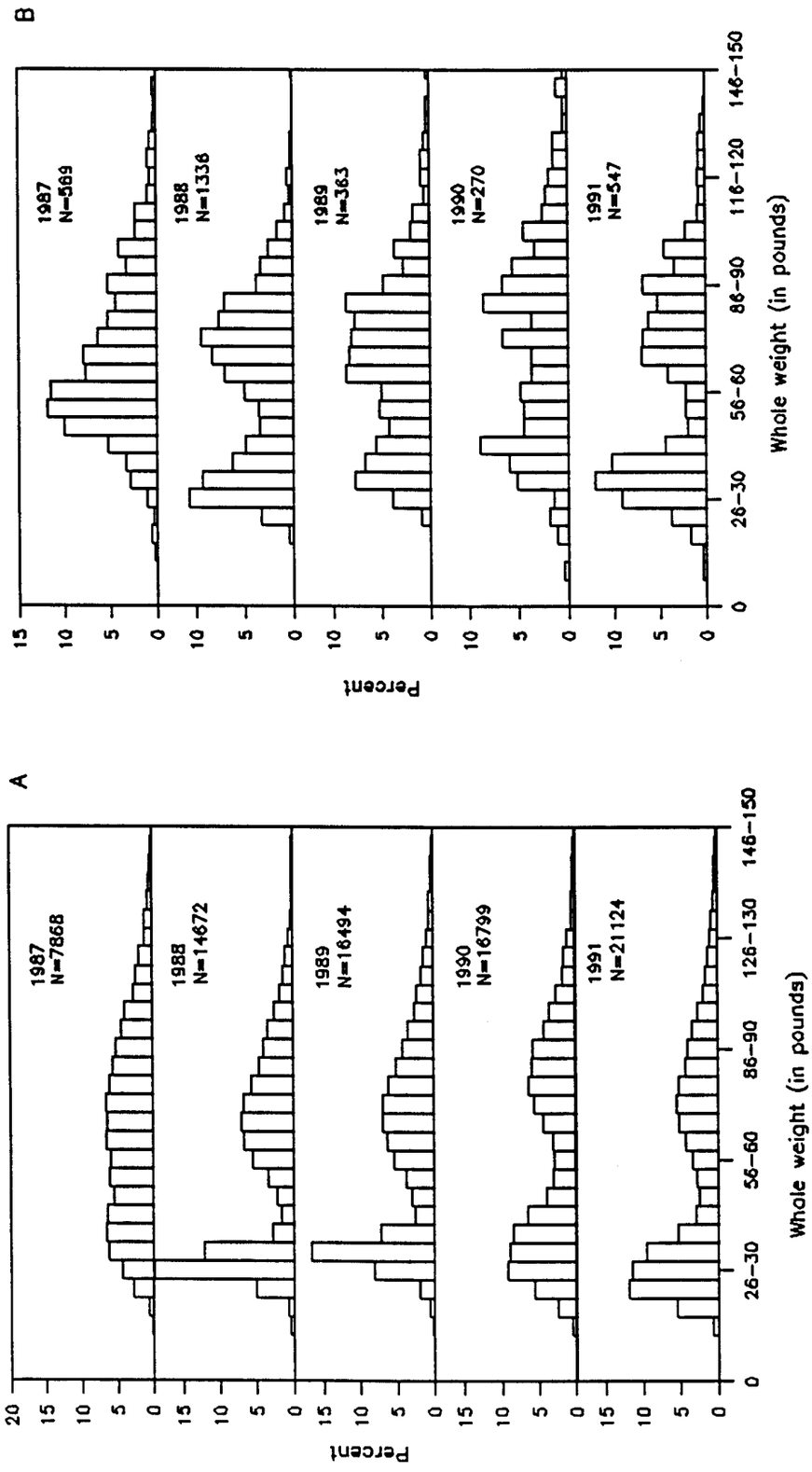

Figure 10.--Weight-frequency histograms of striped marlin for (A) longline and (B) troll and handline, 1987-91.

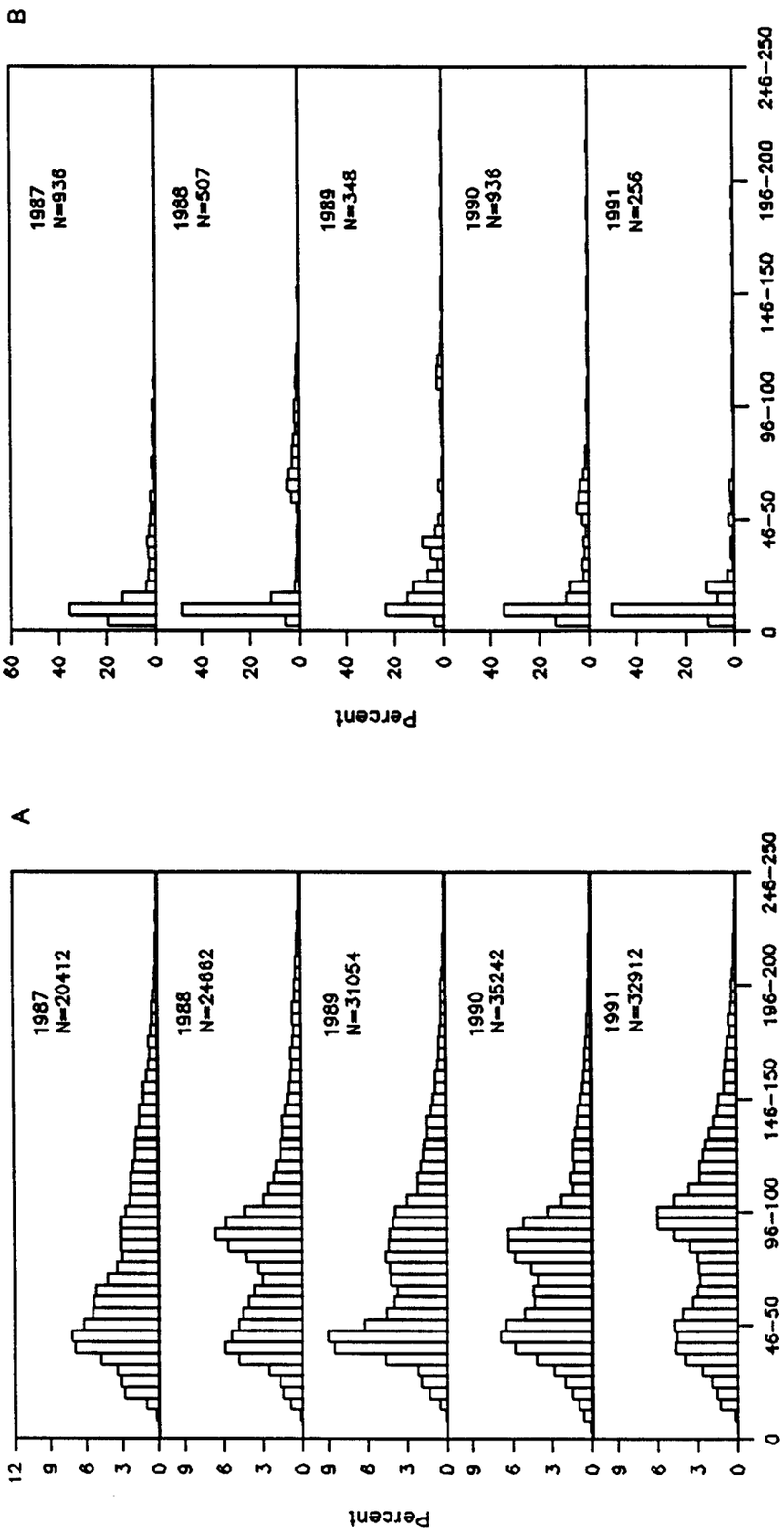

Figure 11.--Weight-frequency histograms of bigeye tuna for (A) longline and (B) troll and handline, 1987-91.

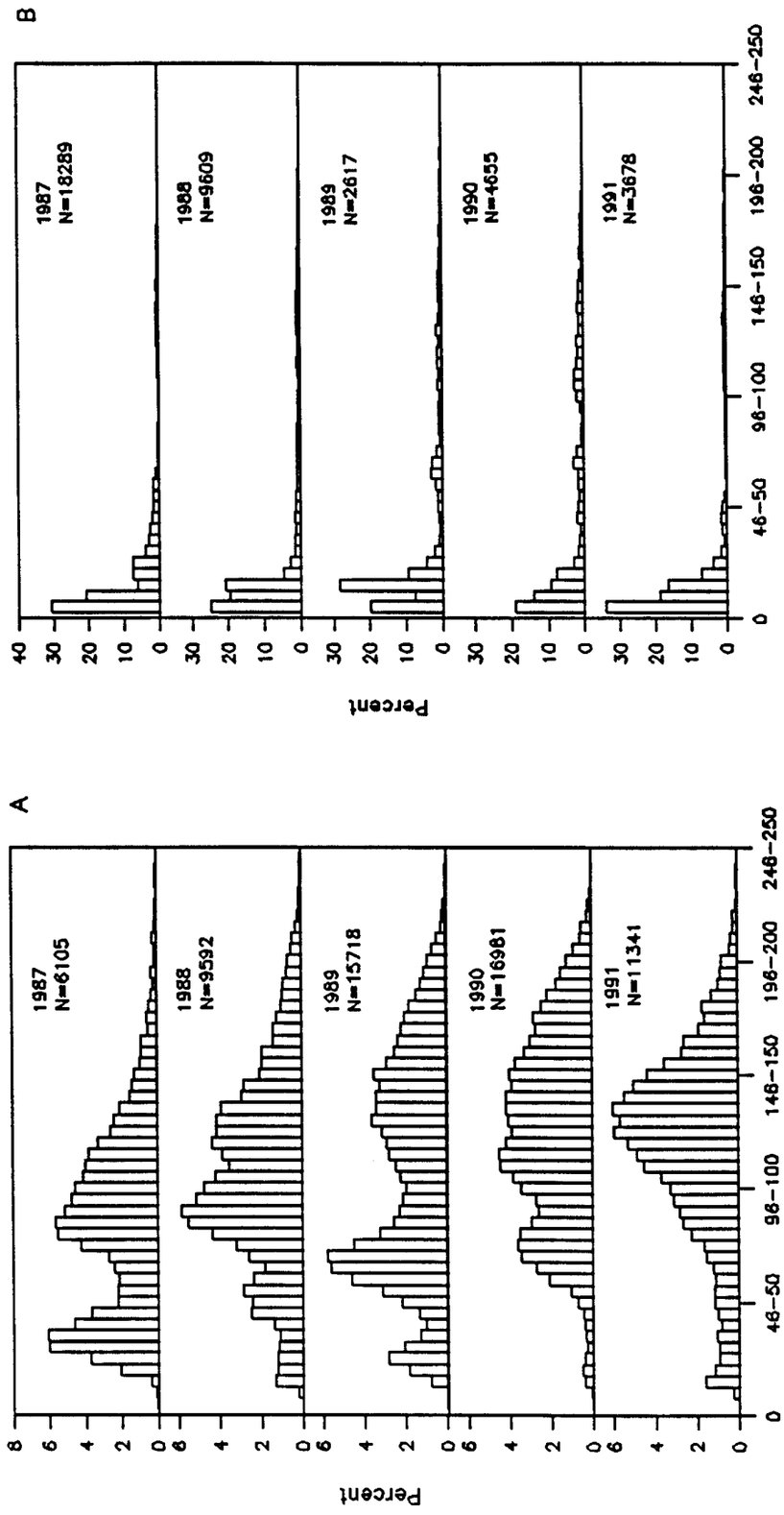

Figure 12.--Weight-frequency histograms of yellowfin tuna for (A) longline and (B) troll and handline, 1987-91.

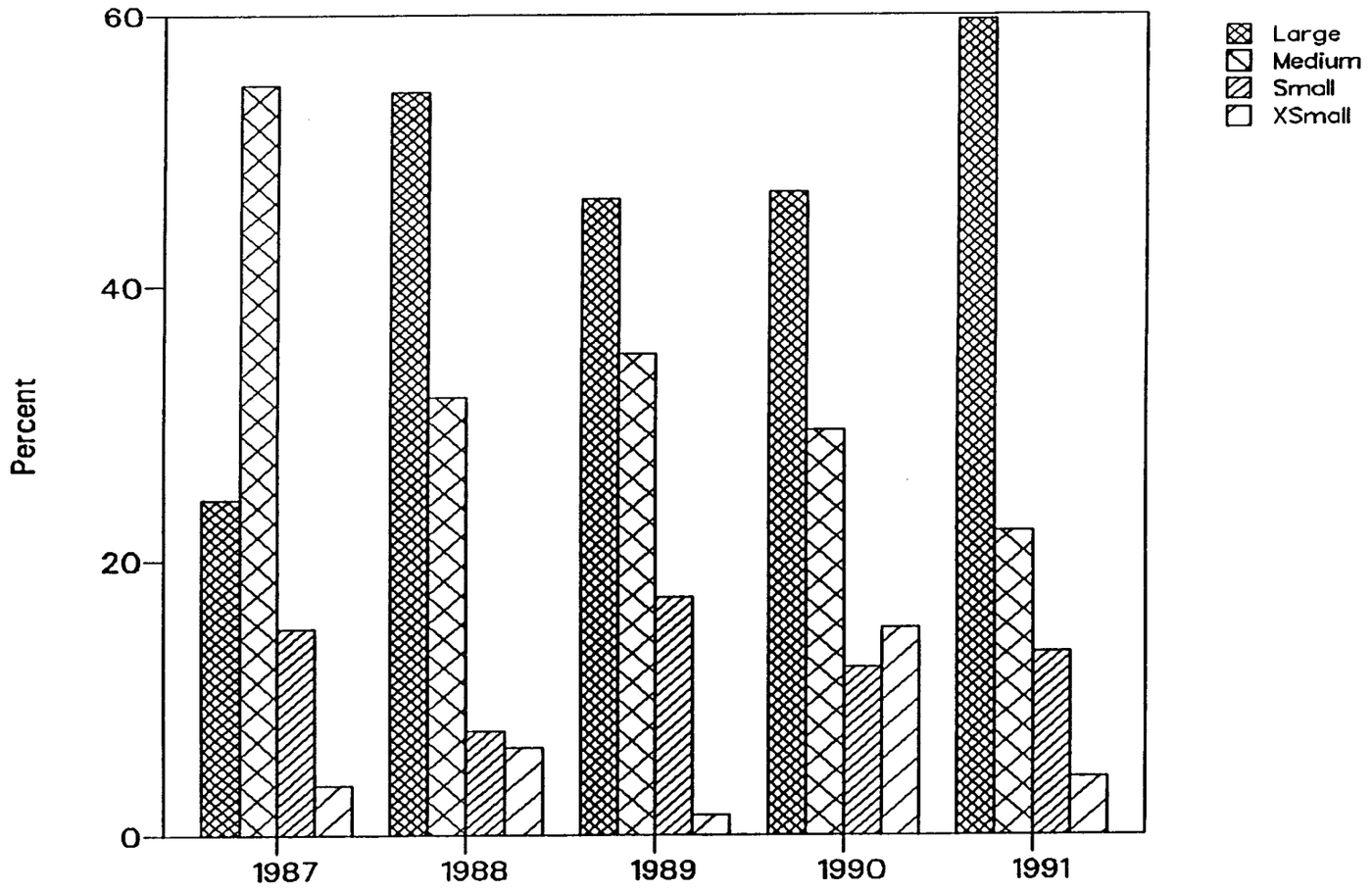

Figure 13.--Hawaii's pole and line landings by size category (percent total weight by size category), 1987-91.

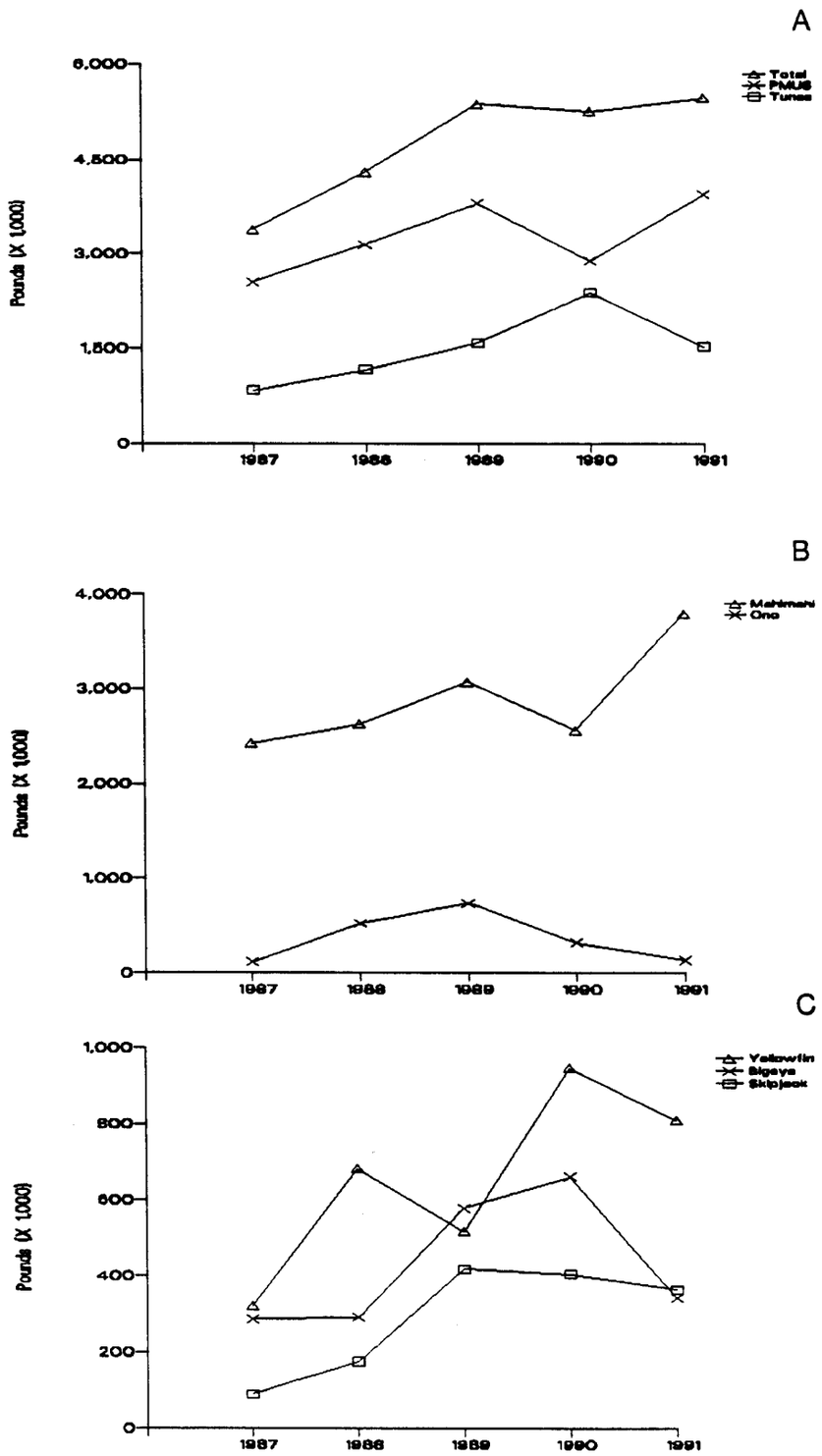

Figure 14.--Hawaii's imports by (A) category, (B) PMUS, and (C) tunas (PMUS = pelagic management unit species).

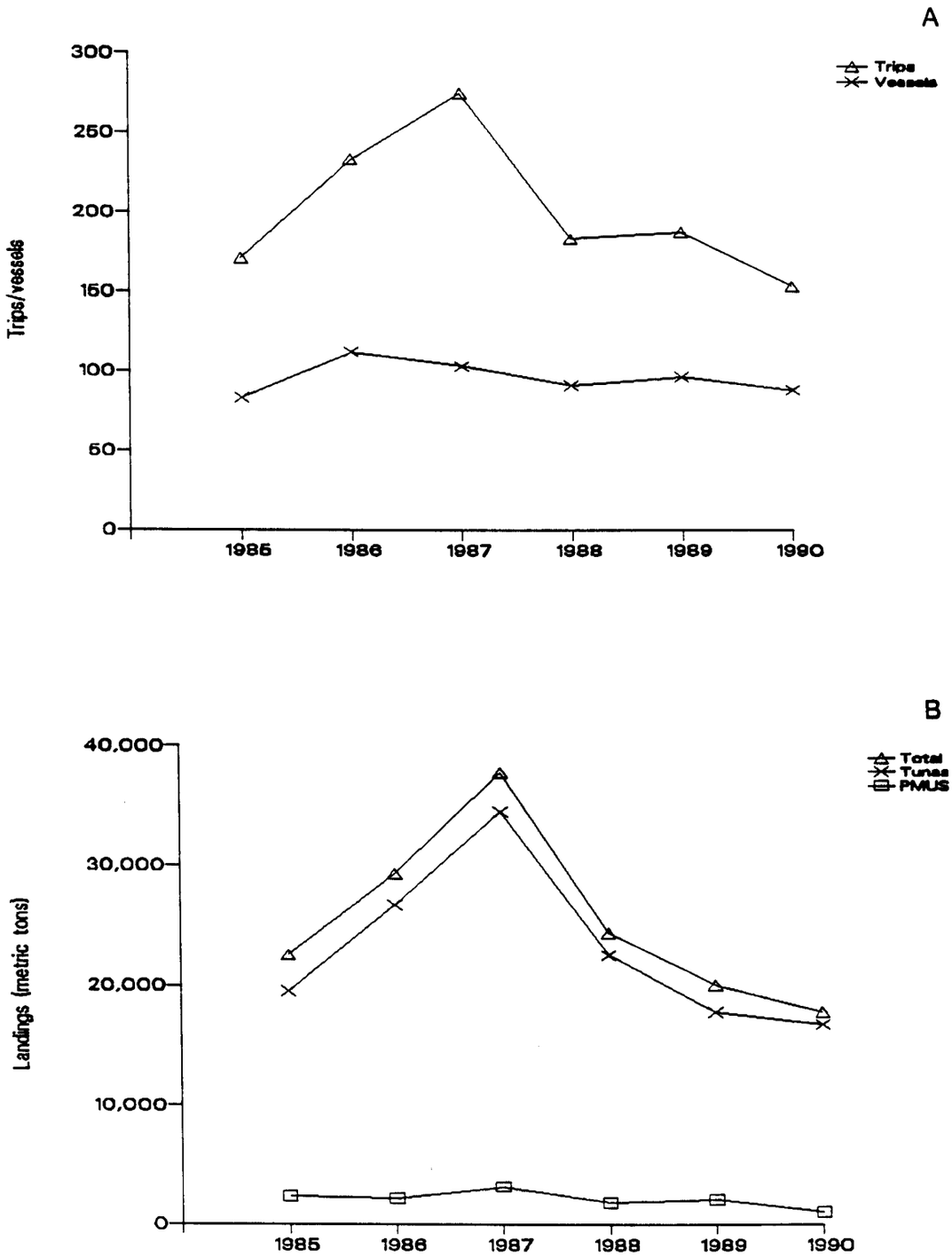

Figure 15.--American Samoa foreign longline (A) vessel activity and (B) landings, 1986-90 (PMUS = pelagic management unit species).

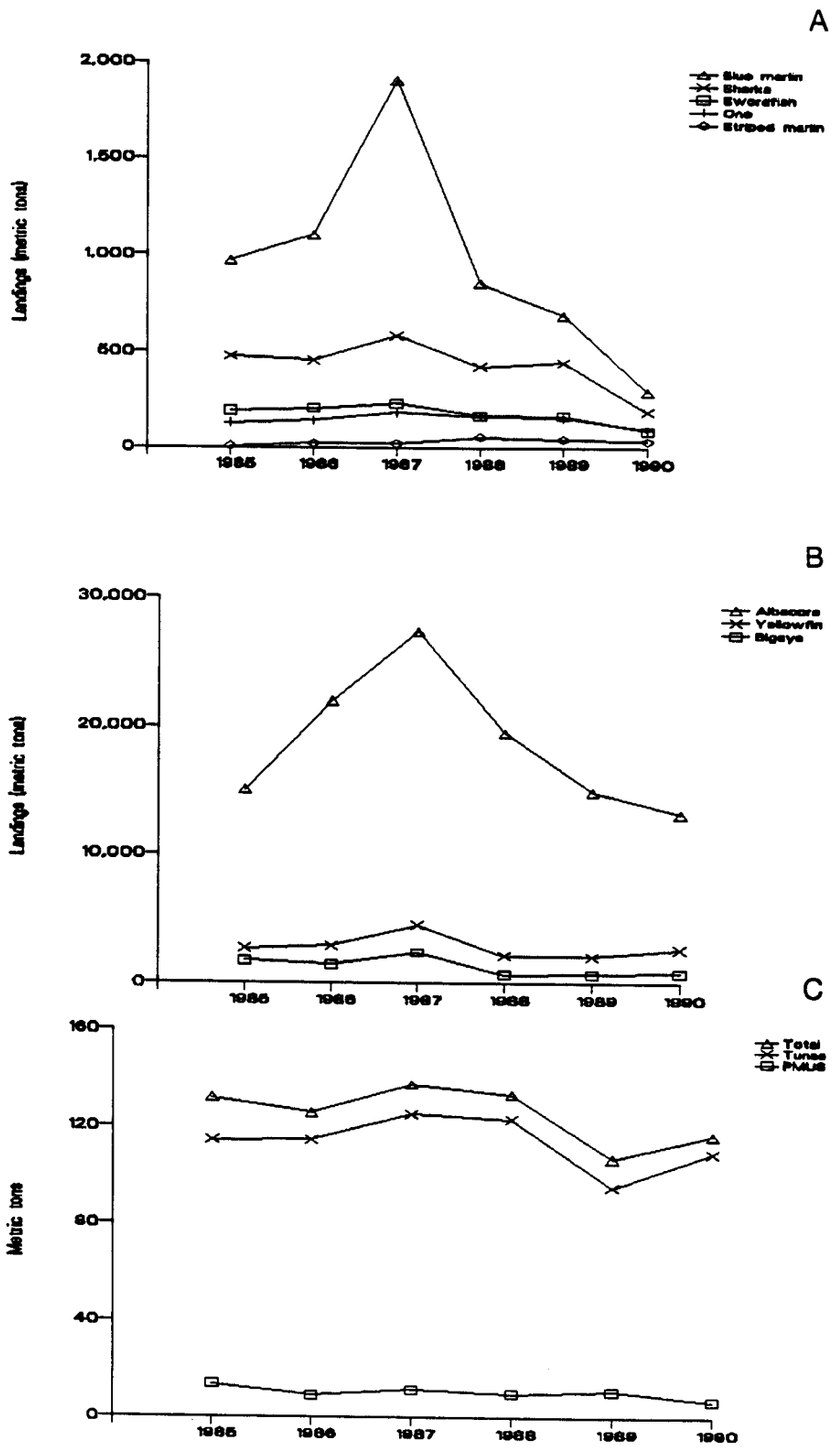

Figure 16.--(A) PMUS composition, (B) tuna composition, (C) average catch per trip of longliners in American Samoa, 1986-90 (PMUS = pelagic management unit species).