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Estimated Catches of Walleye Pollock, Atka Mackerel and Pacific Cod Within Critical Habitat of the Steller Sea Lion in the Bering Sea, Aleutian Islands and Gulf of Alaska From 1977-92

October 1993

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ESTIMATED CATCHES OF WALLEYE POLLOCK, ATKA MACKEREL AND PACIFIC COD WITHIN CRITICAL HABITAT OF THE STELLER SEA LION IN THE BERING SEA, ALEUTIAN ISLANDS AND GULF OF ALASKA FROM 1977-92

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Abstract

This report contains annual and first quarter catch estimates of walleye pollock, Pacific cod and Atka mackerel by foreign, joint-venture, and domestic fisheries within designated critical habitat of the Steller sea lion (58 FR 17181) in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) from 1977-92. Data are plotted as both species catch estimates and percent of regional (BSAI and GOA) species catch taken from the three types of critical habitat (within 20 nautical miles of rookeries and haulouts, and within aquatic foraging areas) each year and first quarter. Trends in removals from critical habitat from 1977-92 are described in light of the changes in the composition and management of the region's groundfish fisheries.

INTRODUCTION

The objective of this report and two others in this series (Fritz 1993a,b) is to document the activities of the Alaskan groundfish fisheries in proposed critical habitat of the Steller sea lion using data collected by fisheries observers from 1977-92. During this period, not only did the sea lion population in Alaska decline, but the nature of the groundfish fishery changed, as evidenced by the change in participants, and areas and seasons fished. From the accompanying charts, tables and graphs, it is clear that catches of groundfish species, including some which are sea lion prey, from proposed critical habitat increased between 1977-92. It is this coincidence that has led some to suggest that the sea lion decline was caused by increases in fish removals from sea lion habitat (e.g. Greenpeace vs. Mosbacher 1991, US District Court, Western District of Washington, C91-887(Z)C). Analyses in 1991 of Gulf of Alaska (GOA) fishery statistics along with data on sea lion population biology led the National Marine Fisheries Service (NMFS) to conclude that spatial and temporal concentration of the pollock fishery in the 1980s could have contributed to the decline in sea lions, but a causal link between the two could not be established (NMFS Section 7 consultation, biological opinion on the walleye pollock (*Theragra chalcogramma*) total allowable catch specification for the 1991 GOA groundfish fishery, 5 June 1991). It is not the intent of this report to refute or support this conclusion, but simply to document the recent removals of three important commercial and prey species from designated critical habitat for Steller sea lions.

Steller sea lions (*Eumetopias jubatus*) range throughout the perimeter of the North Pacific Ocean from Japan and Korea northward to the Bering Strait, throughout the Aleutian Islands and the Gulf of Alaska, and south to the Channel Islands of California (Hoover 1988). Sea lions eat primarily schooling fish, such as Pacific sand lance (*Ammodytes hexapterus*), salmon (*Oncorhynchus* spp.), capelin (*Mallotus villosus*), Pacific herring (*Clupea pallasii*), walleye pollock and Atka mackerel (*Pleurogrammus monopterygius*), some of which are also commercially exploited by fisheries off Alaska. The historical center of abundance has been in Alaskan waters from the Aleutian Islands eastward to the Kenai Peninsula. After a survey of sea lion abundance at key index sites in 1985, researchers at the National Marine Mammal Laboratory (NMML) and at the Alaska Department of Fish and Game (ADFG) observed that the sea lion population in the eastern Aleutian Islands had declined by almost 80% since the mid-1950s (Merrick et al. 1987). The range-wide survey in 1989 confirmed not only that the decline in the eastern Aleutian population had continued, but that populations in the GOA (54% decline between 1960 and 1989) and the former USSR (74% decline) had shrunk as well (Loughlin et al. 1992). Furthermore, studies in the central GOA suggested that the physical condition of sea lions had deteriorated, possibly due to nutritional deficiencies (Calkins and Goodwin 1988). Sea lions collected in

1985-86 in the central GOA (near Kodiak Island) were significantly smaller in weight, girth and standard length and had lower hemoglobin values than a similar group collected in the 1970s from the same area (Calkins and Goodwin 1988). Analyses of sea lion life tables (York 1993) and data on resightings of tagged pups (Merrick 1992) suggests that the decline in the sea lion population as a whole may be due to an increase in mortality of juveniles, particularly during the first year of life. Recently weaned sea lions tend to eat smaller fish than adults and forage in surface waters (usually less than 20 m depth; Merrick (1992)).

Concern for the survival of the species led the NMFS to list the Steller sea lion as threatened throughout its range under the Endangered Species Act (ESA) on an emergency basis on 5 April 1990 (55 FR 12645) and on a final basis on 26 November 1990 (55 FR 49204). Section 7 of the ESA requires that each federal agency, in consultation with the Secretary (of Commerce, in the case of sea lions), insure that its actions are not likely to jeopardize the continued existence of a listed species. As part of the ESA Section 7 review of the 1991 GOA pollock fishery, the NMFS concluded that spatial and temporal concentration of trawl fishing for pollock in the 1980s could have contributed to the decline in the sea lion population. To protect sea lions, the NMFS (in 1992) implemented fishery management regulations (pursuant to Amendment 20 to the Bering Sea/Aleutian Islands (BSAI) and Amendment 25 to the GOA fishery management plans (FMP)) to spatially allocate the total allowable catch (TAC) of pollock in the GOA and separate sea lions from trawlers in important sea lion habitats. The spatial separation took the form of 10 nm trawl exclusion zones around 37 sea lion rookeries west of 150°W longitude in the GOA and BSAI. The 10 nm trawl exclusion zones are in place year-round. Furthermore, 20 nm trawl exclusion zones were created around six rookeries in the eastern and central Aleutians islands from January-April 15, during the BSAI pollock "A" or roe season.

A requirement of Section 4 of the ESA is the designation of critical habitat, which is rather broadly defined in Section 3(5)(A)(i) of the ESA as:

> **the specific areas** within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) **essential to the conservation of the species and** (II) **which may require special management consideration or protection** (author's emphasis).

On 1 April 1993, the Department of Commerce published a proposed rule designating critical habitat for the Steller sea lion (58 FR 17181). The proposed critical habitat is:

> (1) all Steller sea lion rookeries (where adult males actively defend territories and most females give birth

and mate) and major haulouts (where greater than 200 sea lions have been counted, but where few pups are present and little breeding takes place) (Table 1), including:

(a) a zone 3000 feet landward and seaward from each site east of 144°W longitude (including those in Alaska, Washington, Oregon and California); and

(b) a zone 3000 feet landward and 20 nautical miles (nm) seaward of each site west of 144°W longitude where the population had declined more precipitously and where the former center of abundance of the species had been; and

(2) three aquatic foraging habitats within the core of the species' range (Figures 1-3):

(a) an area in the eastern Bering Sea surrounding Bogoslof Island from approximately 60 nm north of Unimak Island west to 60 nm north of the Islands of Four Mountains and south to the Aleutian Island chain;

(b) Seguam Pass in the Aleutian Islands; and

(c) Shelikof Strait in the GOA.

Portions of proposed critical habitat, specifically within 10 nm of all rookeries west of 150°W and 20 nm of six rookeries in the eastern and central Aleutians, were receiving "special management consideration or protection" prior to its designation as critical habitat. However, designation of critical habitat for a species does not, in and of itself, prohibit or restrict any activity in that area. Designation of critical habitat, much like the Section 7 process, creates a mechanism whereby each federal agency insures that its actions within the area are not likely to destroy those features which make it "critical" nor adversely modify its usefulness to sea lions.

METHODS

As a result of the Fishery Conservation and Management Act of 1977 which promoted "domestication" of fisheries in the exclusive economic zone (between 3-200 miles offshore) of the United States, the participants, and areas and seasons fished by the groundfish fisheries off Alaska changed dramatically during the 1980s. From the mid-1960s to 1982, Alaskan groundfish fisheries were dominated by distant-water fleets of foreign nations, particularly Japan, the former USSR, Korea and Poland. Beginning in about 1980, domestic catcher vessels formed joint-

ventures with foreign processing ships to supply groundfish via cod-end transfer at sea. This practice continued through 1990 in the BSAI and 1988 in the GOA, after which groundfish fisheries were prosecuted solely by domestic enterprises.

The NORPAC database, maintained by the Alaska Fisheries Science Center, NMFS, contains all data collected by fishery observers aboard foreign, joint-venture and domestic vessels in the North Pacific, which includes BSAI, GOA and off the coasts of Washington, Oregon and California. The FUNCTION AREA statement in the FETCH database query language was used to sum catches of walleye pollock, Pacific cod and Atka mackerel within 20 nm of each sea lion rookery and haulout west of 144°W longitude and each aquatic foraging area by foreign, joint-venture and domestic components of the fishery (Fritz 1993a). Catches were also accumulated by quarter (January-March, April-June, July-September and October-December) and either vessel class (foreign and joint venture data) or gear (domestic data). Quarterly and annual totals within critical habitat and within each fishery management region (BSAI: INPFC areas 51-55; GOA: INPFC areas 61-64), as well as quarterly and annual percents taken within critical habitat were calculated.

Observer coverage, or the percent of actual catch of a species in the observer data, varied between species and years. For instance, observer coverage was lower during the first several years of the foreign/joint venture (1977-81) and domestic (1987-89) programs than after they had been fully implemented. To estimate total catches from critical habitat for a species, observed catches were multiplied by adjustment factors, which were calculated for each year (1977-92), management area (BSAI or GOA) and fishery component (foreign/joint venture or domestic) for pollock, Pacific cod and Atka mackerel (Table 2). Adjustment factors were defined as the annual species catch in a management area by a fishery component divided by the observed catch of the species for the year, management area and fishery component. Estimates of annual and first quarter catches of pollock, Pacific cod and Atka mackerel, and the percent of total annual and first quarter catches of each species taken from critical habitat in the BSAI are displayed in Figures 4-27 and for the GOA in Figures 28-49.

RESULTS AND DISCUSSION

Trends in the Bering Sea/Aleutian Islands Groundfish Fisheries

The most important BSAI groundfish fisheries with respect to actual and percent of total catches taken within designated sea lion critical habitat are the trawl fisheries for pollock and Atka mackerel (Fritz 1993 a,b). Both species are important sea lion prey, and both fisheries have been prosecuted to a large extent within critical habitat. Furthermore, the pollock fishery is the only one that uses pelagic or midwater trawls to capture fish within the water column where sea lions, particularly juveniles, feed.

Pollock Fishery - Figures 4-9, 22-27. Between 1977-86, it is estimated that trawl fisheries for pollock in the BSAI caught between 100,000 and 300,000 mt of pollock per year in sea lion critical habitat. This represented between 10-30% of the total BSAI pollock catch in those years. Most of the catch in critical habitat came from the Bogoslof or Eastern Bering Sea (EBS) aquatic foraging area, with total catches within 20 nm of rookeries and haulouts never exceeding 50,000 mt. Furthermore, the pollock fishery in those years was primarily prosecuted in the spring and summer north and west of the Pribilof Islands; only in 1986 did pollock catches in the first quarter exceed 50,000 mt.

This pattern changed abruptly in 1987 with the advent of the Bogoslof pollock roe fishery, which targeted spawning females in the deep waters north of Umnak and Unalaska Islands in the first quarter of the year. Between 1987-91, total pollock catches from critical habitat ranged from about 500,000 mt to almost 600,000 mt, while the percent from critical habitat was between 37-54%, both significant increases from the previous 10-year period. Catches from within 20 nm of rookeries and haulouts increased from over 100,000 mt in 1987 to 260,000 mt in 1991 (14-24% of total pollock catches), but were outpaced by increases in landings from the eastern Bering Sea foraging area.

Pollock catches from critical habitat increased to almost 450,000 mt in the first quarters of 1987 and 1991, and over 200,000 mt in 1988, 1990 and 1992, all significant increases from 1977-86. In 1987-90, the percent of first quarter landings taken from critical habitat ranged between 70-80% and jumped to 93% in 1991 from a range of 0-43% between 1977-86.

Beginning in 1990, the annual pollock TAC (total allowable catch) was divided into an "A", or roe season from January to mid-April which initially received 40% of the TAC (raised to 45% in 1993, and a "B" season beginning in June and lasting until the TAC was reached (BSAI FMP Amendment 14). This measure, while insuring sufficient pollock TAC for the "B" season after the higher-priced roe pollock were caught, increased pollock catches during the first quarter compared to 1977-86.

In 1992, statistical area 518, or the Bogoslof district, was closed to directed pollock fishing by the North Pacific Fisheries Management Council (Council) due to declines in the Aleutian Basin pollock stock which spawns there. Because of concerns over the displacement of trawling for roe pollock from area 518 to spawning concentrations on the eastern Bering Sea shelf north of Unimak Island, the NMFS extended the trawl exclusion zones to 20 nm around six rookeries (Sea Lion Rock, Akun, Akutan, Seguam and Agligadak Islands in 1992, and Ugamak Island in 1993) in the eastern and central Aleutians for the pollock "A" season. This action resulted in a drop in first quarter pollock removals from critical habitat to 250,000 mt in 1992, or just less than 50% of the total first quarter landings, due mostly to significant reductions in catches within 20 nm of rookeries and haulouts.

Despite the drop in first quarter landings, annual pollock catches from critical habitat in 1992 increased to almost 650,000 mt, or 47% of the total BSAI pollock catch. Most of the "B" season catch from critical habitat was taken by catcher vessels for onshore processing plants, most of which are located in Dutch Harbor, AK. During the "B" season, onshore processing plants were guaranteed 35% of the TAC as well as exclusive use of the Catcher Vessel Operational Area (CVOA) by BSAI FMP amendment 18. The CVOA is located south of 56°N latitude between 163°W and 168°W longitude, which is almost entirely within the Bogoslof foraging critical habitat area. Beginning in 1993, as a result of a delay in the start of the BSAI pollock "B" season to August 15, the 20 nm trawl exclusion zones around the six rookeries protected during the pollock "A" season will begin November 1 if significant amounts of pollock TAC are expected to be available after that date.

Atka mackerel fishery - Figures 10-15, 22-27. Of all Alaskan groundfish fisheries operating between 1979-91, the BSAI Atka mackerel fishery has had the highest percentage of target species landings from sea lion critical habitat. Excluding 1987-88 (which both had just under 50%), every year since 1979 has had 65% or greater (with 7 years over 90%) of the annual catch of Atka mackerel taken from critical habitat. However, total landings have been small compared to the pollock fishery. Between 1977-83, no more than 20,000 mt was removed annually from critical habitat, but increased to between 26,000-31,000 mt in 1984-86. After drops in landings from critical habitat in 1987-88, landings increased to over 30,000 mt in 1992.

The most important Atka mackerel fishing areas have been Seguam Pass, the Delarof Islands and Tanaga Pass, south of Amchitka Island and Petrel Bank, all of which except the last are within critical habitat. This fishery, conducted exclusively by bottom trawls, was probably displaced the most after establishment of 10 nm annual and 20 nm BSAI pollock "A" season trawl exclusion zones around rookeries. Most Atka mackerel trawling occurs in relatively shallow water (75-200 m). Atka mackerel has recently been shown to be an important prey resource for Steller sea lions throughout the Aleutian Islands (Merrick, pers. comm.).

Except for large catches in the first quarter of 1979, Atka mackerel were caught in the Aleutian Islands almost exclusively in summer between 1977-90. However, in 1991, the fishery began to be prosecuted earlier in the year, with over 90% of the TAC taken in the first quarter and almost all of this taken within critical habitat. In 1992, with the implementation of 20 nm BSAI pollock "A" season trawl exclusion zones around rookeries on Seguam and Agligadak Islands, the percent of first quarter and annual catches taken within critical habitat dropped to 73% and 65%, respectively. This decline occurred despite the increase in annual landings from critical habitat due to the increase in TAC from 1991 to 1992.

Because Atka mackerel resources have been relatively lightly exploited in the Aleutian Islands, the Council supported a phased-in increase of exploitation rates, starting in 1992, based on a more scientific and rigorous stock assessment (Lowe 1991). Lowe (1991) also raised concerns about potential localized depletion of Atka mackerel stocks in the central and eastern Aleutians if exploitation rates were raised and the TAC was not spatially allocated. This led the Council to implement BSAI FMP Amendment 28, which created three sub-districts within the Aleutian Islands in 1993 for the purposes of spatially allocating the TACs for Atka mackerel and other fish species. Spatial dispersal of effort for Atka mackerel is consistent with the goals of NMFS Steller sea lion/groundfish fishery management strategy, and may decrease the potential impact of removals of this important prey species on Steller sea lions.

Pacific Cod Fishery - Figures 16-27 - Trawl and fixed gear (longline and pot) fisheries for Pacific cod have taken increasing amounts of cod from sea lion critical habitat since 1987. Between 1977-87, no more than 25,000 mt of cod per year were caught in critical habitat. The high catch estimate from critical habitat in 1989, 85,000 mt (Figures 17-18), may be higher than actually occurred due to low observer coverage (note high adjustment factor of 18.4 in Table 2) in the domestic cod fishery, which accounted for 73% of annual landings. However, based on the 1988 data, the high catches from critical habitat in both years may be fairly accurate. In both 1988-89, joint-venture and domestic vessels dominated the fishery. In many cases, the same vessels participated in both fisheries. Domestic BSAI observer data in 1988 was not included in this analysis due to very low coverage, but catches in the joint-venture fishery were well-observed (adjustment factor of only 1.64; Table 2). Therefore, the high catch estimate in critical habitat for 1988, 78,000 mt, may be relatively accurate, which lends some credibility to the 1989 estimate. In 1990, cod catches from critical habitat declined to about 48,000 mt but have since increased to 58,000 mt in 1992, or about 33% of the total BSAI cod catch.

In two of the three phases of the BSAI Pacific cod fishery (foreign and domestic, but not joint-venture), trawl catches initially dominated the total landings, but were superceded by longline catches after several years. For instance, in 1990, 68% of the domestic Pacific cod were caught by trawls and 30% by longlines. In 1992, the trawl proportion declined to 38% while the longline percentage rose to 57% and pot landings increased from <1% to 5%. This shift is primarily due to higher bycatch mortality rates of prohibited species, particularly halibut, by trawls than fixed gear. Fixed gear may also have less impact on Steller sea lions due to their more selective removal of large fish, lower bycatch rates of small schooling fish, and less disruption of fish schools by trawl activity.

Other Fisheries - Fisheries for Pacific ocean perch (*Sebastes alutus*) and other rockfish in the BSAI have taken a high

percentage of their total catch within critical habitat, but the total tonnage removed is much lower than for pollock, Pacific cod or Atka mackerel (Fritz 1993a). Furthermore, *Sebastes* spp. have not been shown to be important sea lion prey in the Central/Western GOA or BSAI (Calkins and Goodwin 1988). Trawl fisheries for shallow water flatfish, particularly for yellowfin sole (*Limanda aspera*) and rock sole (*Lepidopsetta bilineata*), have generally taken a low percentage of their catches from within critical habitat and neither species is an important sea lion prey (with the possible exception of yellowfin sole around the Pribilof Islands (Gearin 1987)). Deep water fish, such as Greenland turbot (*Reinhardtius hippoglossoides*) and sablefish (*Anoplopoma fimbria*), are caught principally with longline gear and are not important sea lion prey.

Trends in the Gulf of Alaska Groundfish Fisheries

The most important fisheries with respect to actual and percent of total catches taken from sea lion critical habitat in the GOA are those for pollock, Pacific cod and Atka mackerel. All three of these fisheries are smaller in the GOA than the BSAI. Between 1977-92, total pollock catches in the GOA were only 10-30% of those in the BSAI, while GOA Pacific cod catches were between 10-50% of those in the BSAI. Catches of Atka mackerel in the GOA were about half of those in the Aleutian Islands between 1977-83, then declined to virtually nothing through 1990. The GOA Atka mackerel fishery was reinitiated in 1991 upon discovery of stocks in the western GOA.

Pollock Fishery - Figures 28-33, 44-49. Catches of pollock from GOA critical habitat increased sharply after the discovery of the Shelikof Strait spawning assemblage in 1980 and peaked in 1984 at approximately 225,000 mt. Prior to 1980, catches of pollock came primarily from the outer continental shelf, and catches from GOA critical habitat were less than 10,000 mt. The percent of GOA pollock catch taken in critical habitat also increased from less than 5% in 1977 to over 80% in 1985. In 1986, concern over the decline in size of the spawning assemblage in Shelikof Strait prompted a large reduction in the GOA pollock TAC. Since 1986, pollock removals from critical habitat have remained at between 40,000-50,000 mt, and have come primarily from within 20 nm of haulouts on the east side of Kodiak Island and bordering Shelikof Strait, and to a lesser extent on the Shumagin and eastern Aleutian Islands. However, the percent of GOA pollock catch taken in critical habitat did not decline with the actual tonnage after 1985, but remained between 55-93% until 1992.

As in the BSAI prior to the Bogoslof fishery, the pollock fishery in the GOA prior to the Shelikof fishery was conducted primarily in spring and summer. First quarter pollock landings increased rapidly beginning in 1980 and a large portion of the increase in pollock catches from critical habitat between 1980-85 occurred in the first quarter. It was this temporal and spatial concentration of the GOA pollock fishery that, the NMFS concluded, could have contributed to the decline in the sea lion

population by depleting prey resources in important foraging areas (NMFS Section 7 consultation, biological opinion on the walleye pollock total allowable catch specification for the 1991 GOA groundfish fishery, 5 June 1991). Beginning in 1990, the pollock TAC was allocated quarterly to help prevent preemption of the GOA pollock TAC by large catcher/processing vessels which usually worked in the Bering Sea (GOA FMP Amendment 19). The GOA pollock TAC was spatially allocated, beginning in 1991, among each of three large statistical areas (Areas 61, 62 and 63) based on the pollock biomass distribution of the most recent bottom trawl survey (GOA FMP Amendment 25). While quarterly allocations were not implemented to protect sea lions, both actions dispersed catches of pollock temporally and spatially, possibly reducing the likelihood of localized depletions of sea lion prey.

Pacific Cod Fishery - Figures 34-39, 44-49. Catches of Pacific cod within sea lion critical habitat were low (<10,000 mt) during the foreign and joint-venture portions of the fishery (1977-86), but increased to over 20,000 mt in 1988-89 and between 50,000-63,000 mt in 1990-92. However, the proportion of annual landings taken from critical habitat increased steadily from 7% in 1978 to almost 80% in 1992. Most of the increase in catches from critical habitat came from within 20 nm of rookeries and haulouts in the western Gulf (Shumagin and eastern Aleutian Islands) and to a lesser extent, on Kodiak Island.

Unlike the BSAI, the proportion of the total GOA Pacific cod catch landed by trawls has remained greater than that landed by fixed gear. In 1987, 69% of the GOA Pacific cod were caught by trawls and 31% by longlines and pots. The trawl proportion increased to 90% in 1989, but decreased to only 70% in 1992. While trawling for cod may affect sea lions more than using fixed gear, it may have less impact than trawling for pollock or Atka mackerel since: (1) much pollock trawling occurs in mid-water where bycatch of small fish is greater than on the bottom; and (2) Atka mackerel is preferred to cod by sea lions and the fishery occurs almost exclusively in shallow portions of sea lion critical habitat.

In 1991, almost all of the catch of Pacific cod in the GOA occurred in the first quarter (85%), with most (58,000 mt, or 82%) of the first quarter catch coming from within 20 nm of rookeries and haulouts in the western GOA, particularly on Atkins, Caton, Ugamak, and Tanginak Islands. In 1992, catches from within critical habitat in the first quarter were less than half those of 1991, but most (80%) of the first quarter catch came from critical habitat. The 20 nm BSAI pollock "A" season trawl exclusion zone around Ugamak Island, which went into effect in 1993, displaced much of this effort to areas just outside critical habitat on Davidson Bank.

Atka mackerel fishery - Figures 40-49. An Atka mackerel fishery in the GOA management district existed from 1977-85 in the Central and Western Gulf. Principal areas exploited by this fishery were along the outer continental shelf from Kodiak Island

to Davidson Bank. Consequently, landings and the percent of total taken from critical habitat during this period were low, usually less than 2,000 mt and 20%, respectively. Between 1977-85, the fishery moved westward in pursuit of Atka mackerel and few have been caught in the central GOA since 1985. Between 1986-90, there was no directed fishery for Atka mackerel in the GOA and the species was assigned to the Other Species category for fishery management.

In 1991 and 1992, Atka mackerel were caught in significant quantities in the western GOA south of Umnak and western Unalaska Islands. Even though this is within the GOA fishery management district, the exploited population is likely an Aleutian Atka mackerel stock. Almost 100% of the GOA Atka mackerel landings in 1991-92 came from critical habitat, specifically within 20 nm of rookeries on Ogchul and Adugak Islands and haulouts on Emerald Island and Polivnoi Rock. Landings in 1991 totaled only about 3,200 mt, but increased to almost 14,000 mt in 1992. Concern for management of the species in the GOA and the preemption of the Other Species category by Atka mackerel landings led to the establishment of a separate category for the species beginning in 1994 (GOA FMP Amendent 31).

Other Fisheries - Fisheries for Pacific ocean perch and other rockfish in the GOA have taken lower percentages of their total catches from within critical habitat than BSAI fisheries for the same species, and the total tonnage removed has been much lower than for pollock, Pacific cod or Atka mackerel (Fritz 1993a). Furthermore, *Sebastes* spp. have not been shown to be important sea lion prey in the Central/Western GOA or BSAI (Calkins and Goodwin 1988).

Trawl fisheries for shallow water (yellowfin sole, rock sole, butter sole (*Isopsetta isolepis*), and starry flounder (*Platichthys stellatus*)) in the GOA, take a much higher percentage of their catches from within critical habitat than similar fisheries in BSAI (Fritz 1993a). For instance, in 1992, shallow water flatfish fisheries in the GOA took 87% of their catch within critical habitat, while yellowfin sole and rock sole fisheries in the BSAI took 13% and 16%, respectively. However, these fisheries in the GOA are much smaller than those in the BSAI. Most catches of shallow water flatfish within critical habitat occur near haulouts and rookeries in the Kodiak archipelago and in the western GOA near Unimak Pass.

Deep water flatfish (rex sole (*Glyptocephalus zachirus*), Dover sole (*Microstomus pacificus*) and Greenland turbot) are not important sea lion prey and fisheries for them in the GOA, while occurring to a large extent within critical habitat, are small relative to pollock, Pacific cod and Atka mackerel. Areas fished include the eastside of Kodiak Island and within Shelikof Strait, and to a lesser extent in the western GOA near Umnak Island.

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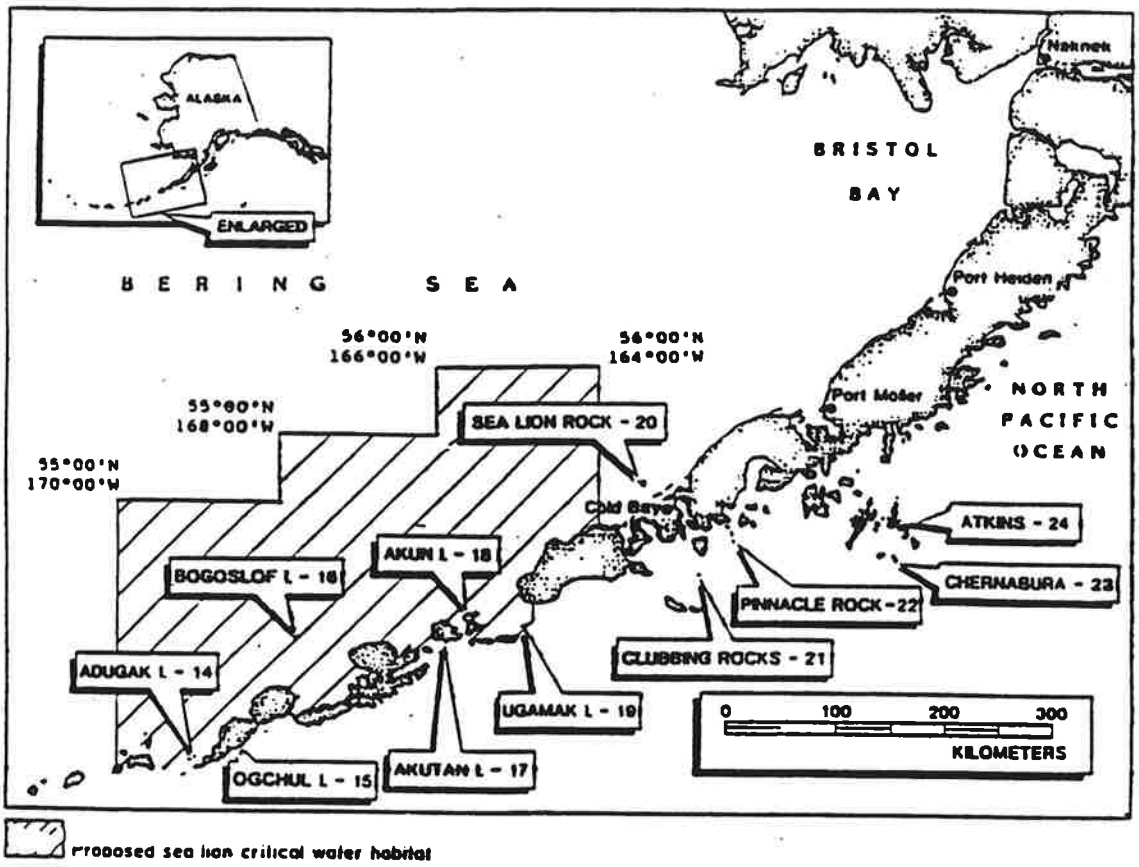


Figure 1. Aquatic foraging area designated as critical habitat for the Steller sea lion in the eastern Bering Sea (in the vicinity of Bogoslof Island). Sea lion rookeries in the western Gulf of Alaska and eastern Aleutian Islands are also noted.

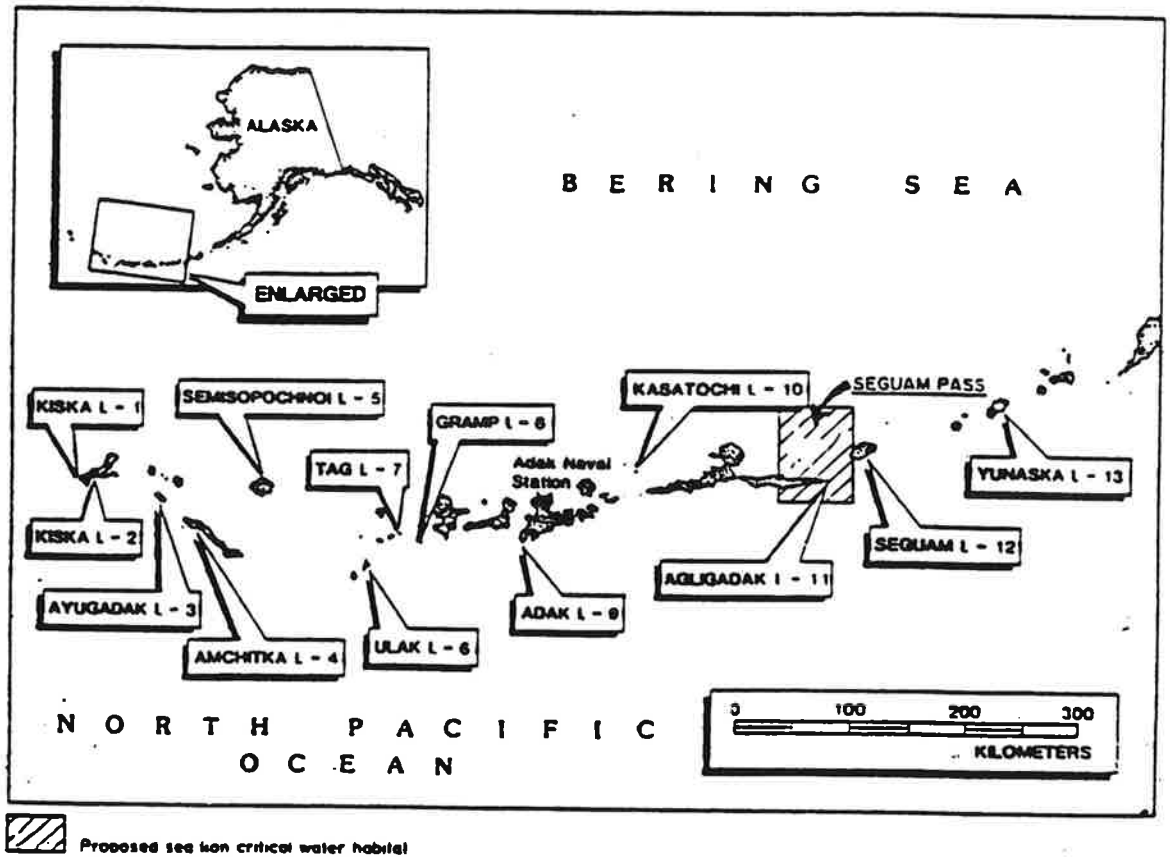


Figure 2. Aquatic foraging area designated as critical habitat for the Steller sea lion in Seguam Pass in the Aleutian Islands. Sea lion rookeries in the central Aleutian Islands are also noted.

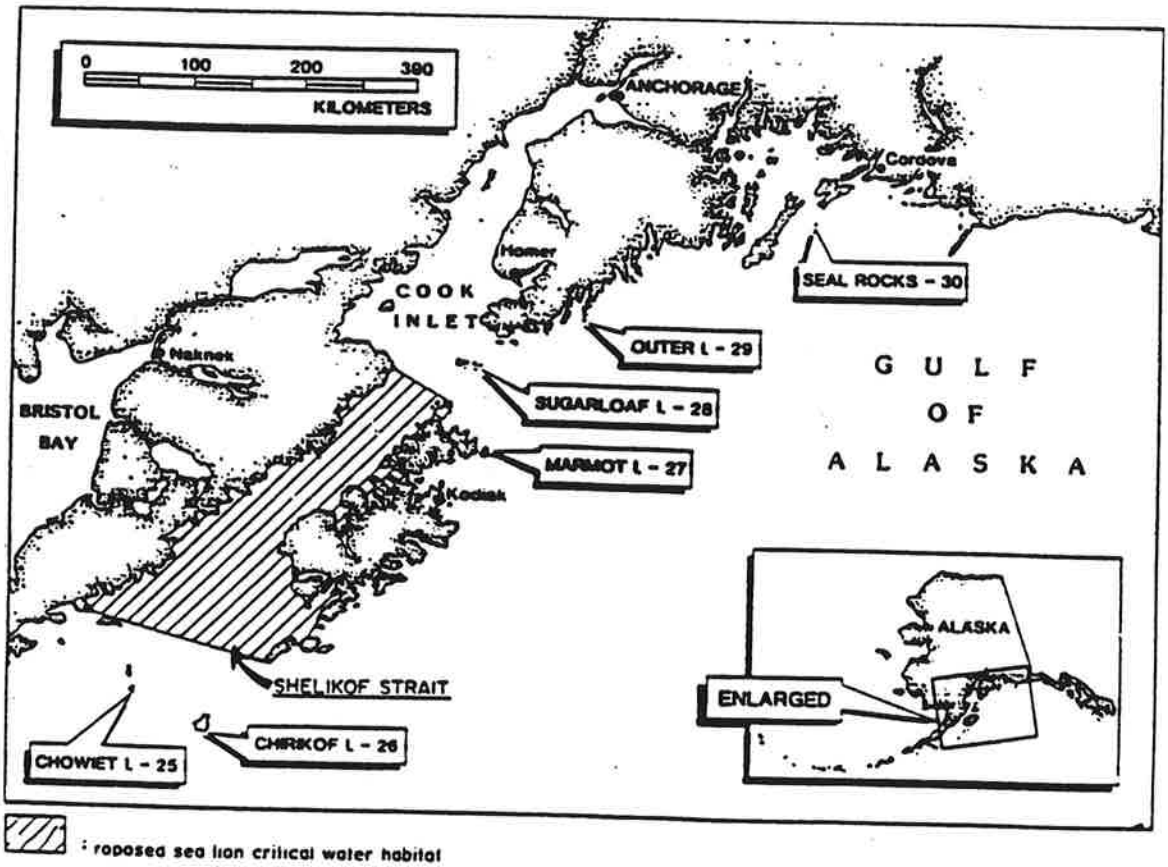


Figure 3. Aquatic foraging area designated as critical habitat for the Steller sea lion in Shelikof Strait in the Gulf of Alaska. Sea lion rookeries in the central Gulf of Alaska are also noted.

Fig. 4. Pollock Catches in BSAI Critical Habitat

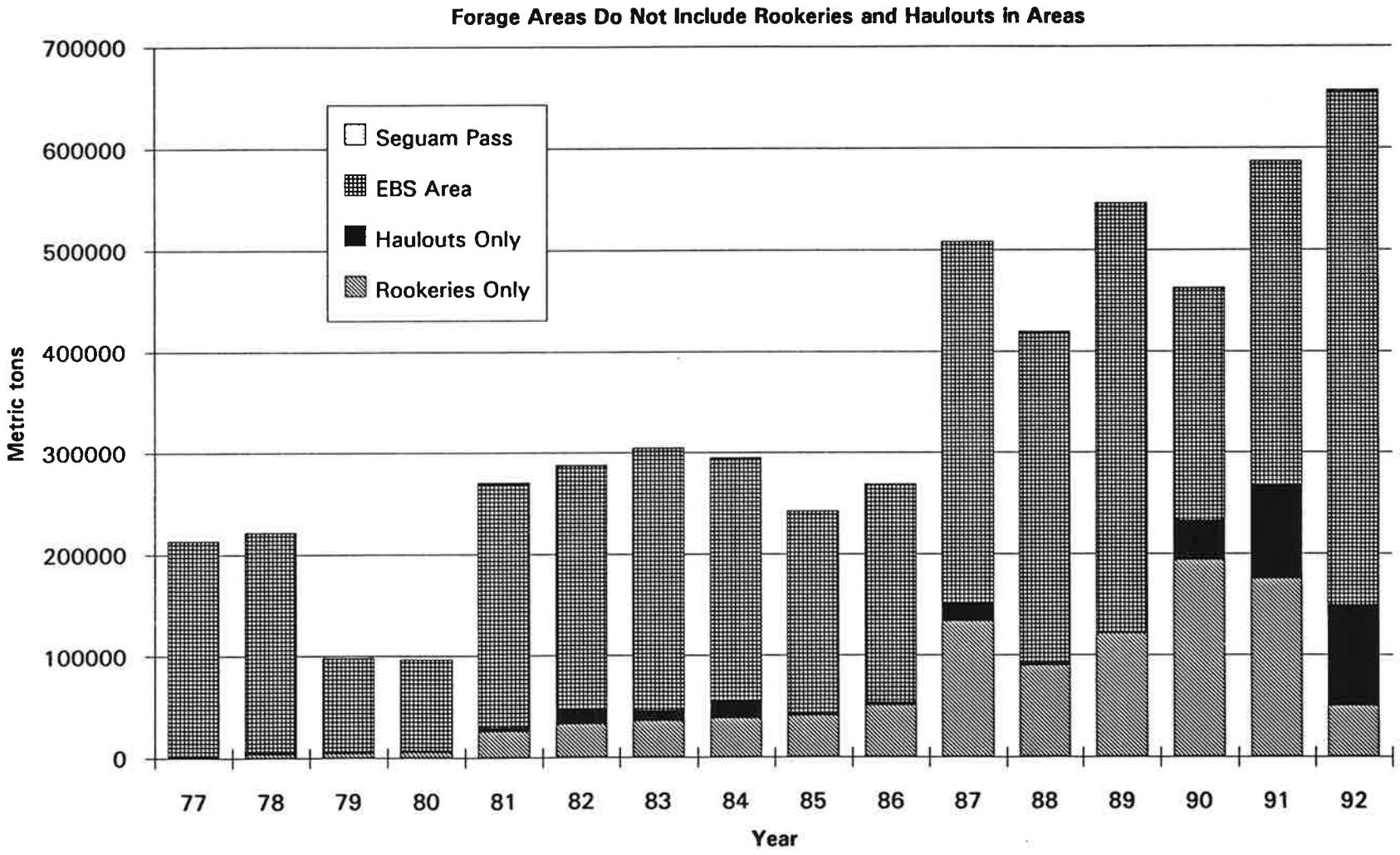


Fig. 5. Pollock Catches in BSAI Critical Habitat

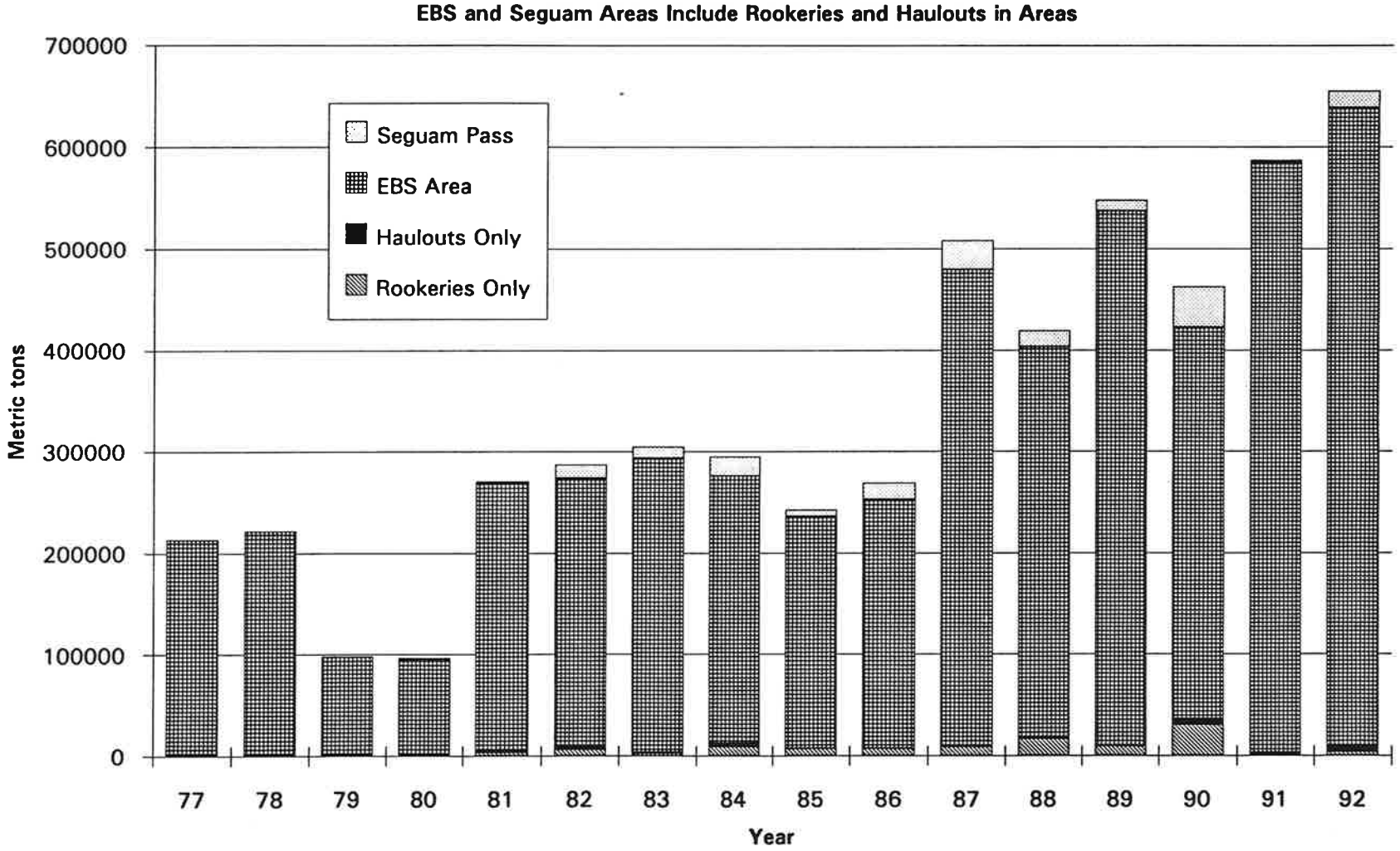


Fig. 6. Pollock Catches in BSAI Critical Habitat

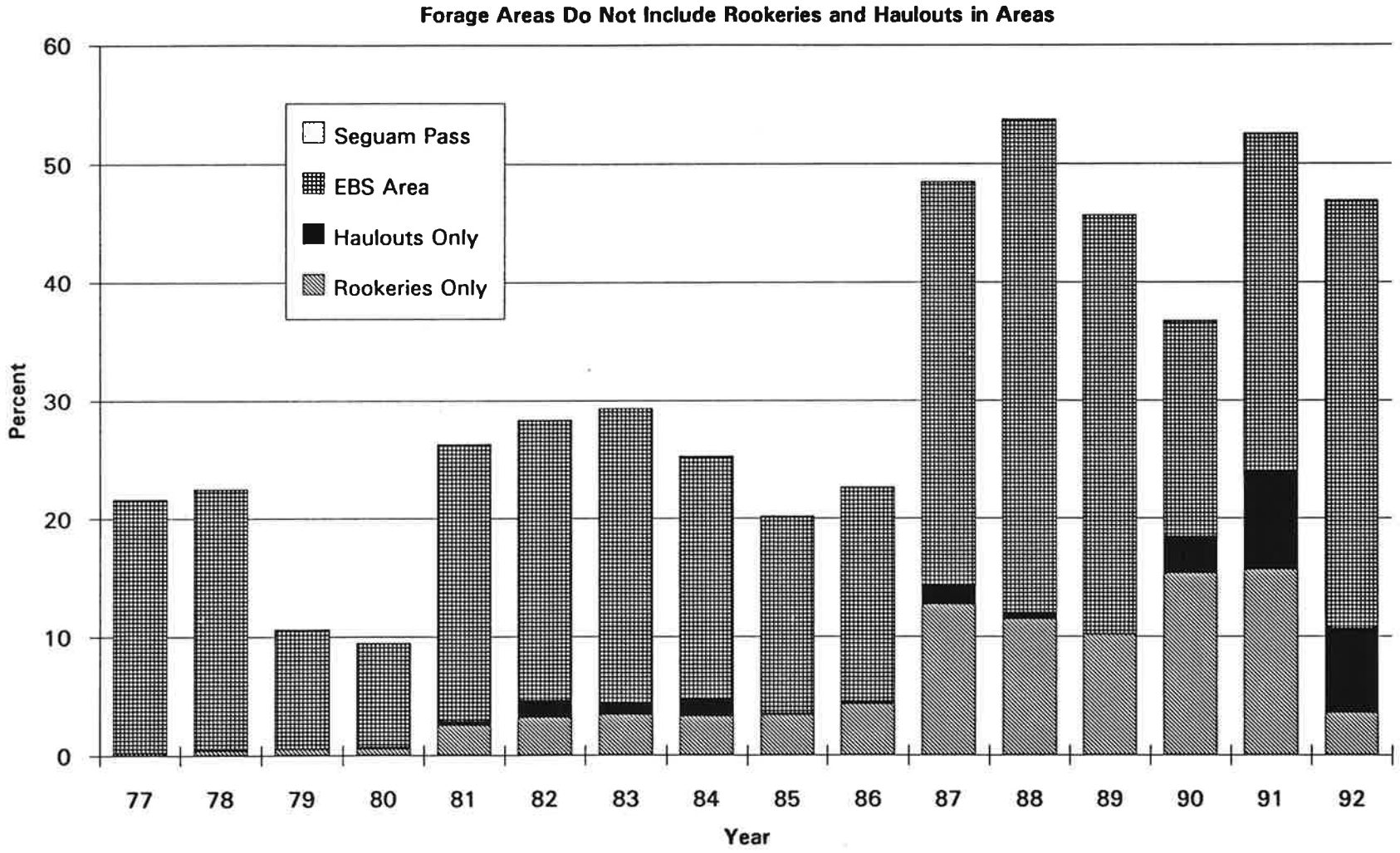


Fig. 7. Pollock Catches in BSAI Critical Habitat

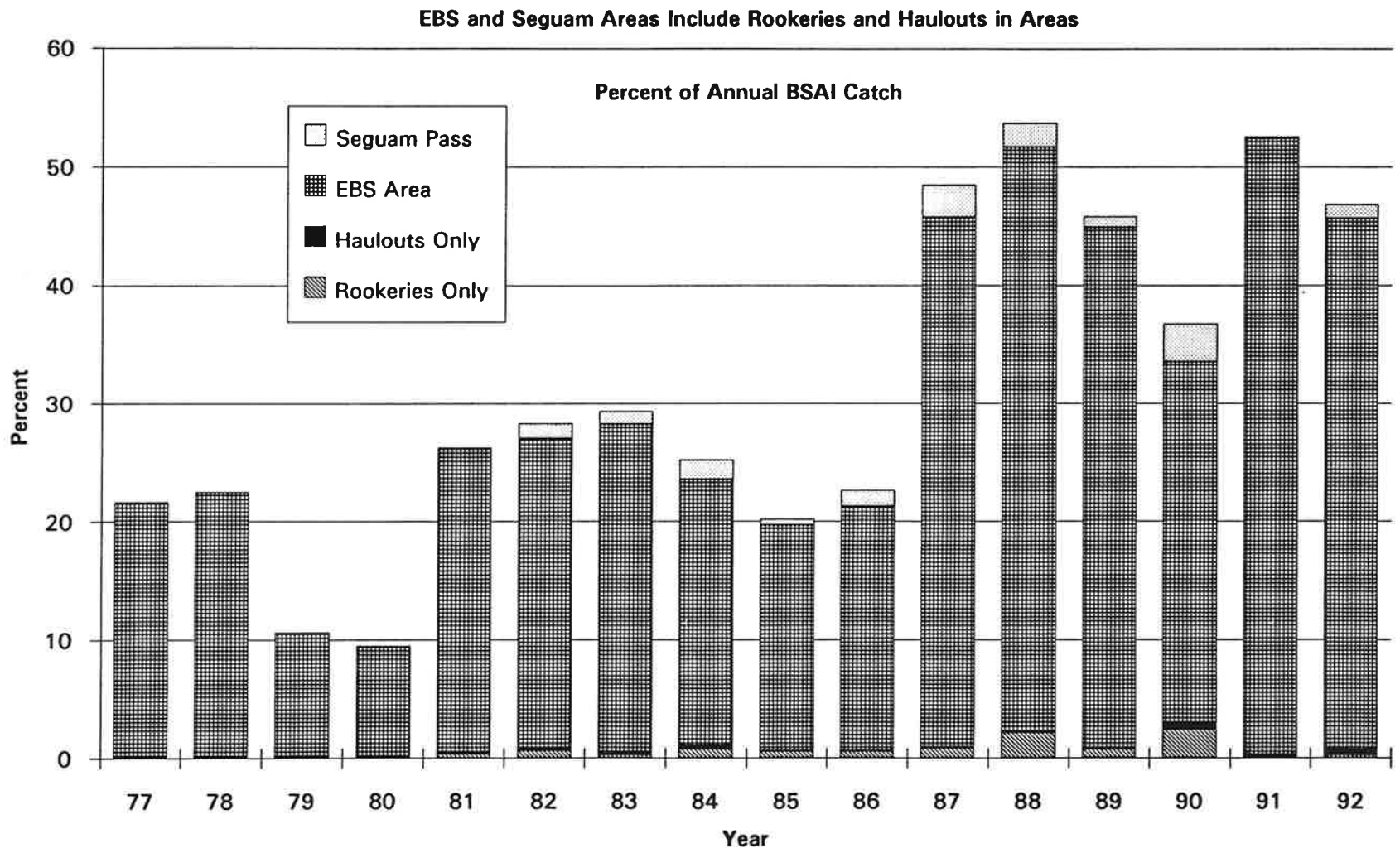


Fig. 8. 1st Quarter Pollock Catches in BSAI Critical Habitat

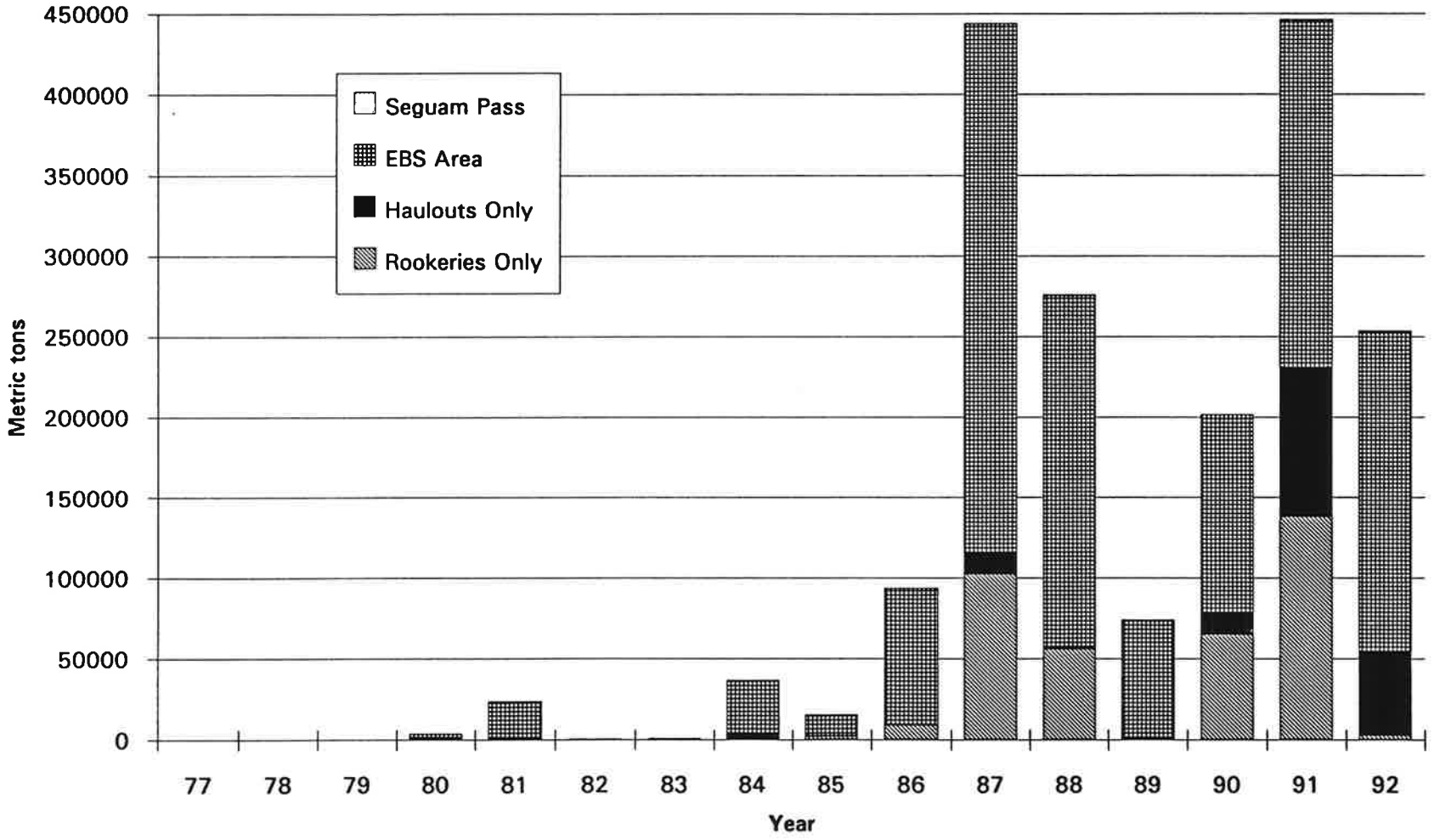


Fig. 9. Percent of 1st Quarter Pollock Catches in BSAI Critical Habitat

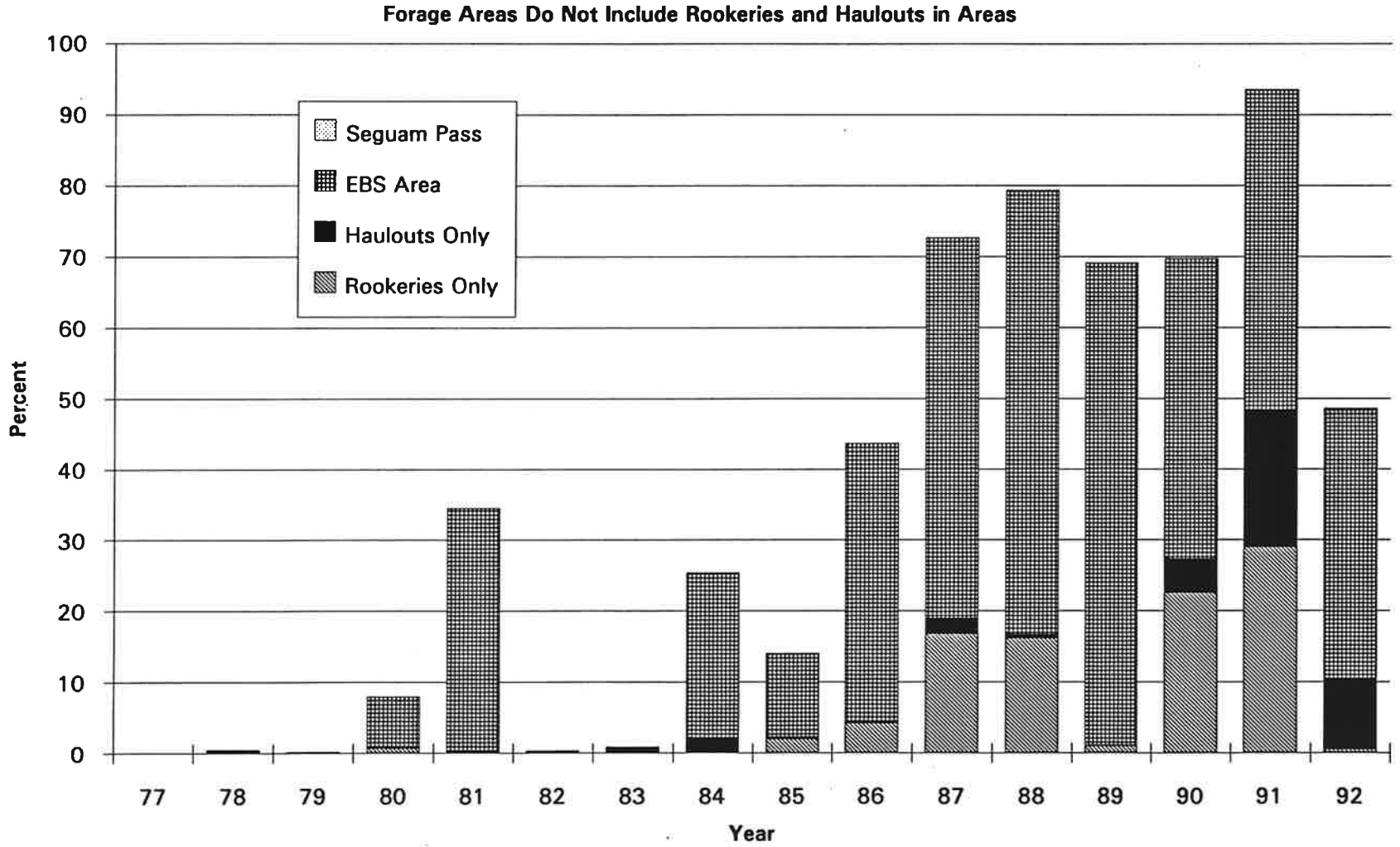


Fig. 10. Atka Mackerel Catches in BSAI Critical Habitat

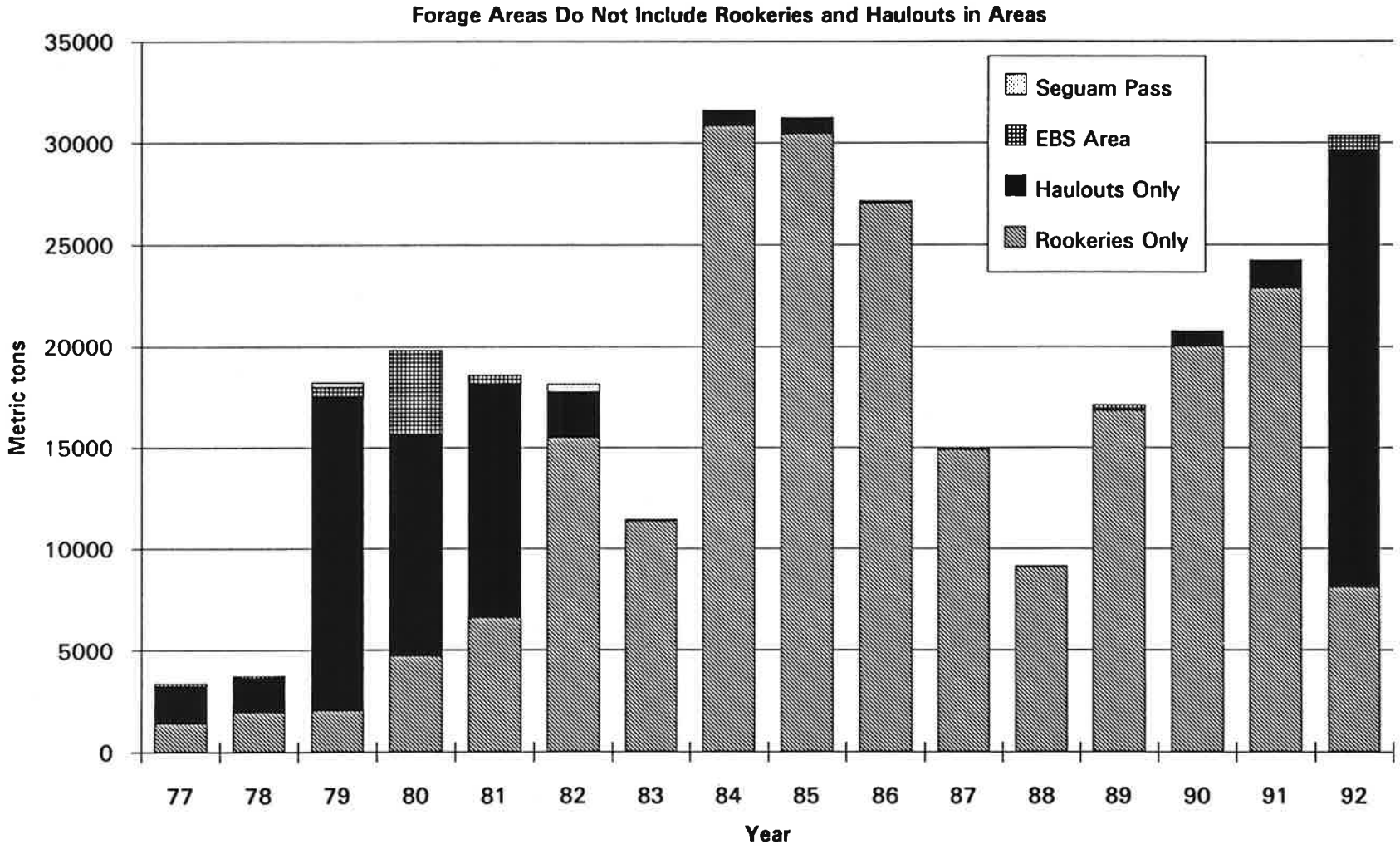
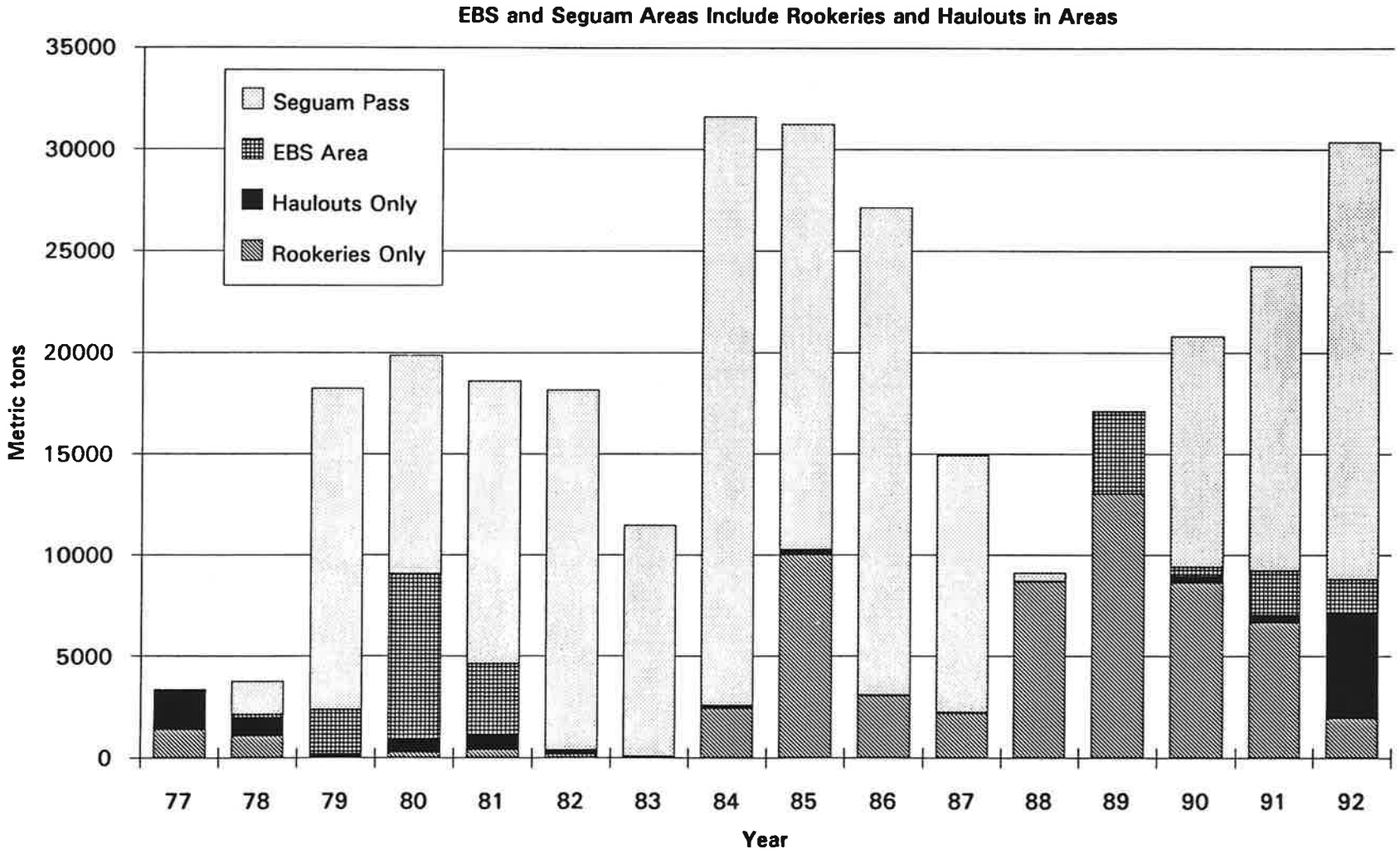


Fig. 11. Atka Mackerel Catches in BSAI Critical Habitat



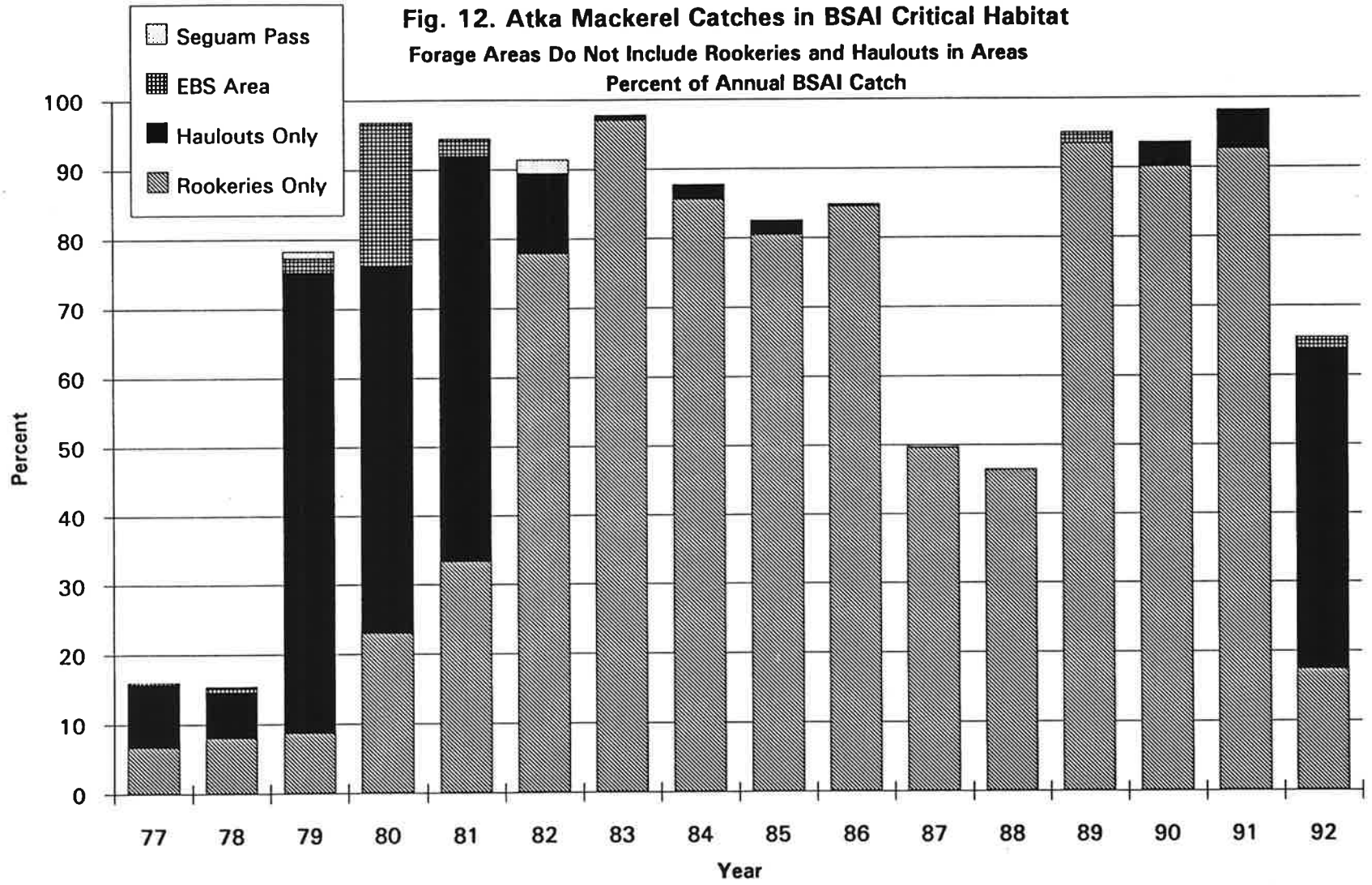


Fig. 12. Atka Mackerel Catches in BSAI Critical Habitat

Forage Areas Do Not Include Rookeries and Haulouts in Areas

Percent of Annual BSAI Catch

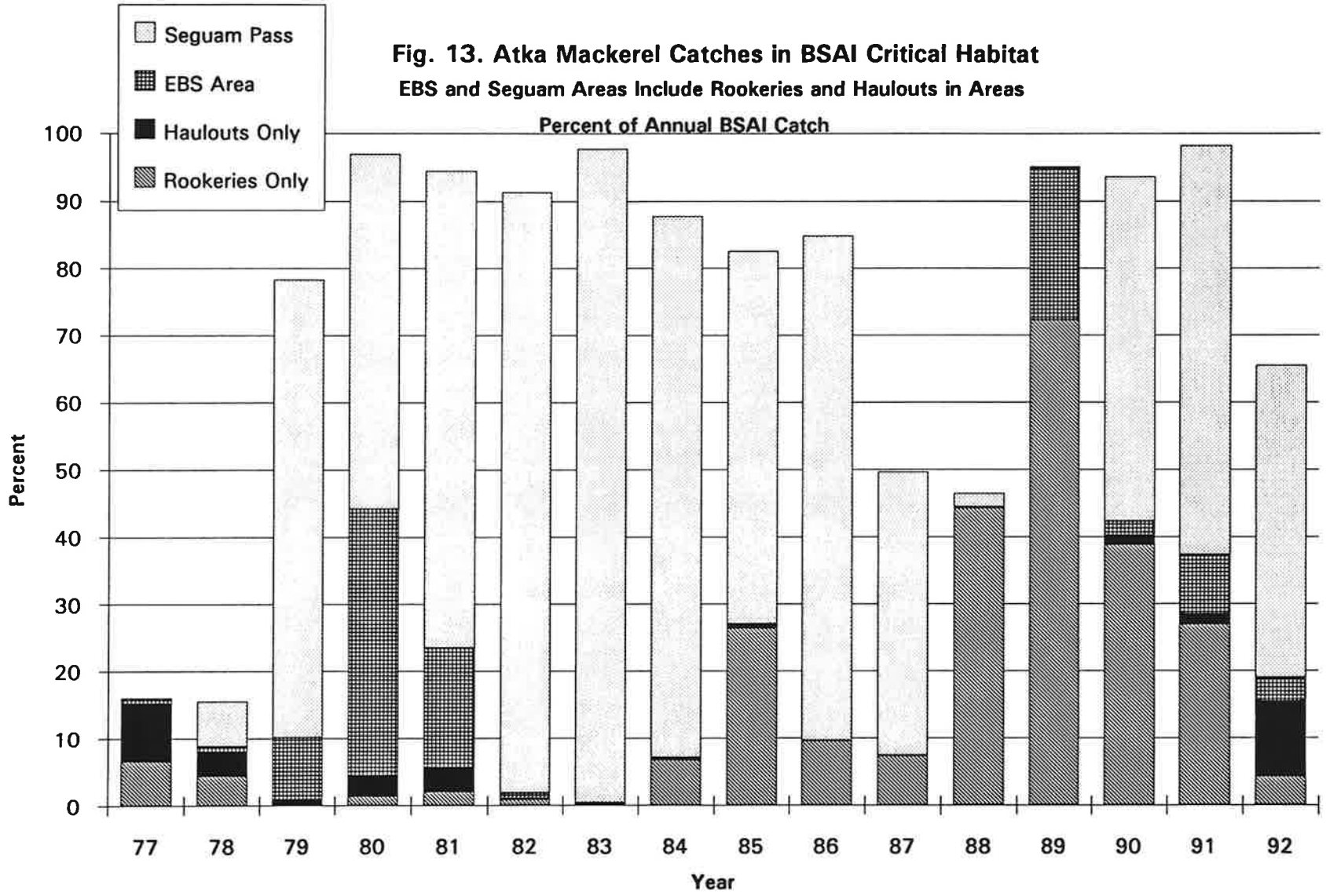


Fig. 13. Atka Mackerel Catches in BSAI Critical Habitat

EBS and Seguam Areas Include Rookeries and Haulouts in Areas

Fig. 14. 1st Quarter Atka Mackerel Catches in BSAI Critical Habitat

Forage Areas Do Not Include Rookeries and Haulouts in Areas

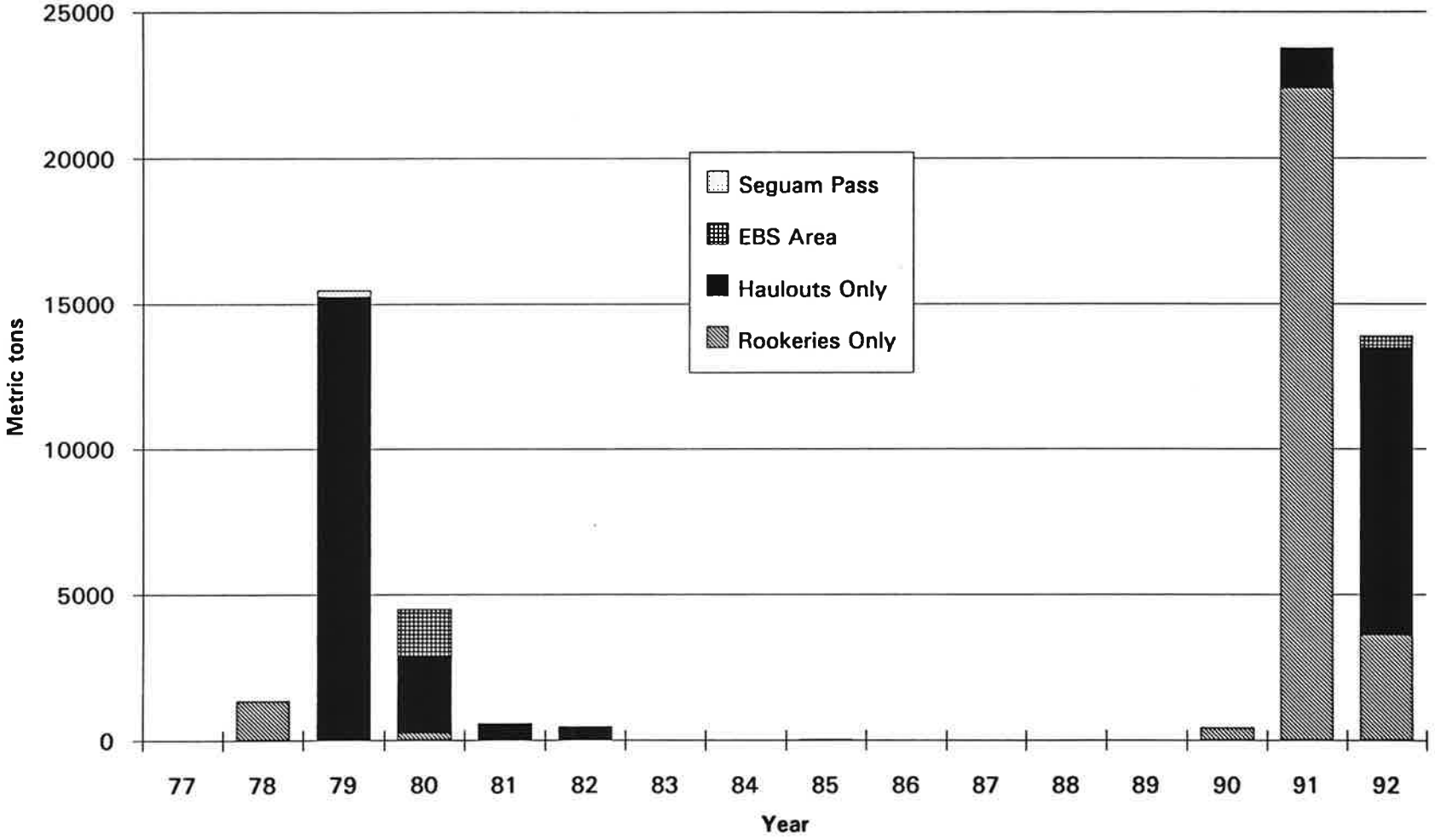


Fig. 15. Percent of 1st Quarter Atka Mackerel Catches in BSAI Critical Habitat

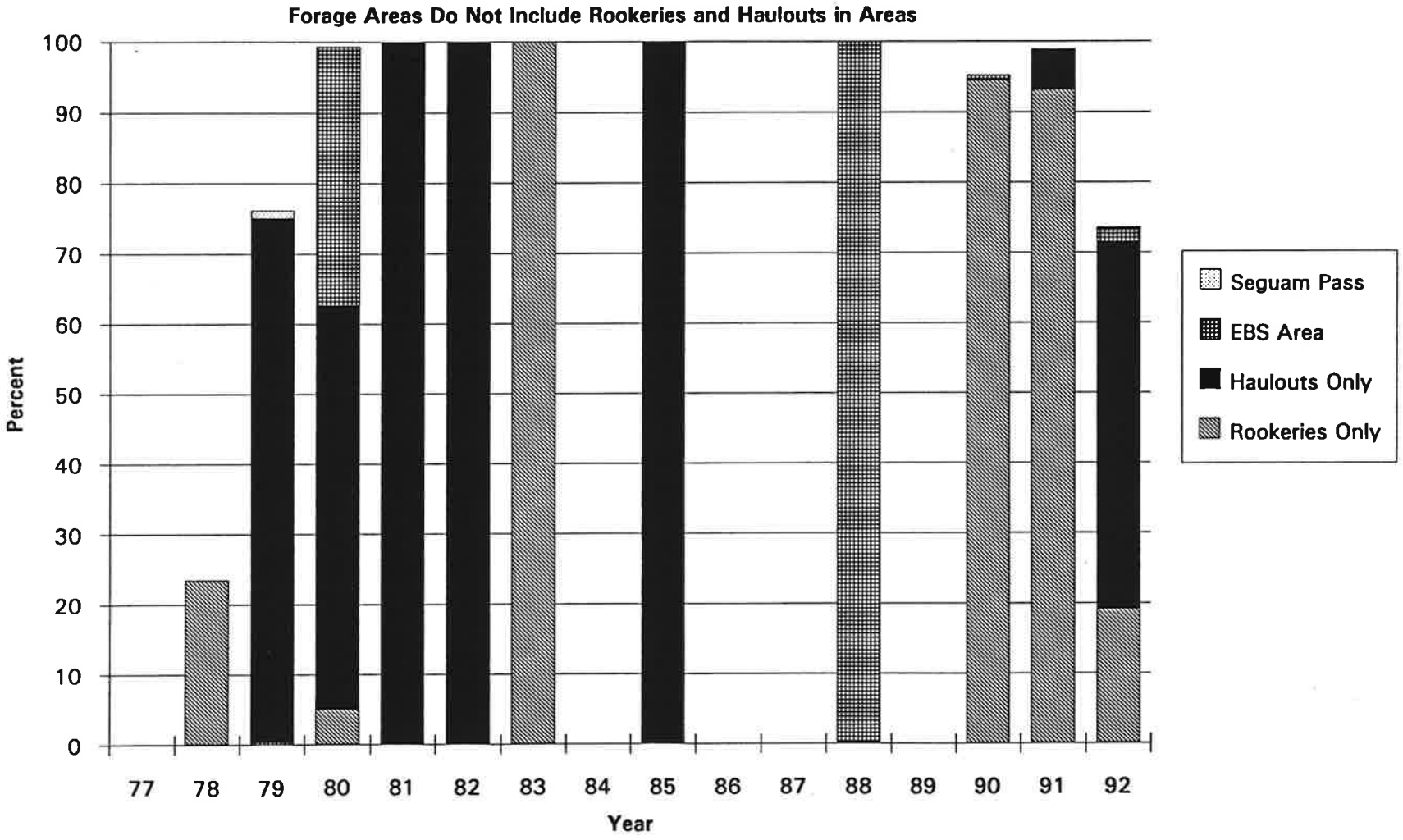


Fig. 16. Pacific Cod Catches in BSAI Critical Habitat

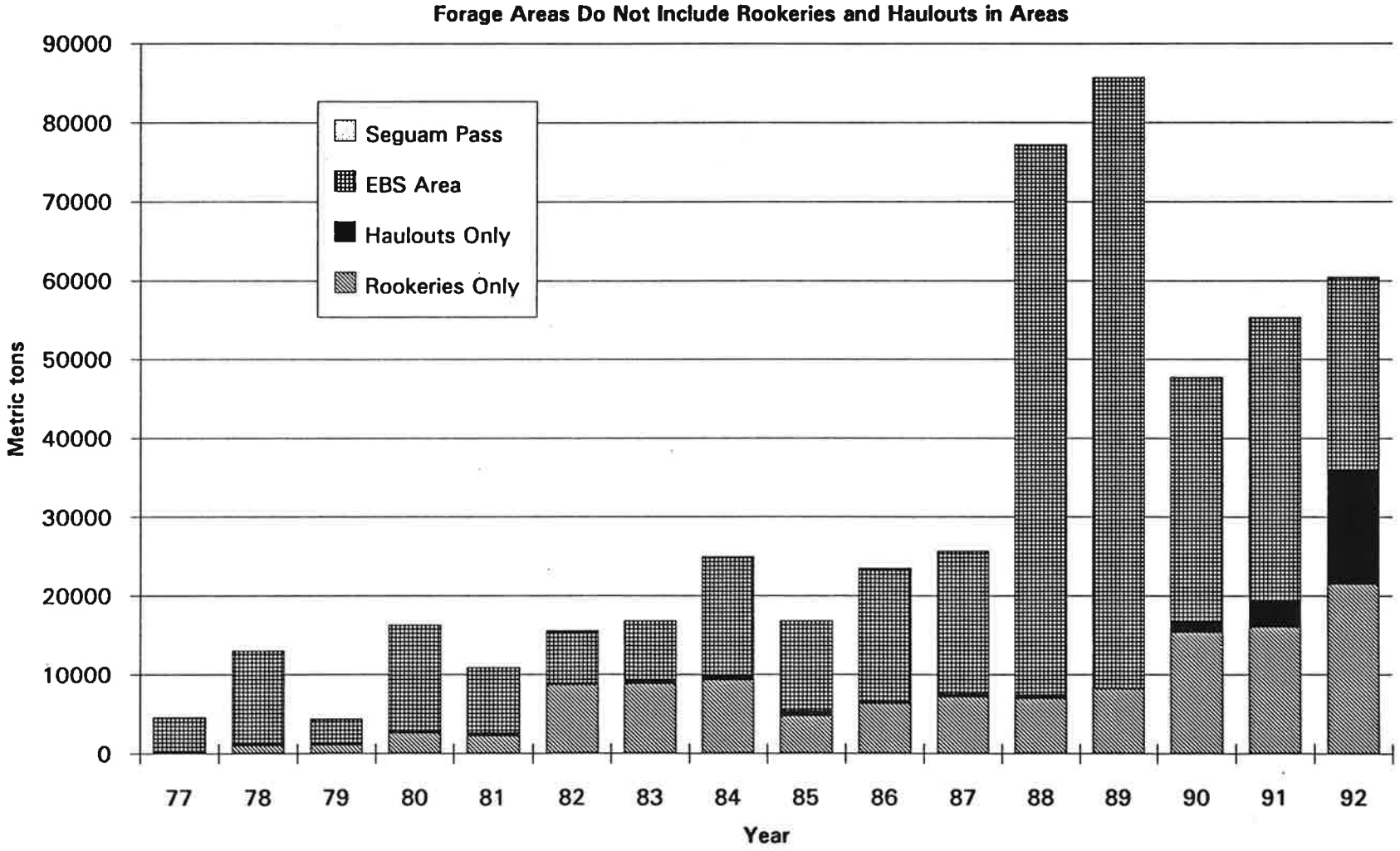


Fig. 17. Pacific Cod Catches in BSAI Critical Habitat

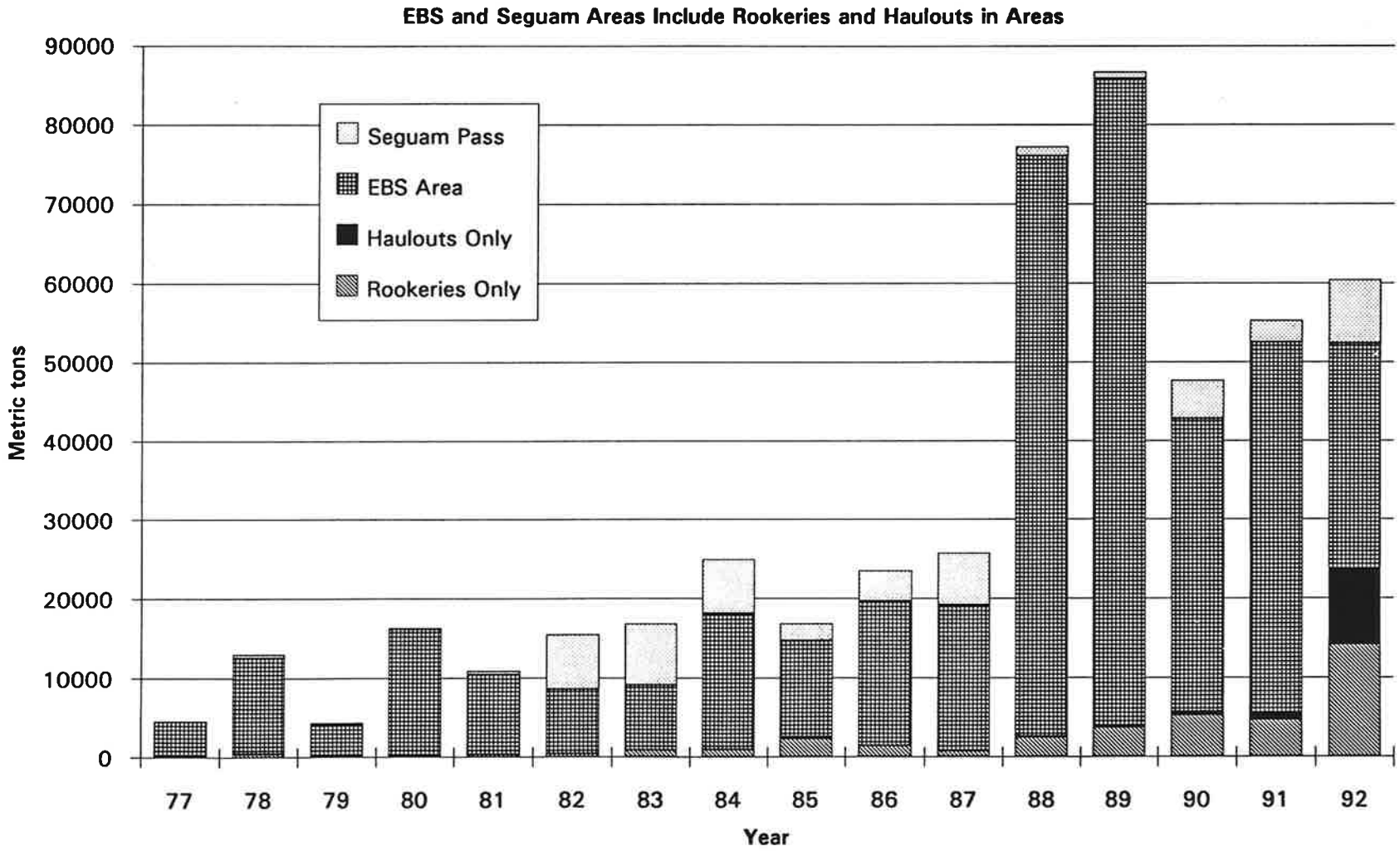


Fig. 18. Pacific Cod Catches in BSAI Critical Habitat

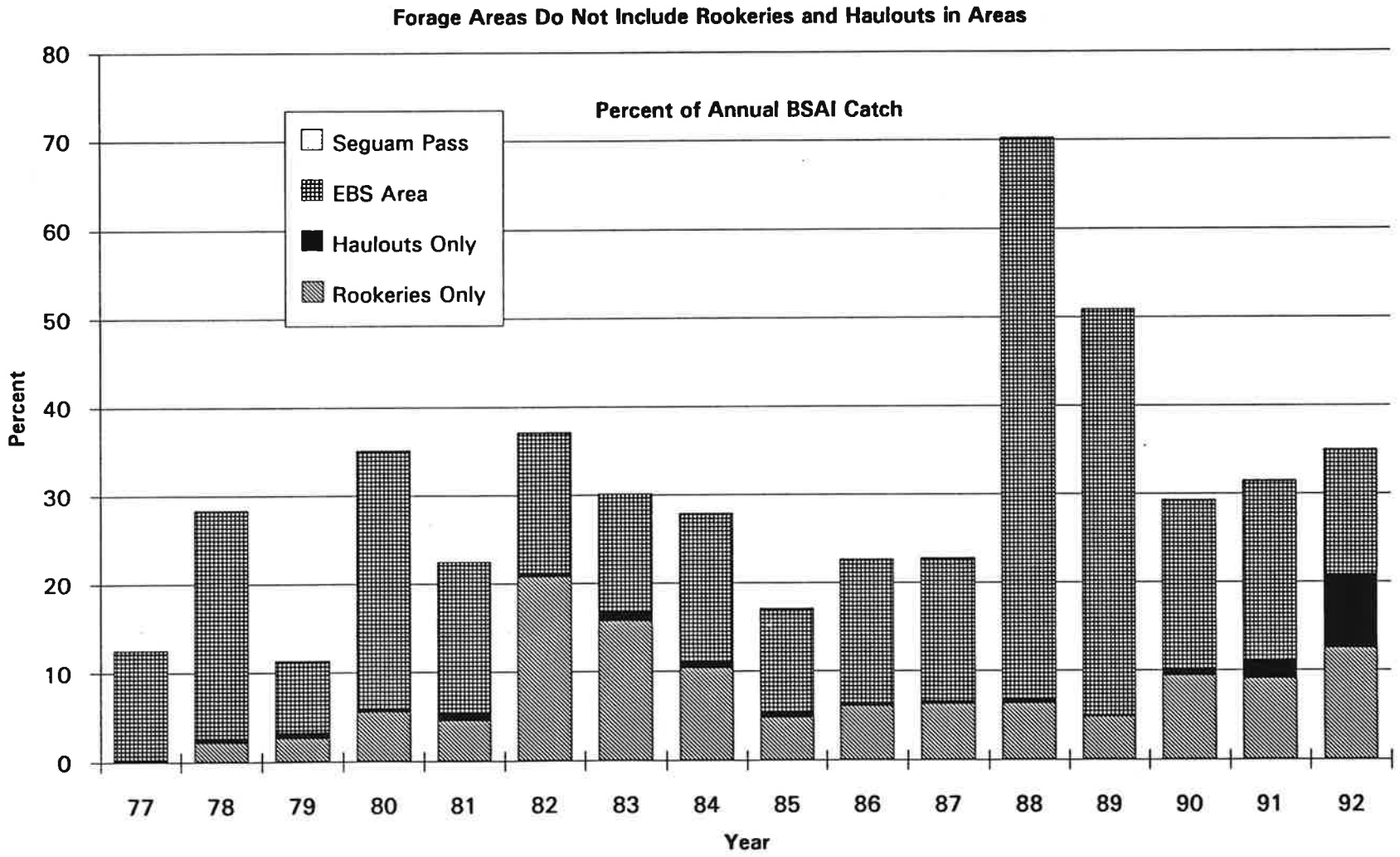


Fig. 19. Pacific Cod Catches in BSAI Critical Habitat

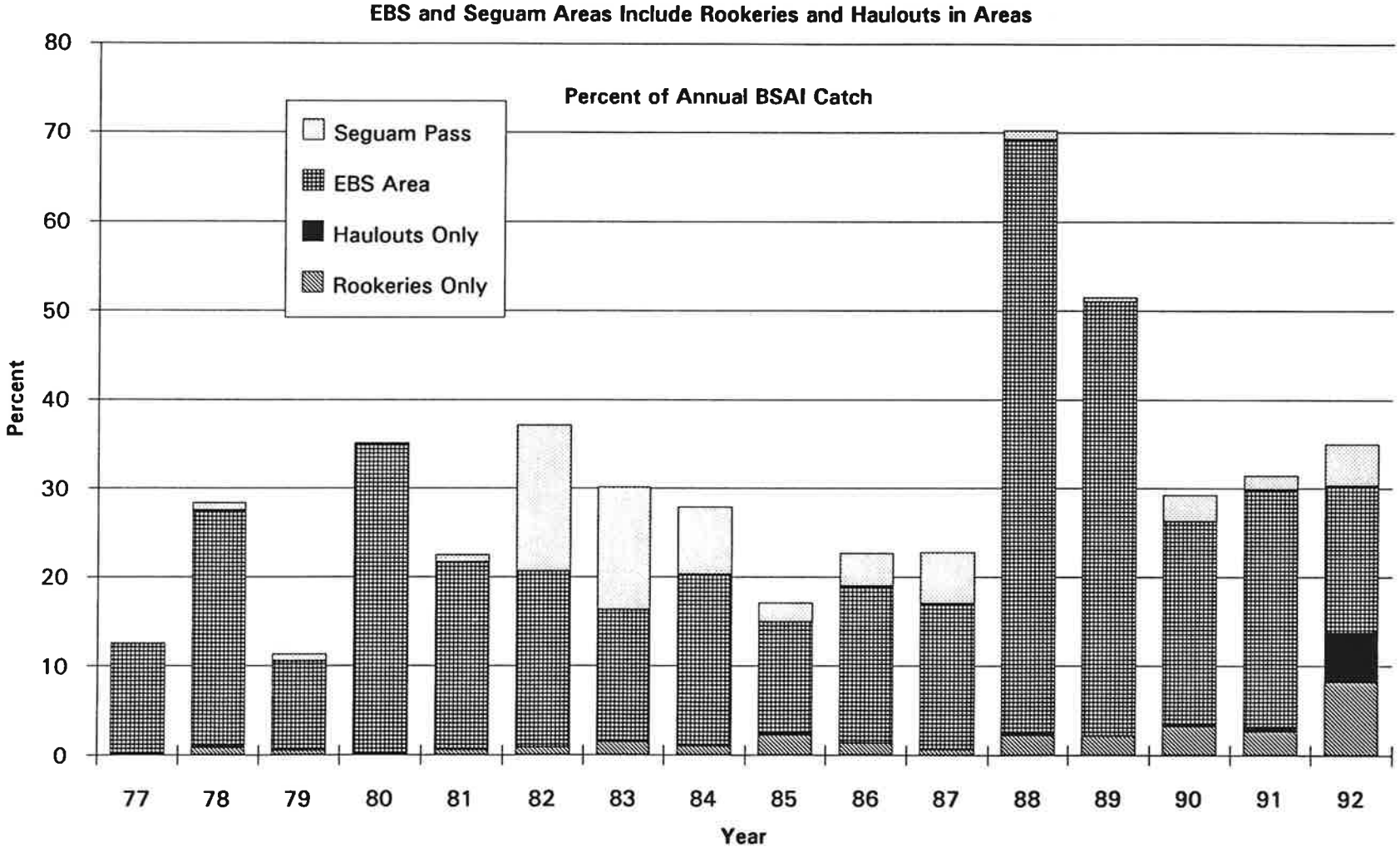


Fig. 20. 1st Quarter Pacific Cod Catches in BSAI Critical Habitat

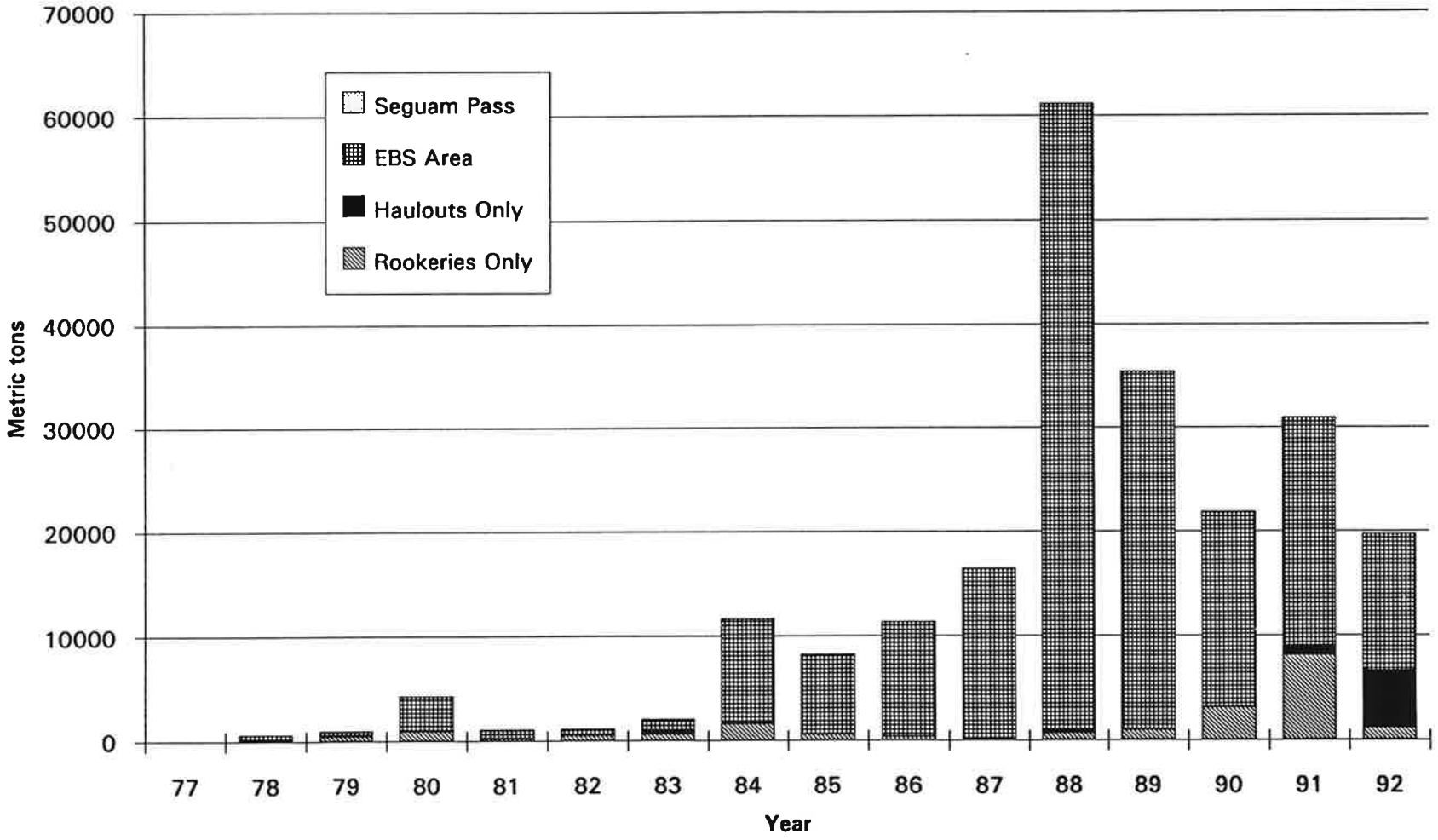


Fig. 21. Percent of 1st Quarter Pacific Cod Catches in BSAI Critical Habitat

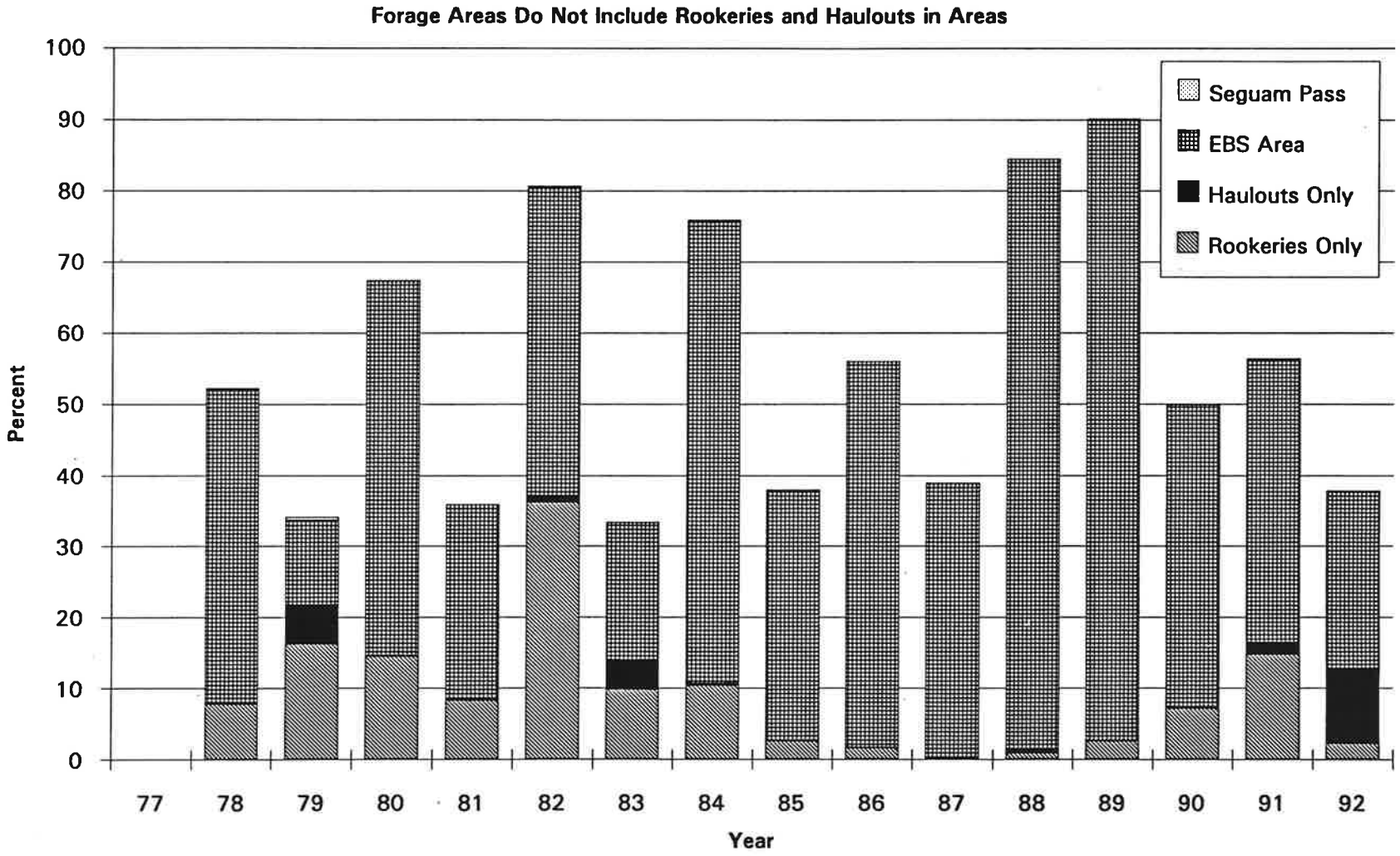


Fig. 22. Pollock, Cod and Atka Mackerel Catches in BSAI Critical Habitat

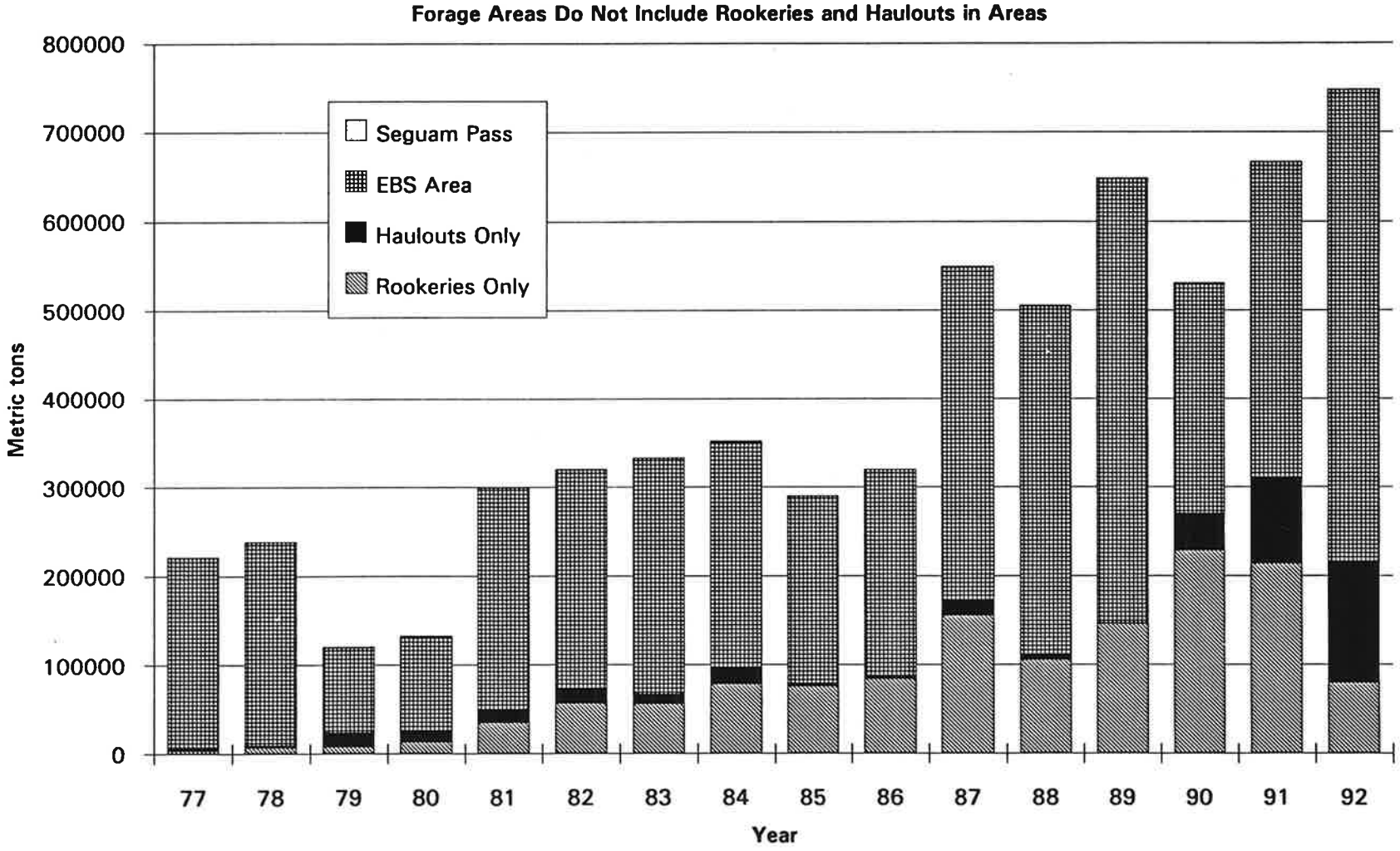


Fig. 23. Pollock, Cod and Atka Mackerel Catches in BSAI Critical Habitat

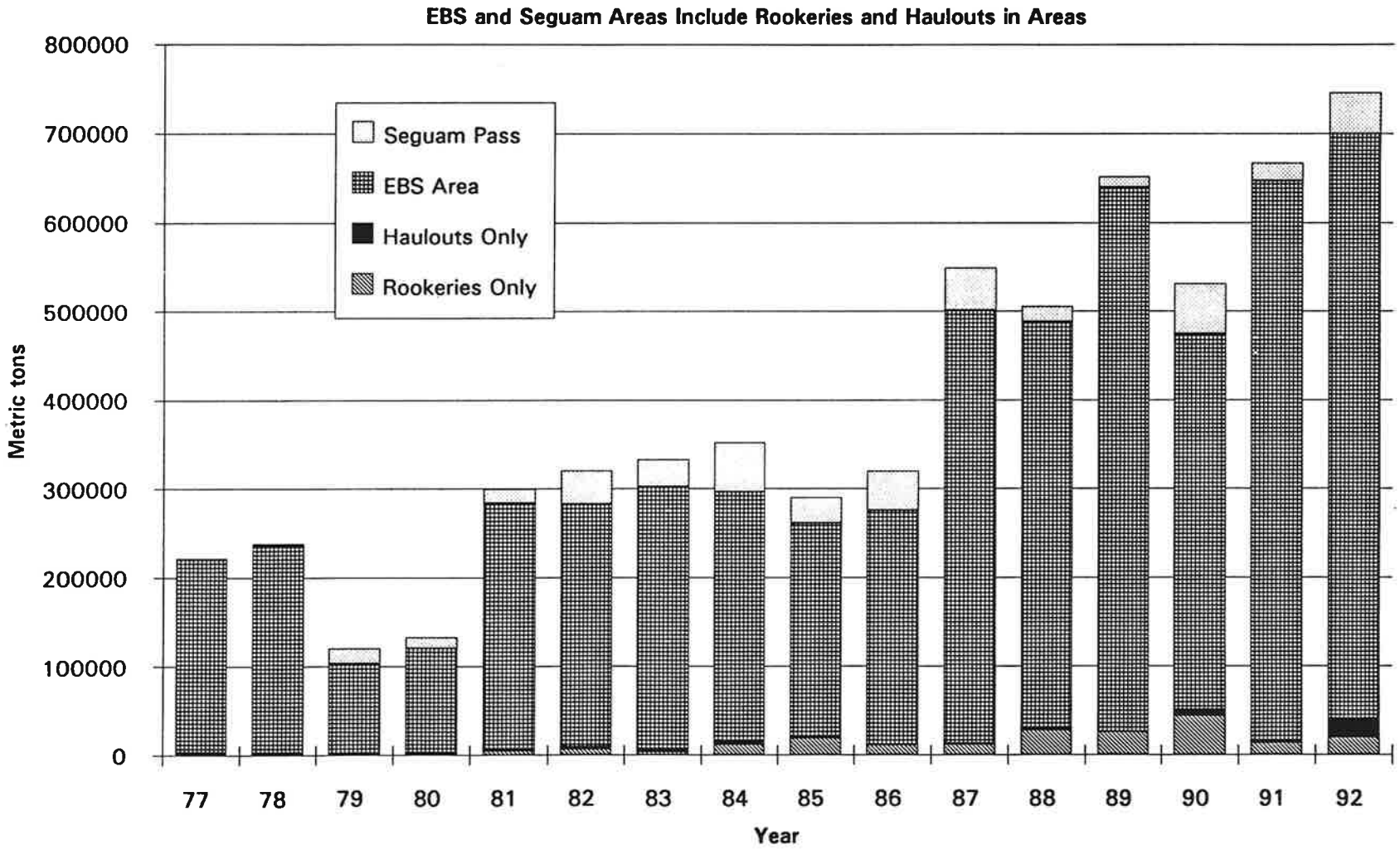


Fig. 24. Pollock, Cod, and Atka Mackerel Catches in BSAI Critical Habitat

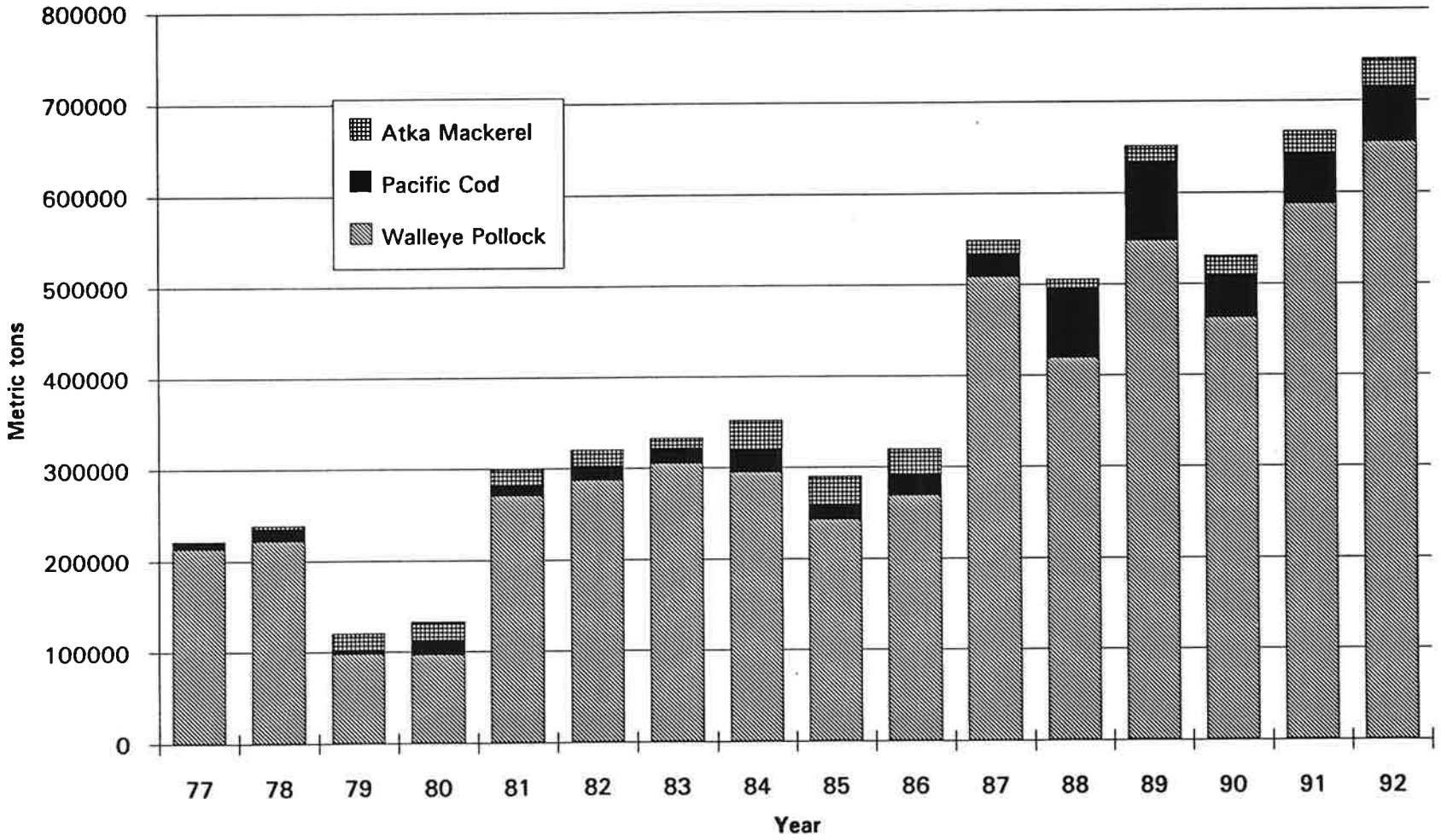


Fig. 25. Percent of Annual BSAI Pollock, Cod and Atka Mackerel Caught in 1st Quarter

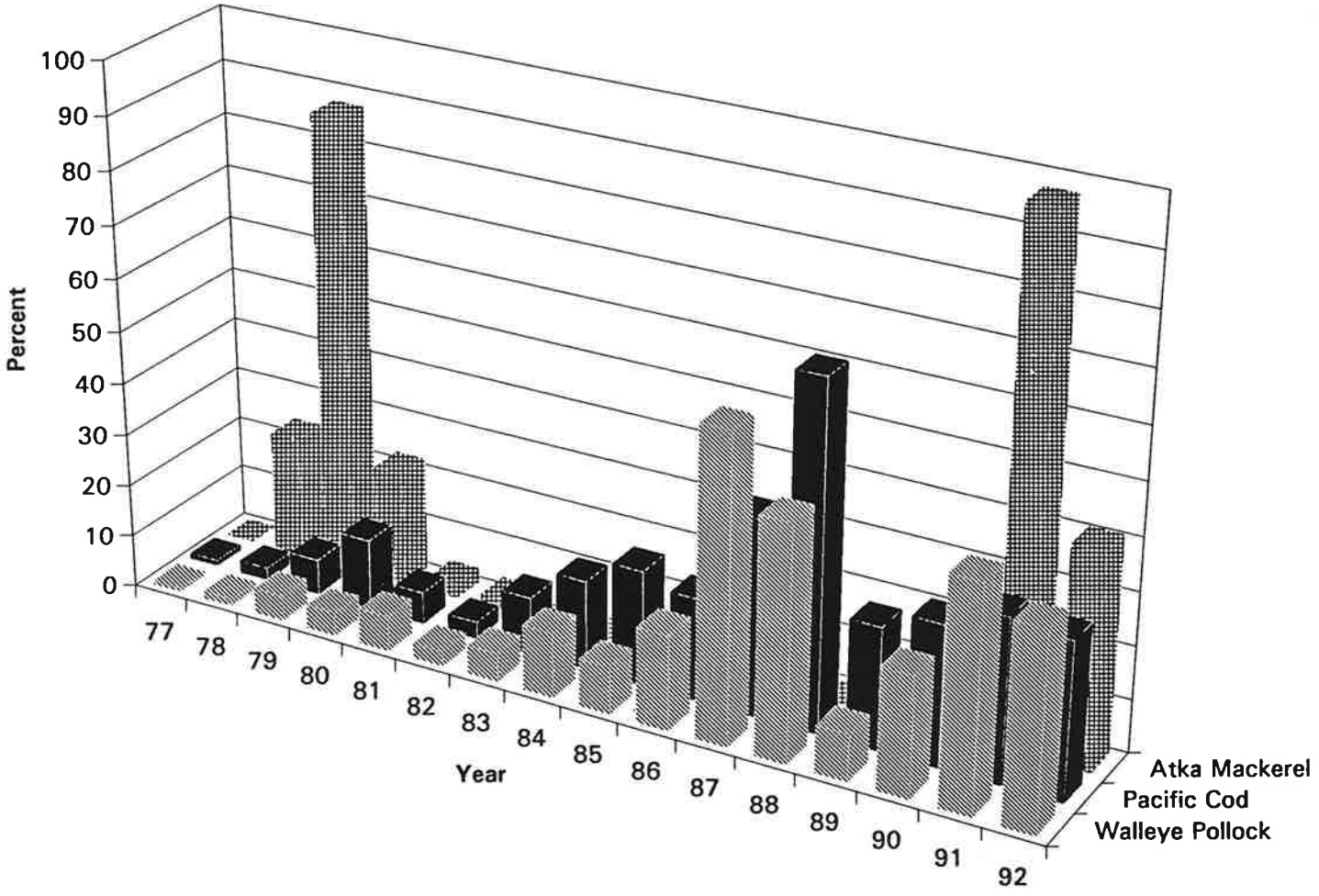


Fig. 26. 1st Quarter Pollock, Cod and Atka Mackerel Catches in BSAI Critical Habitat

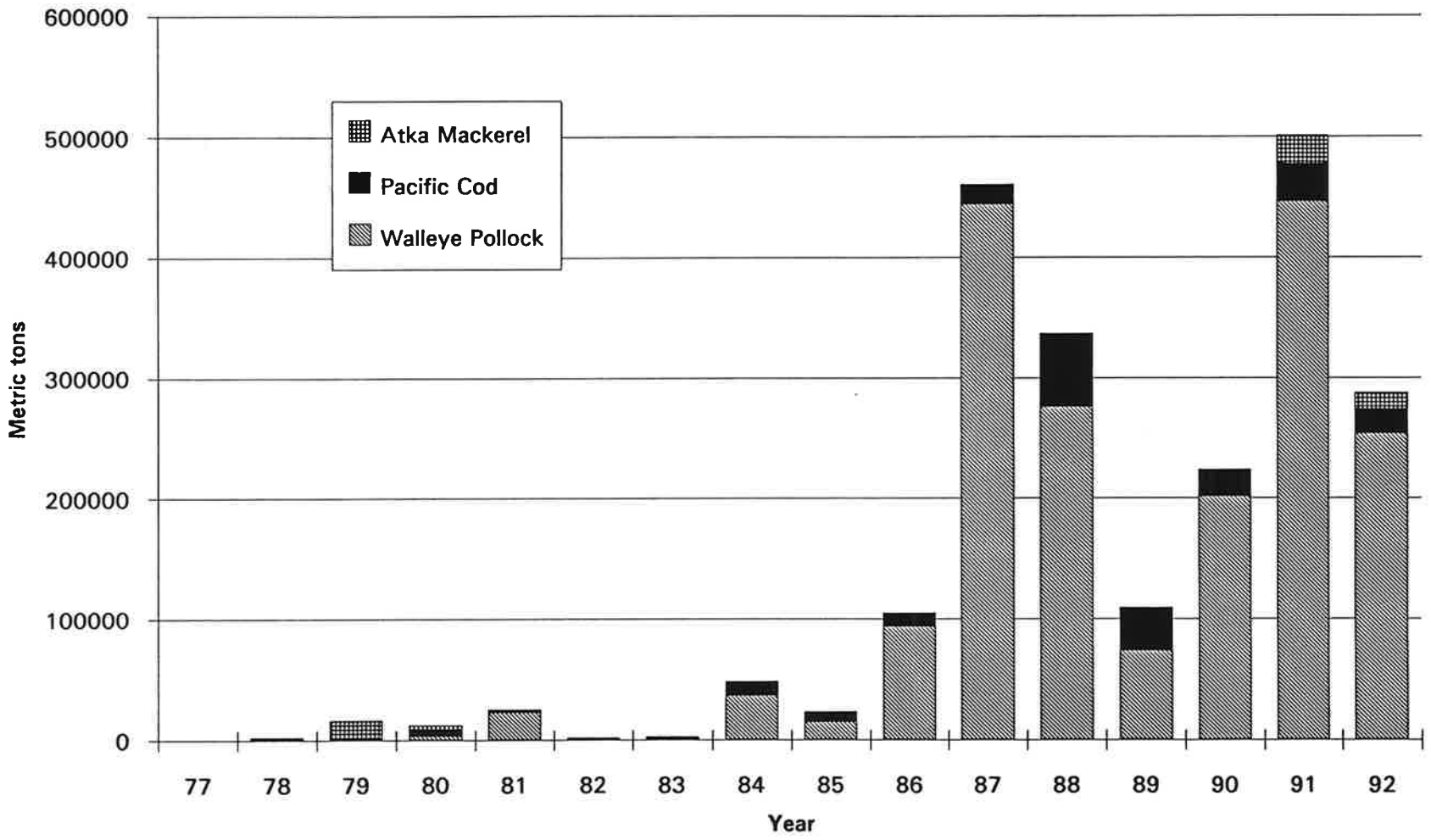


Fig. 25. 1st Quarter Pollock, Cod and Atka Mackerel Catches in BSAI Critical Habitat

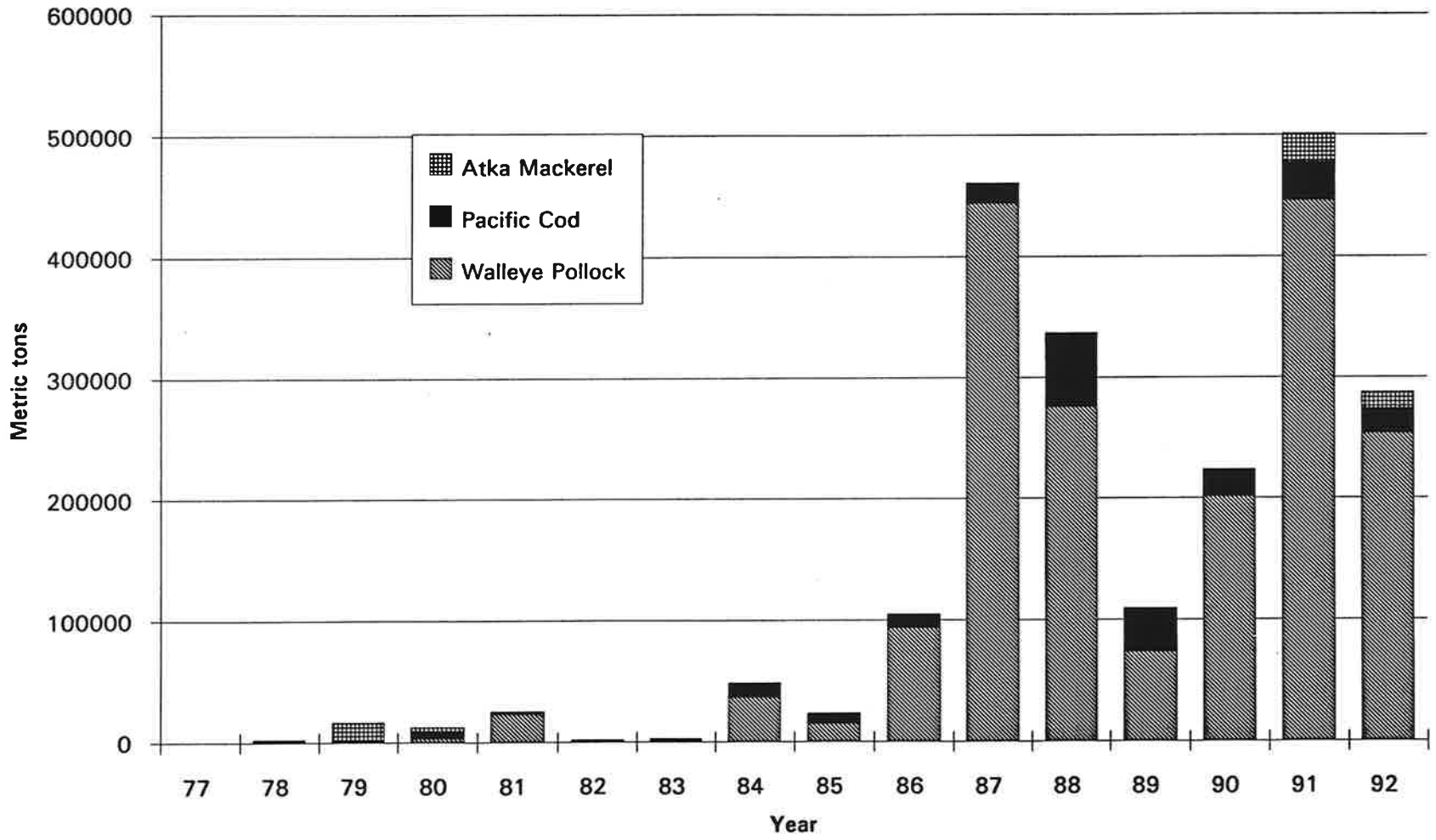


Fig. 28. Pollock Catches in GOA Critical Habitat

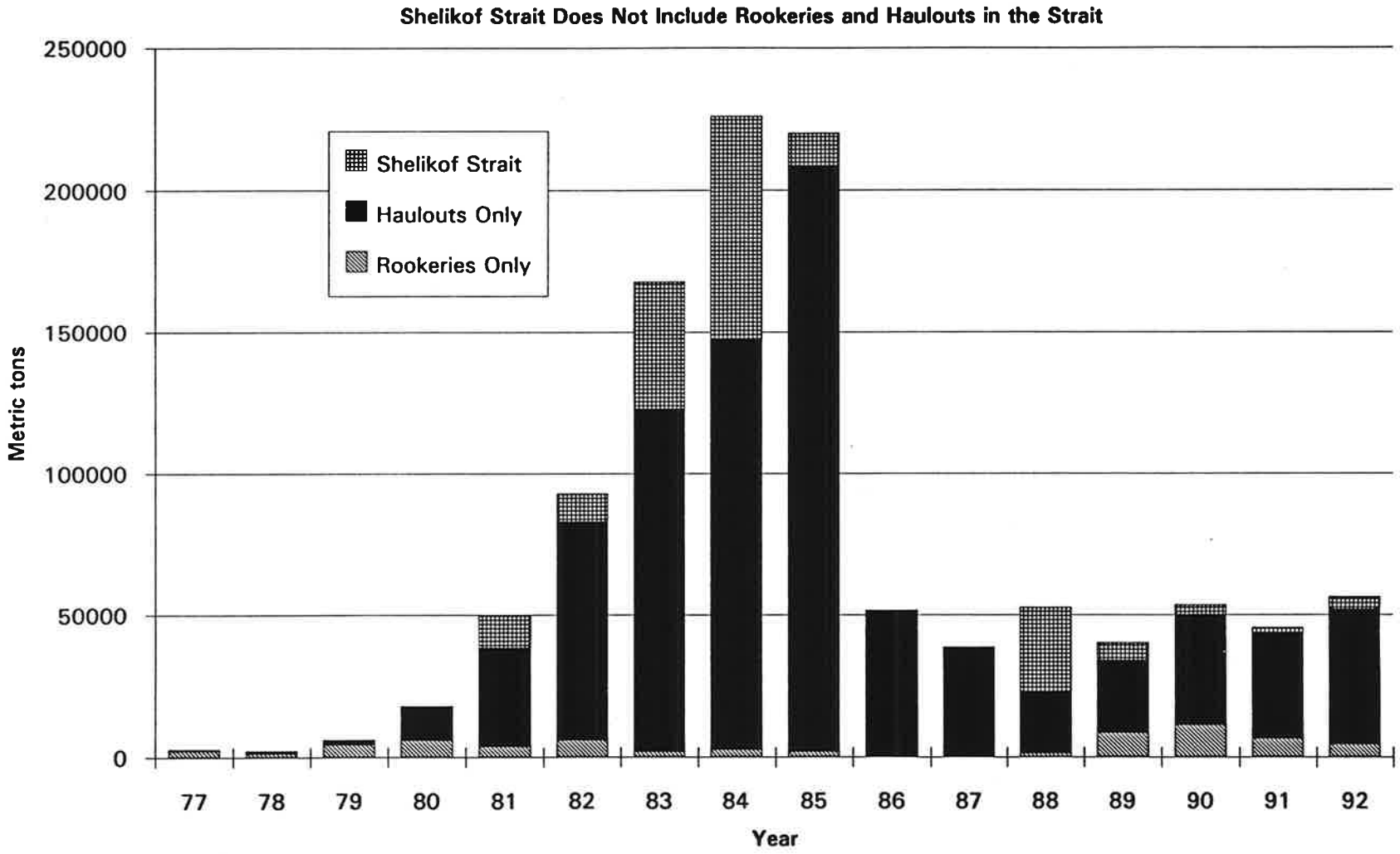


Fig. 29. Pollock Catches in GOA Critical Habitat

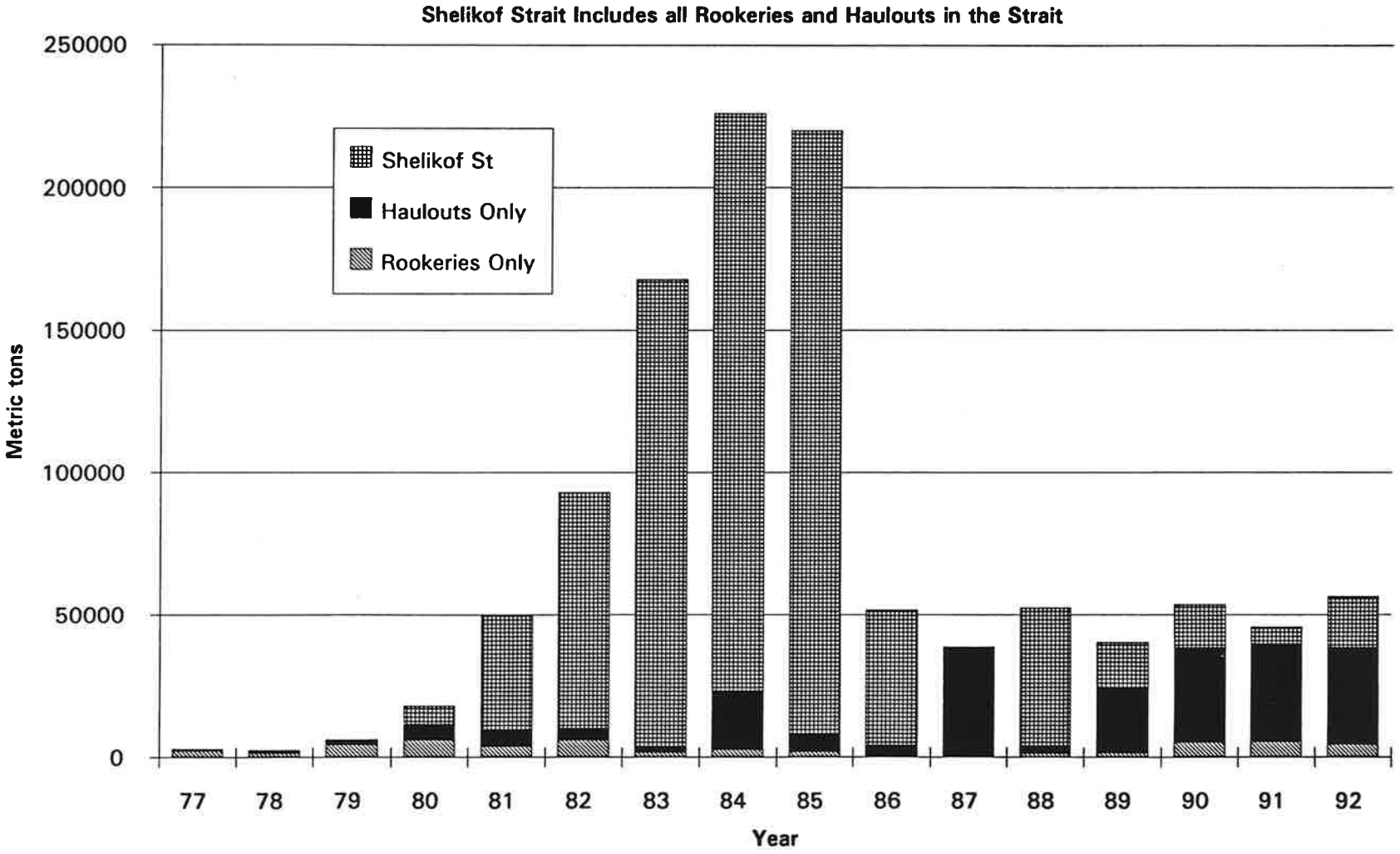


Fig. 30. Pollock Catches in GOA Critical Habitat

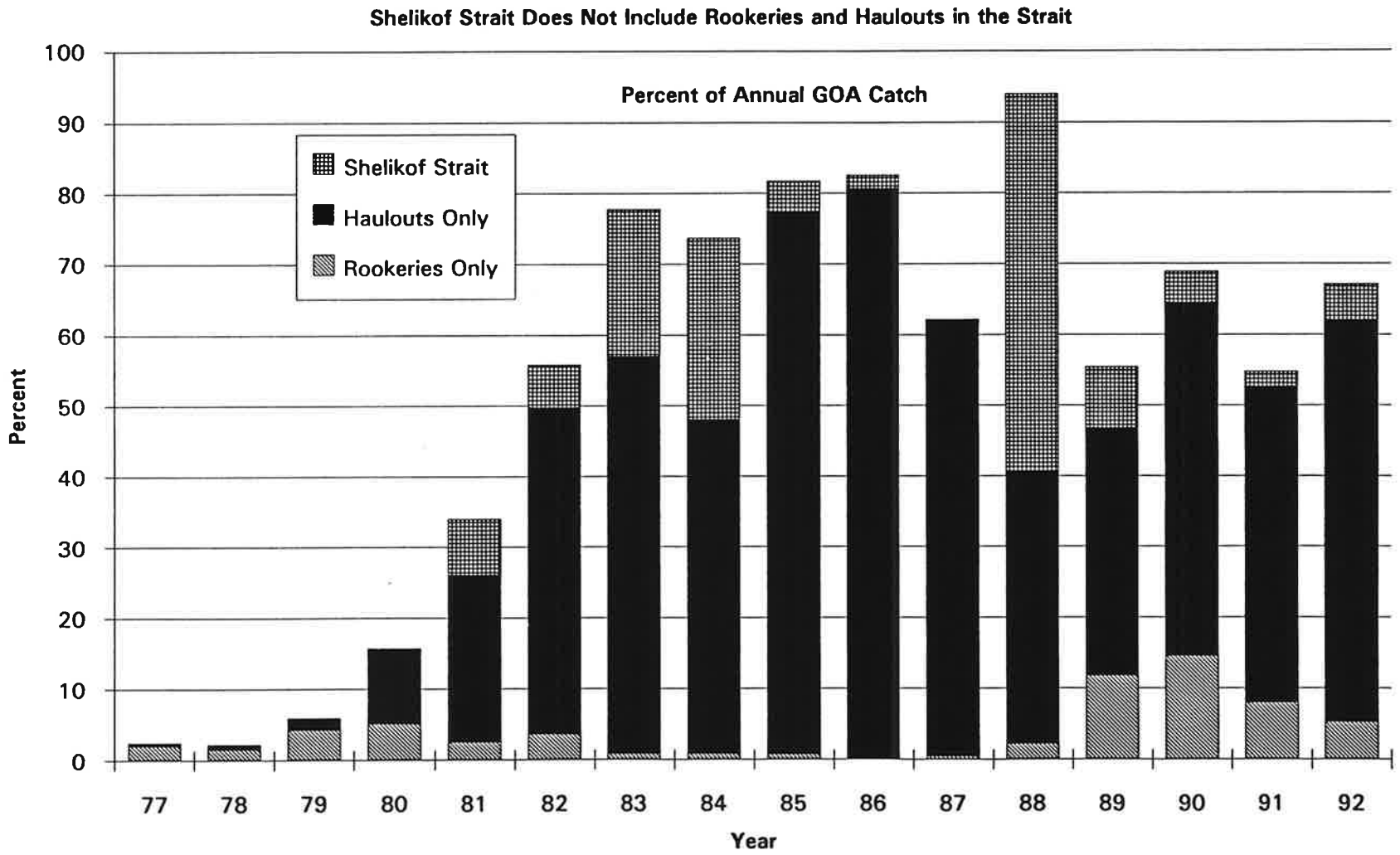


Fig. 31. Pollock Catches in GOA Critical Habitat

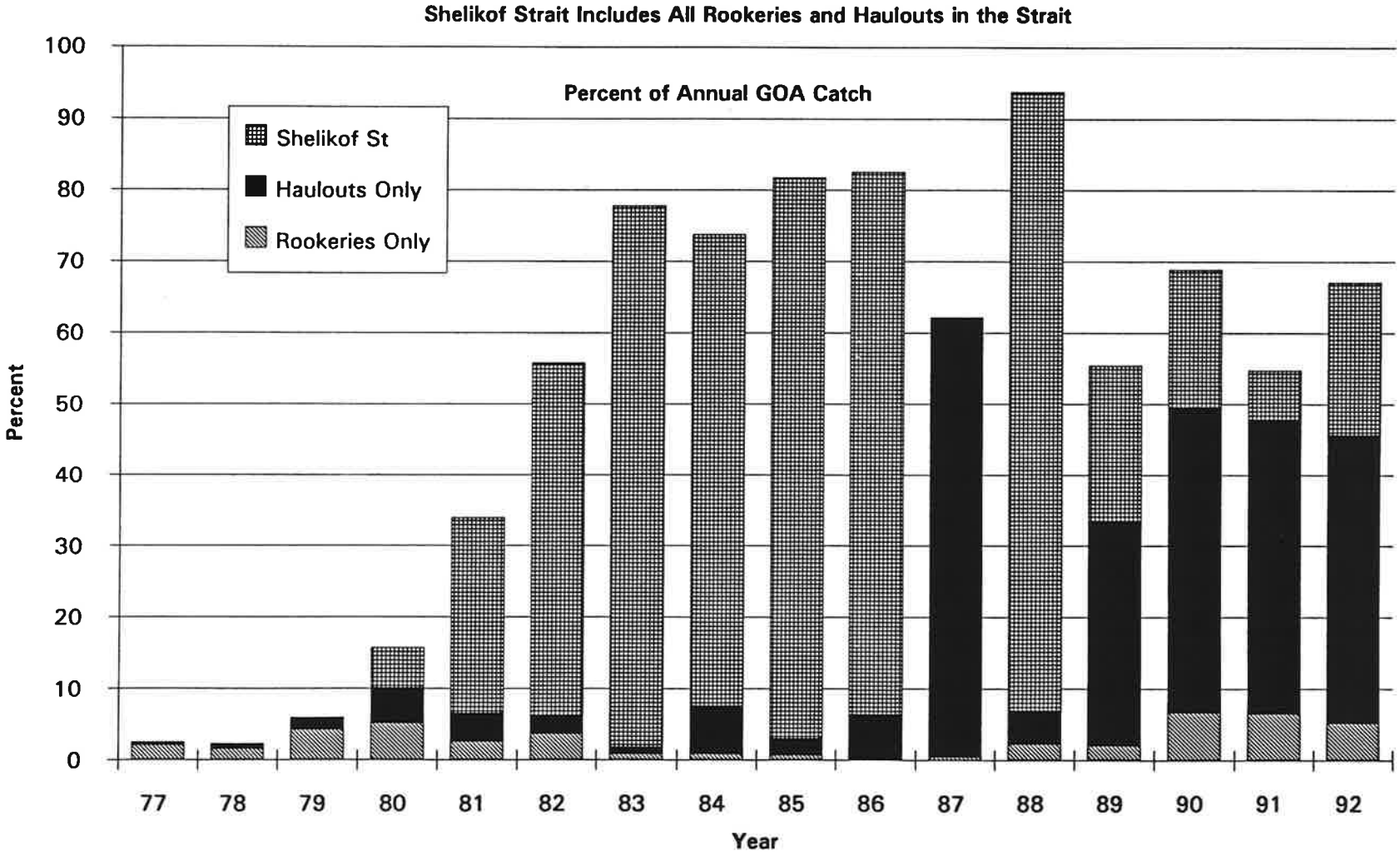


Fig. 32. 1st Quarter Pollock Catches in GOA Critical Habitat

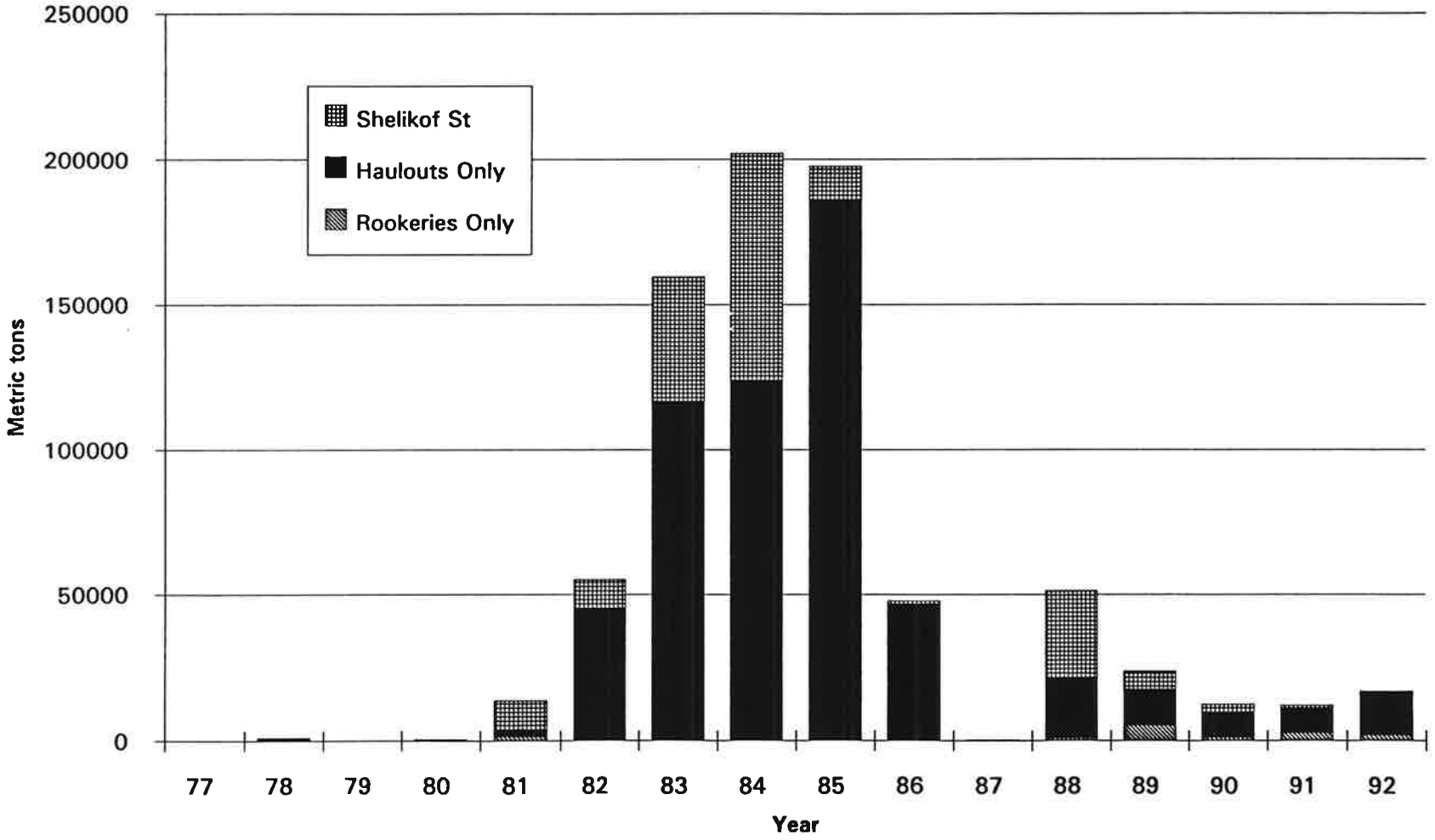


Fig. 33. 1st Quarter Pollock Catches in GOA Critical Habitat

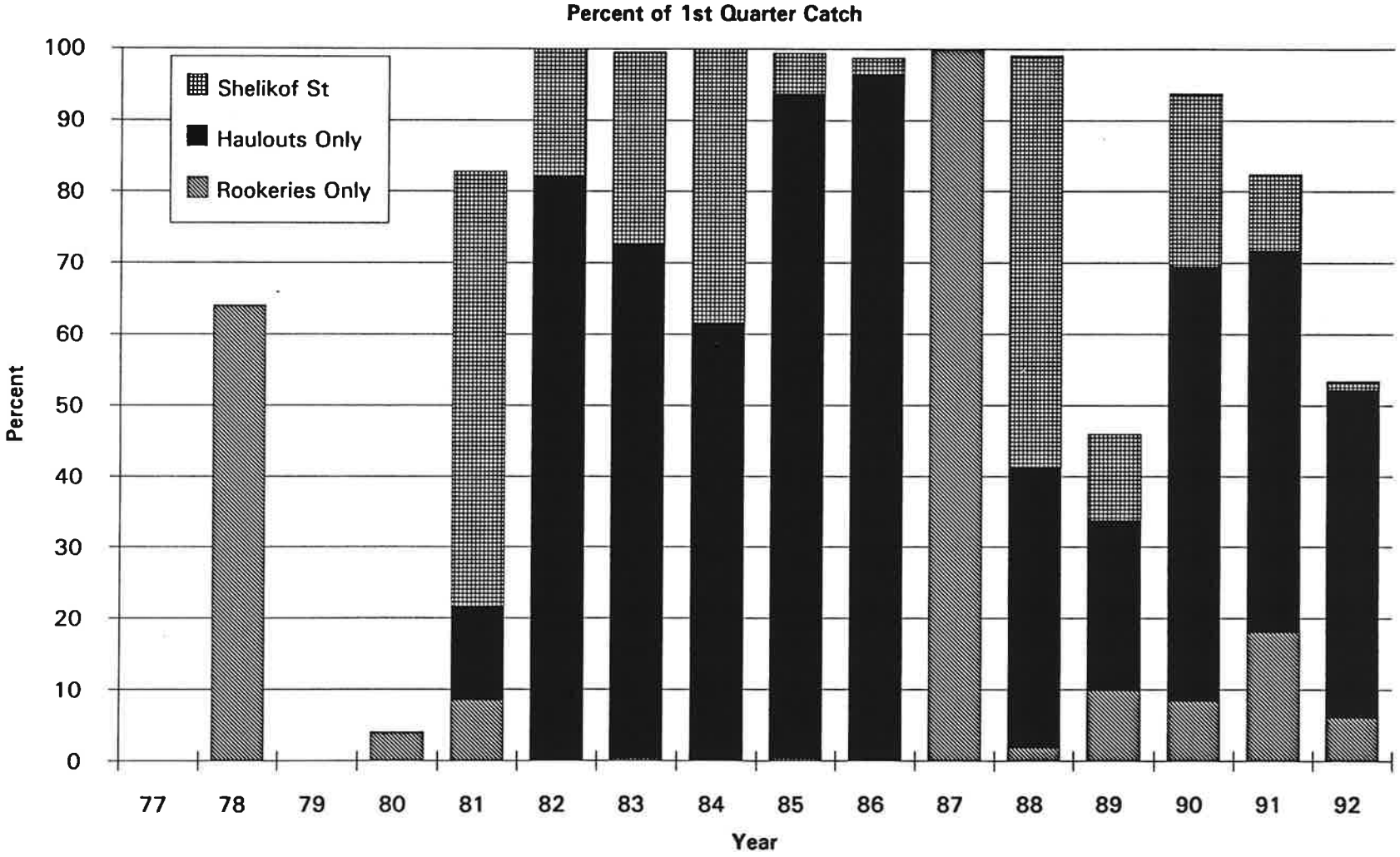


Fig. 34. Pacific Cod Catches in GOA Critical Habitat

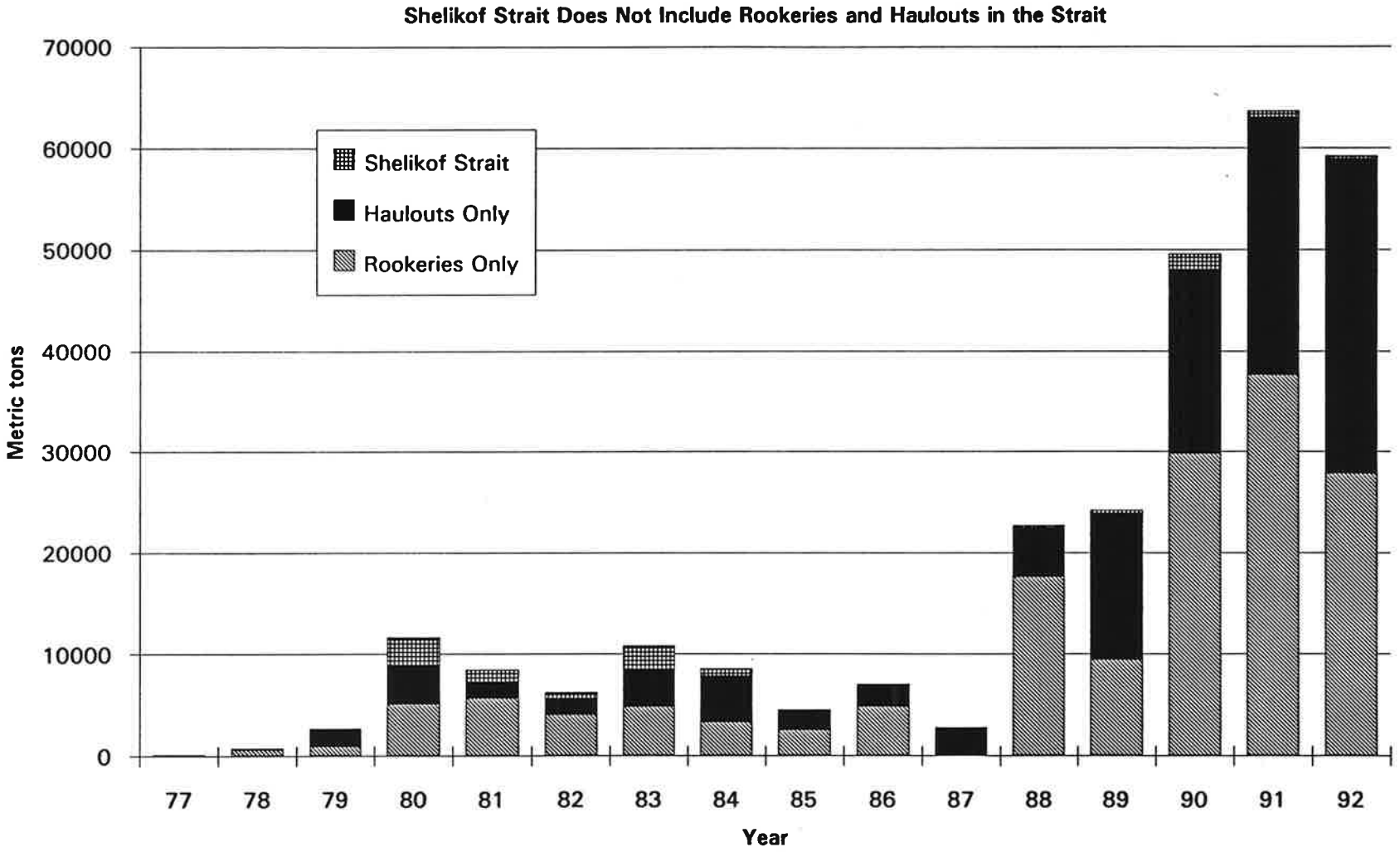


Fig. 35. Pacific Cod Catches in GOA Critical Habitat

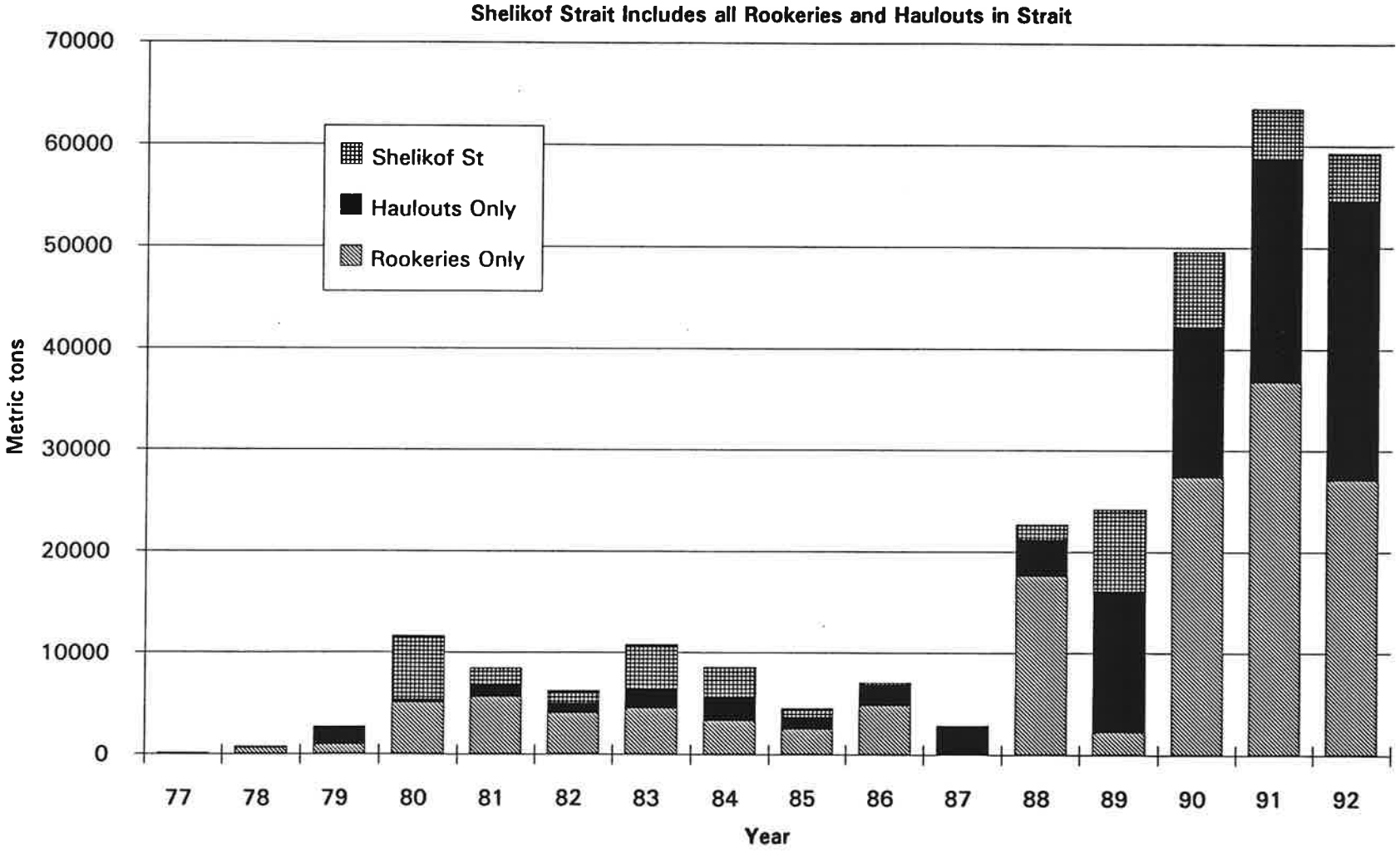


Fig. 36. Pacific Cod Catches in GOA Critical Habitat

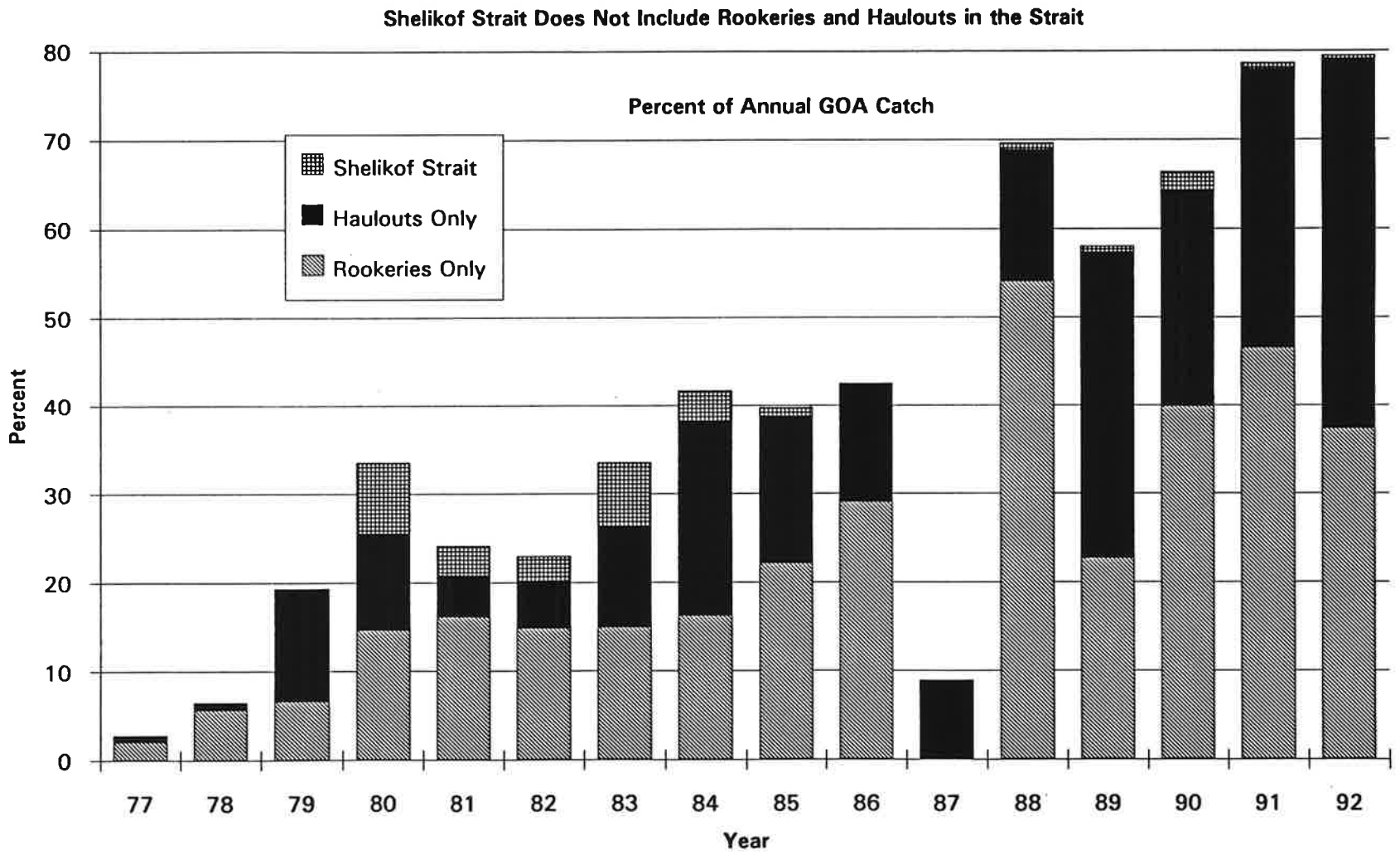


Fig. 37. Pacific Cod Catches in GOA Critical Habitat

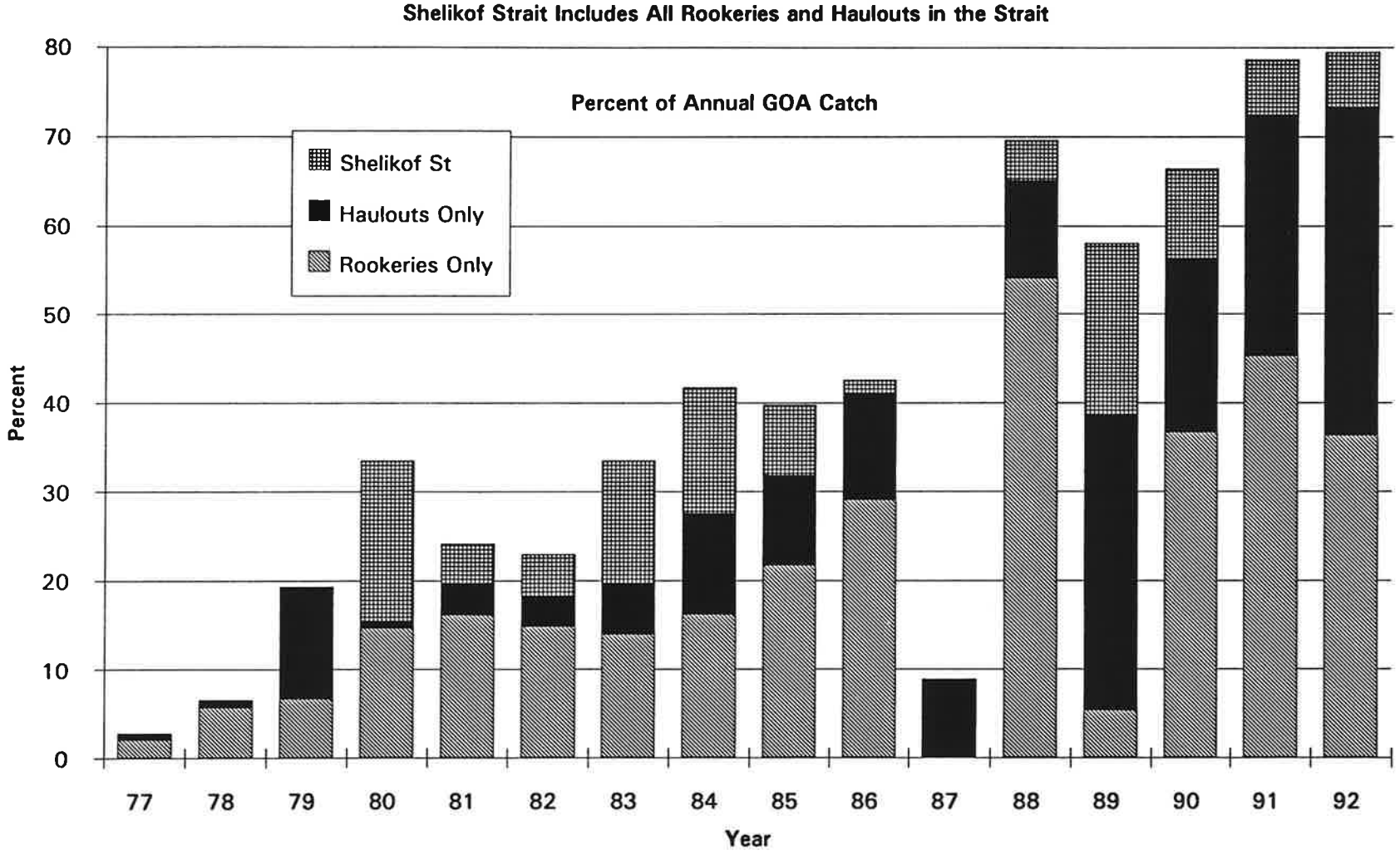


Fig. 38. 1st Quarter Pacific Cod Catches in GOA Critical Habitat

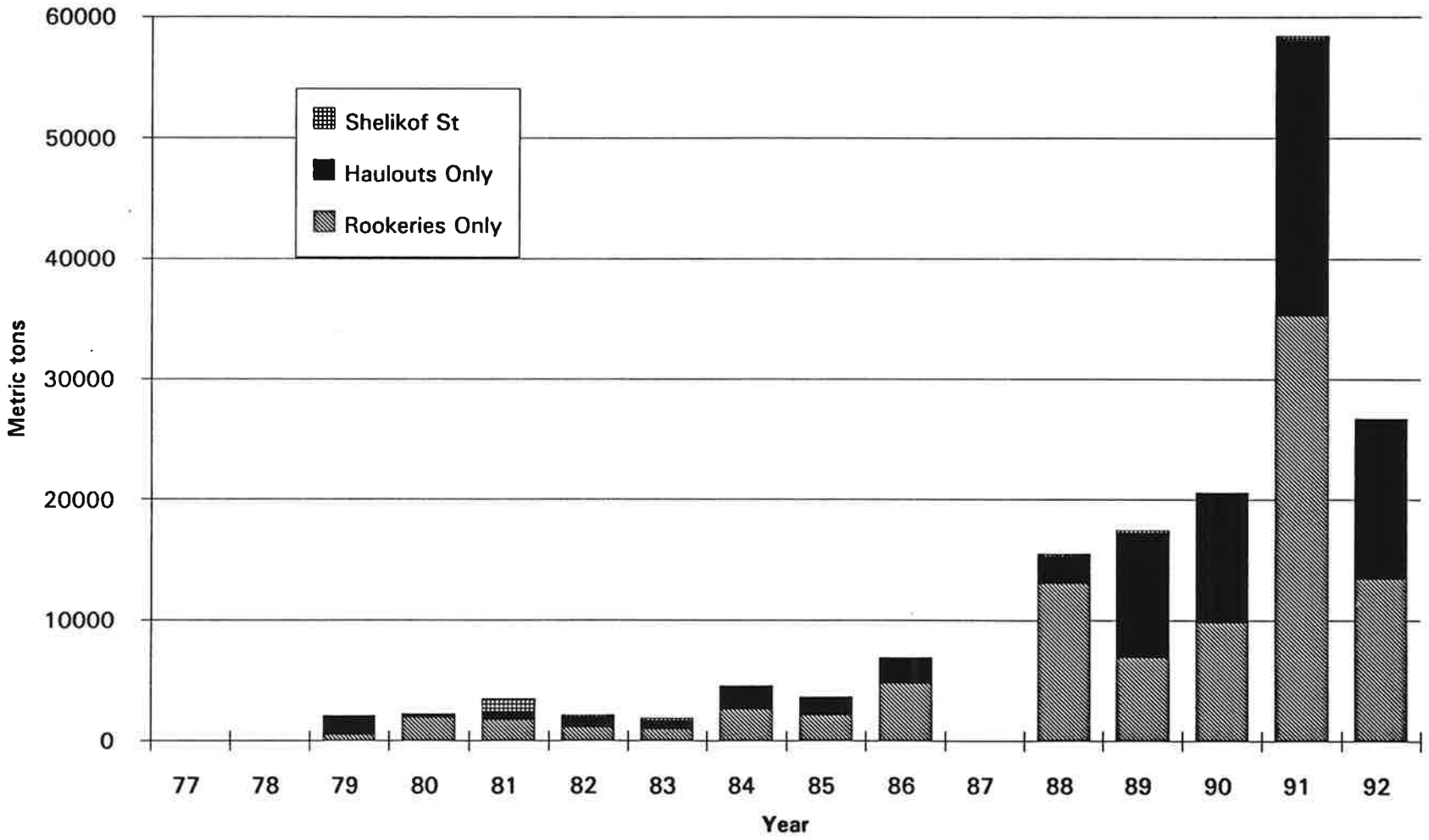


Fig. 39. 1st Quarter Pacific Cod Catches in GOA Critical Habitat

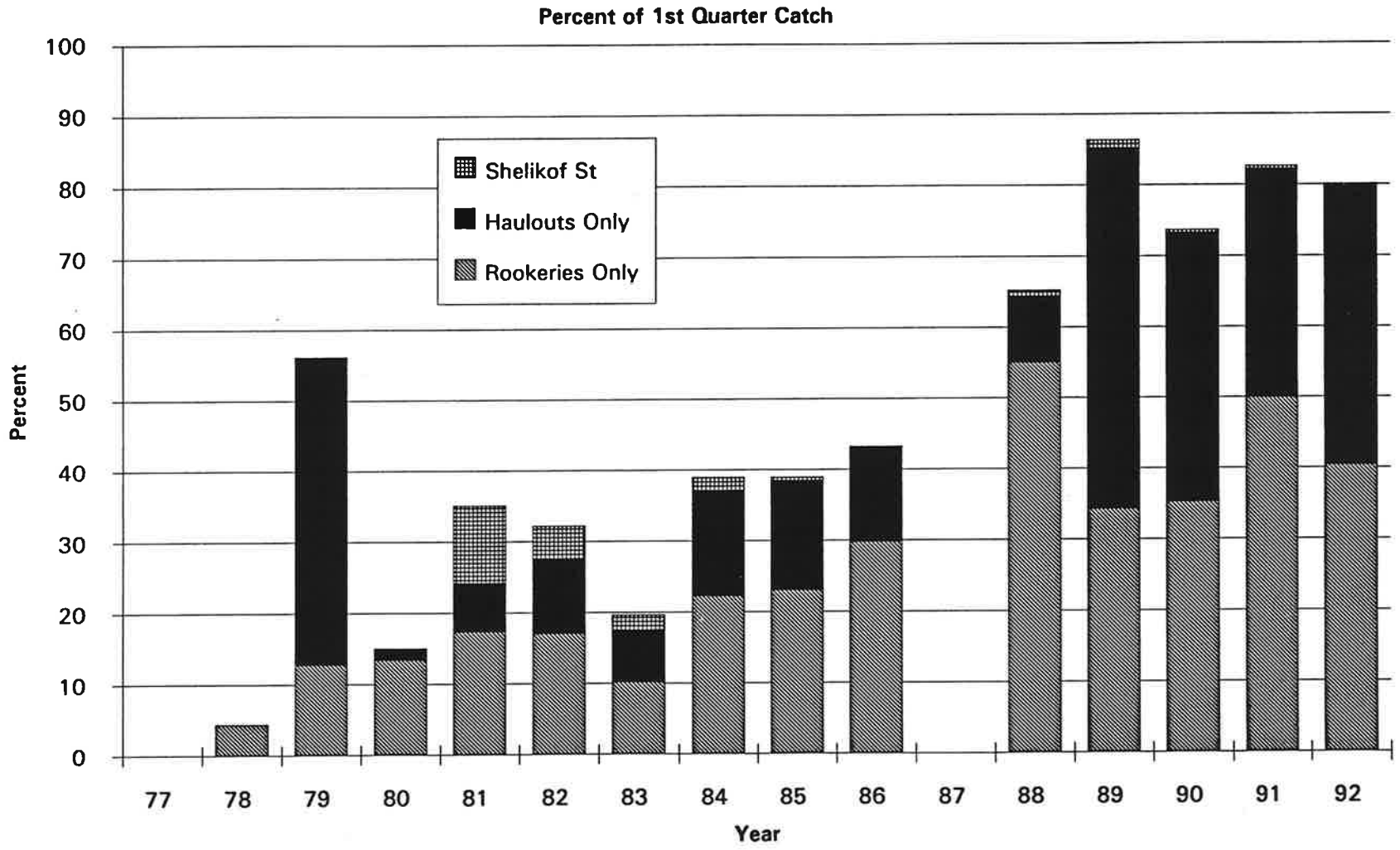


Fig. 40. Atka Mackerel Catches in GOA Critical Habitat

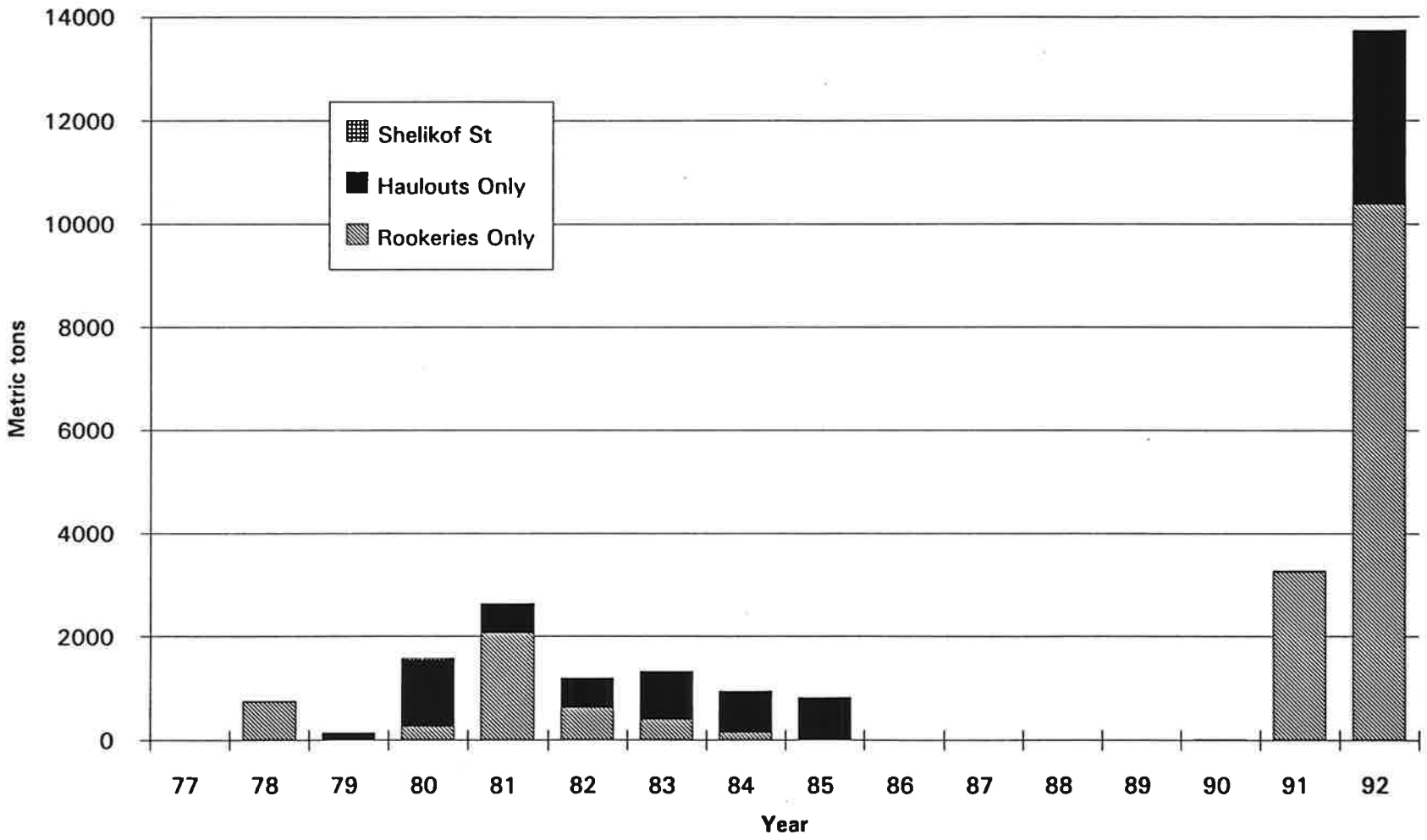


Fig. 41. Atka Mackerel Catches in GOA Critical Habitat

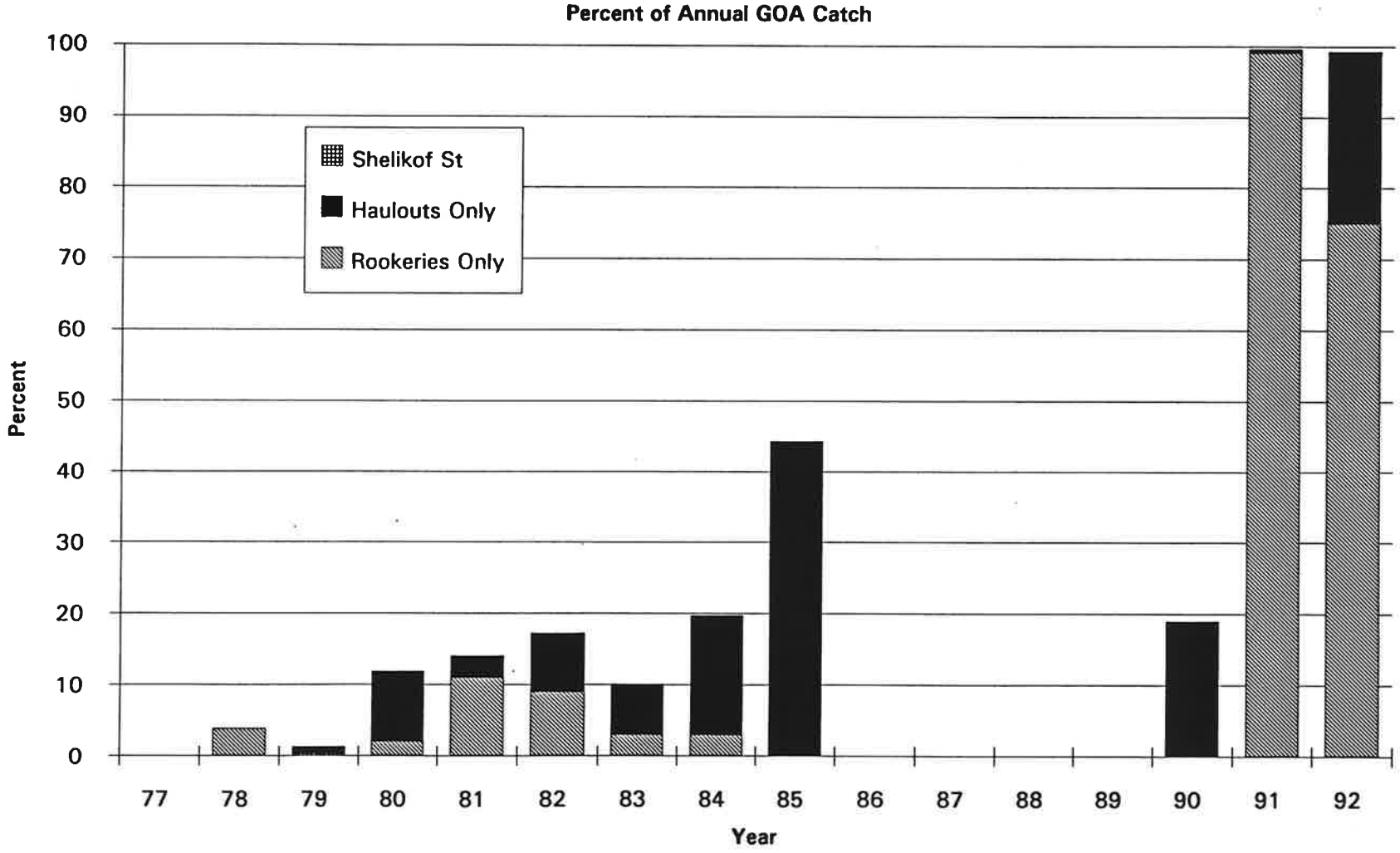


Fig. 42. 1st Quarter Atka Mackerel Catches in GOA Critical Habitat

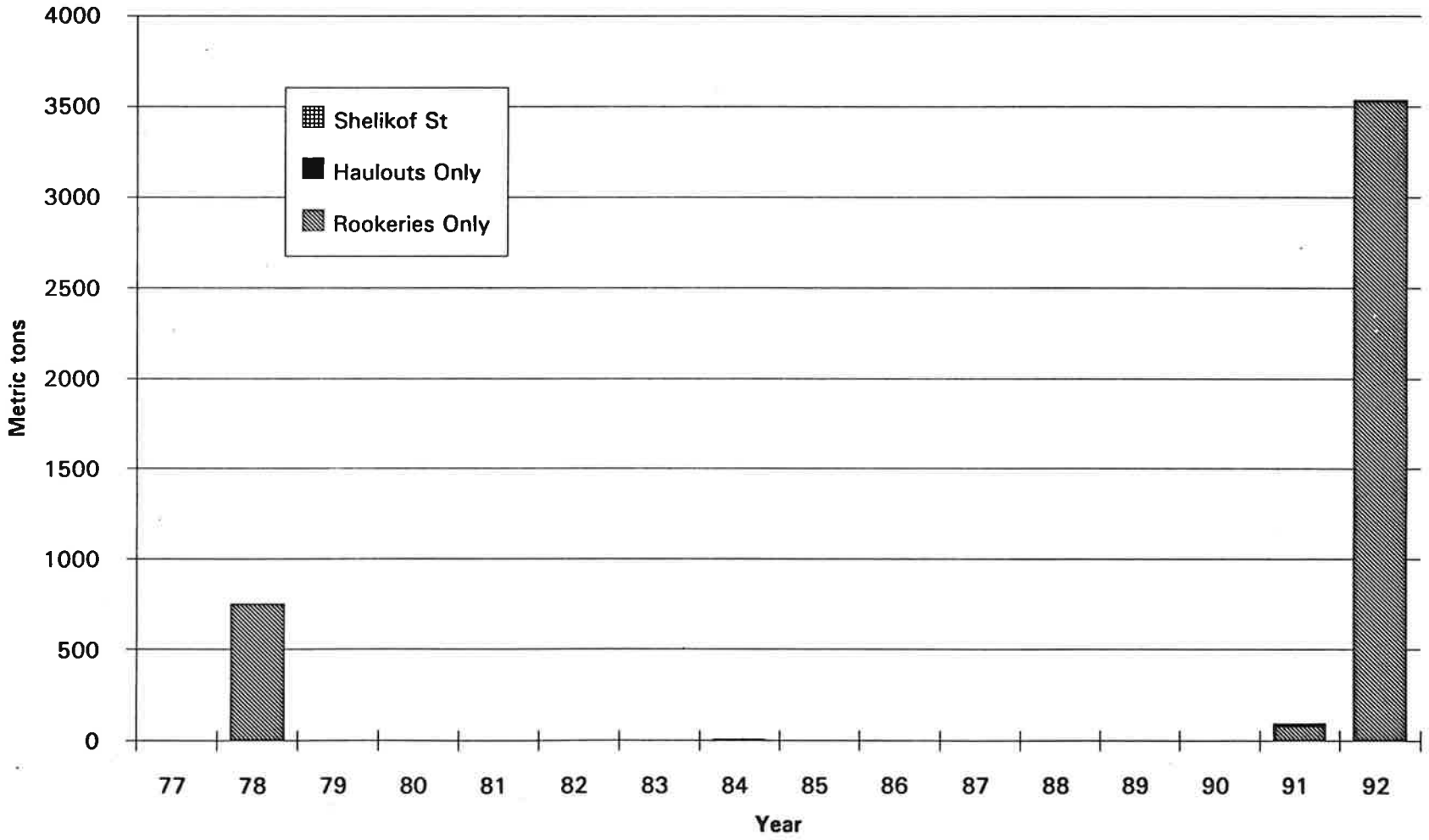


Fig. 43. 1st Quarter Atka Mackerel Catches in GOA Critical Habitat

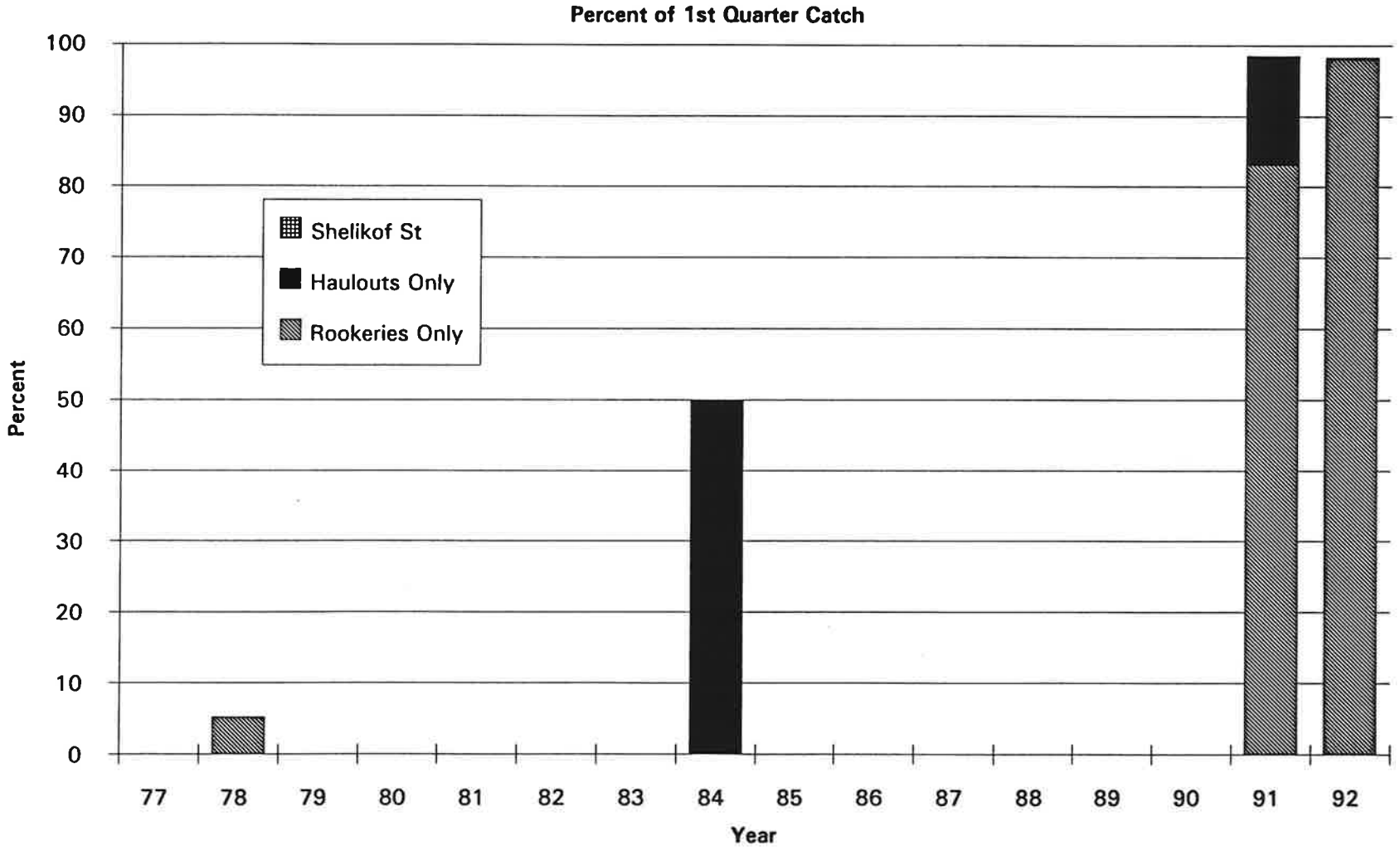


Fig. 44. Pollock, Cod and Atka Mackerel Catches in GOA Critical Habitat

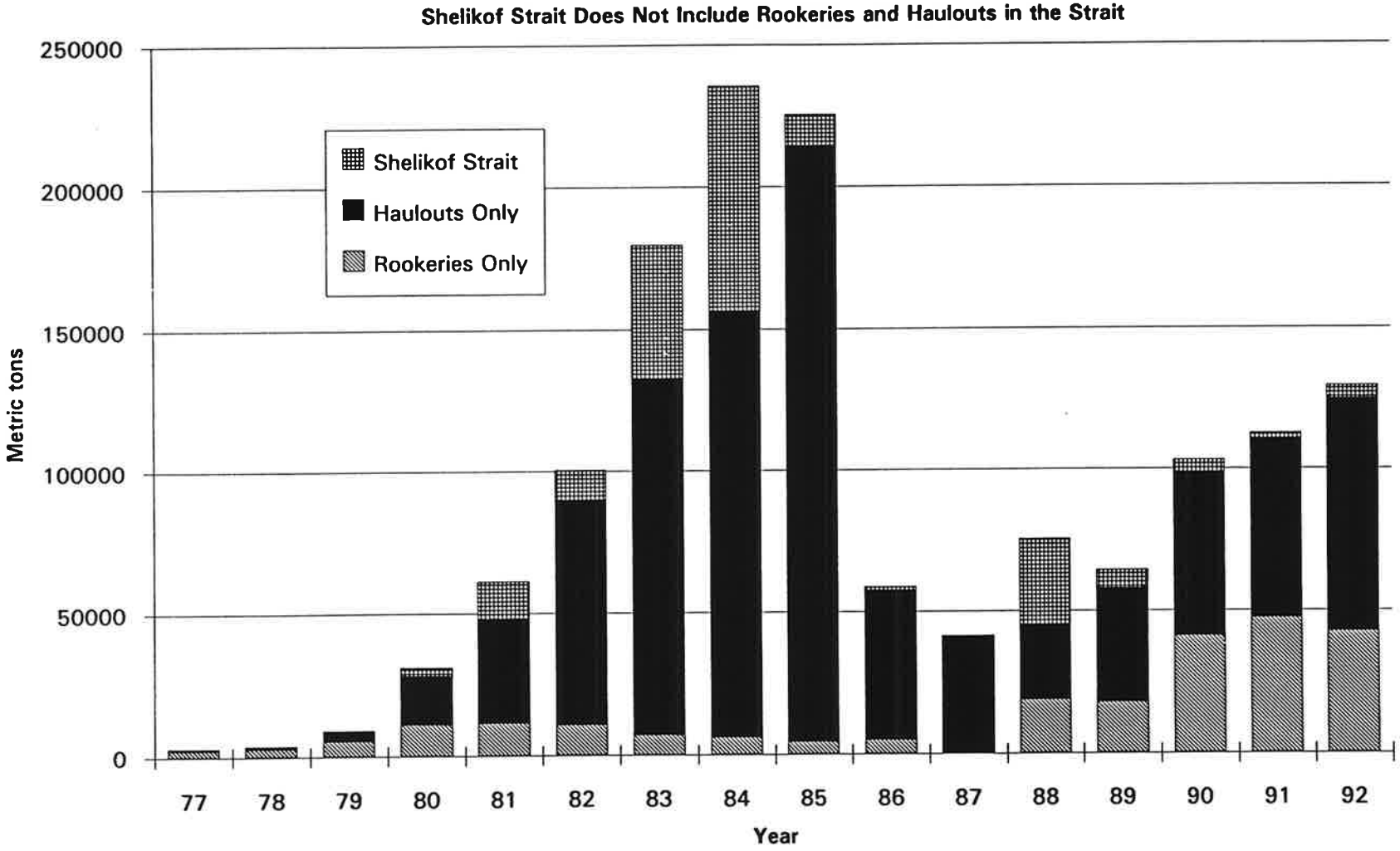


Fig. 45. Pollock, Cod and Atka Mackerel Catches in GOA Critical Habitat

Shelikof Strait Includes All Rookeries and Haulouts in the Strait

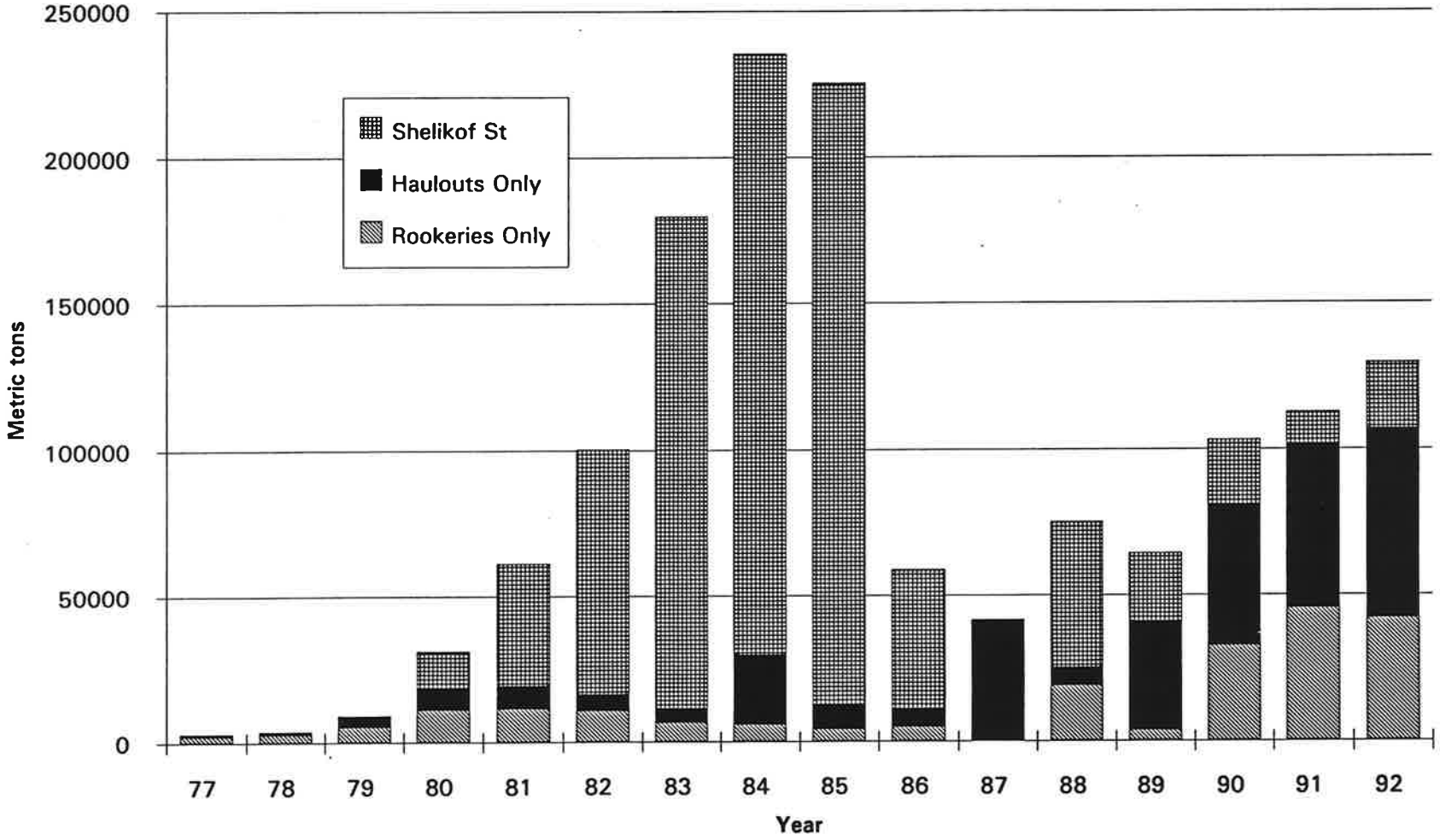


Fig. 46. Pollock, Cod and Atka Mackerel Catches in GOA Critical Habitat

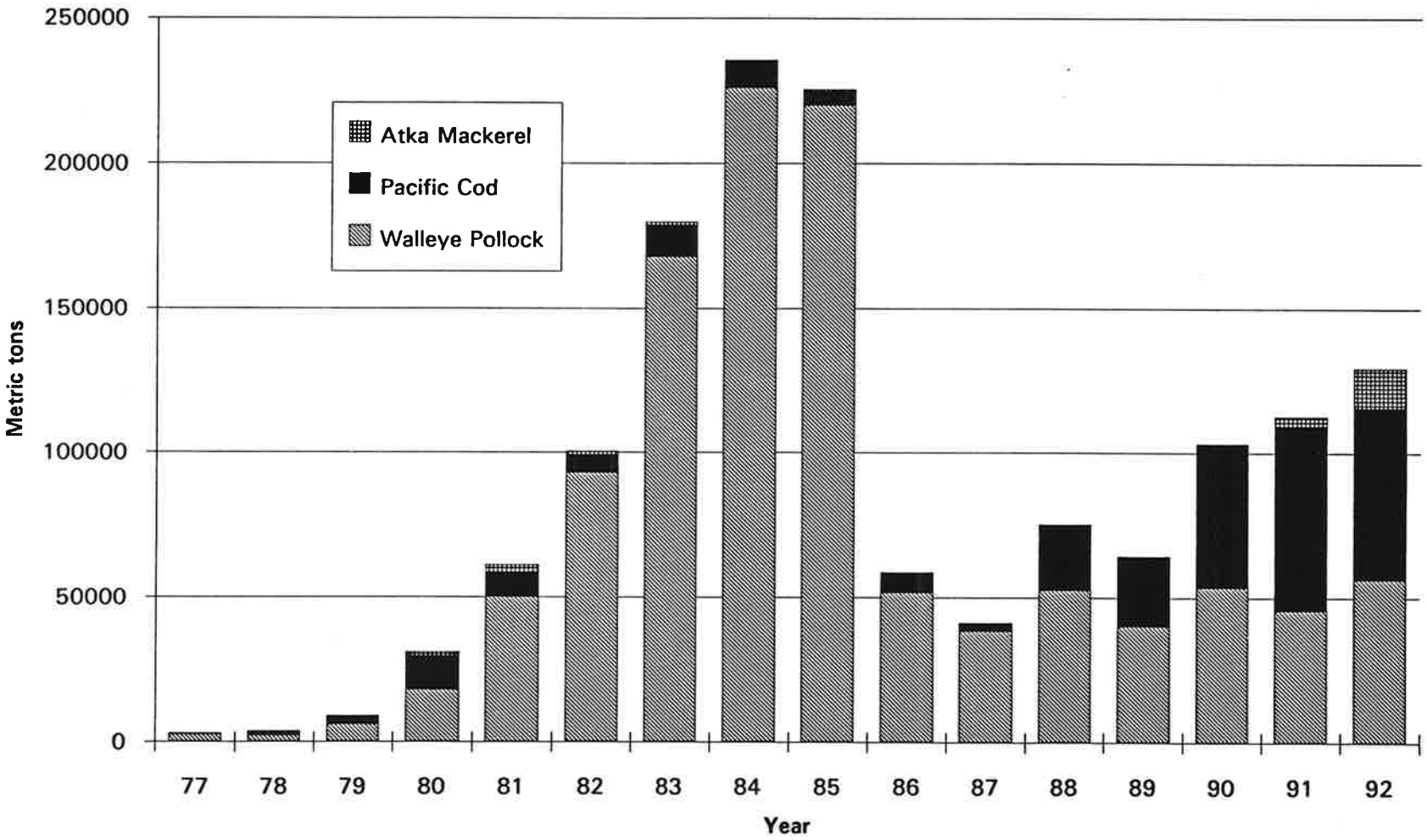


Fig. 47. Percent of Annual GOA Pollock, Cod and Atka Mackerel Caught in 1st Quarter

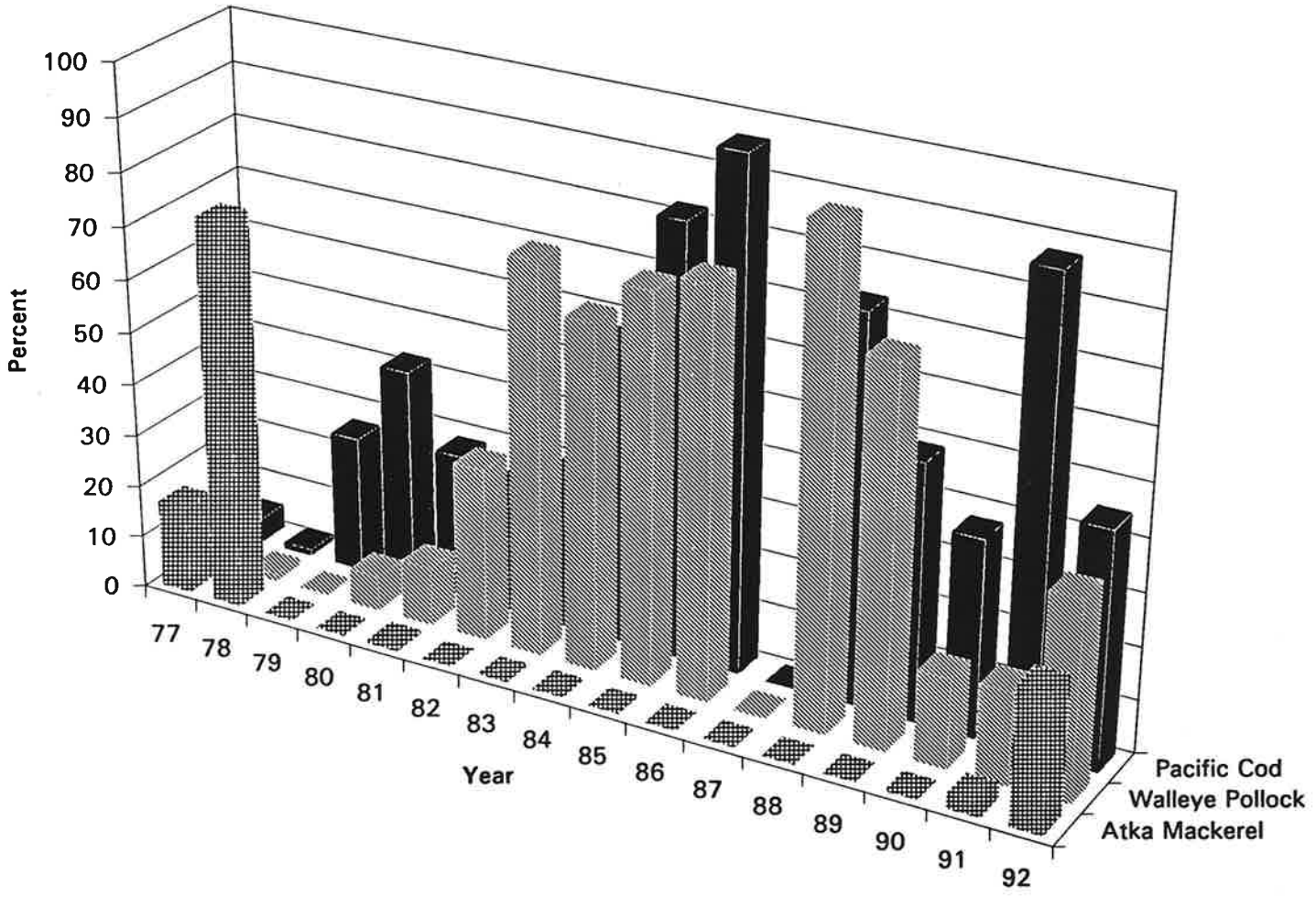


Fig. 48. 1st Quarter Pollock, Cod and Atka Mackerel Catches in GOA Critical Habitat

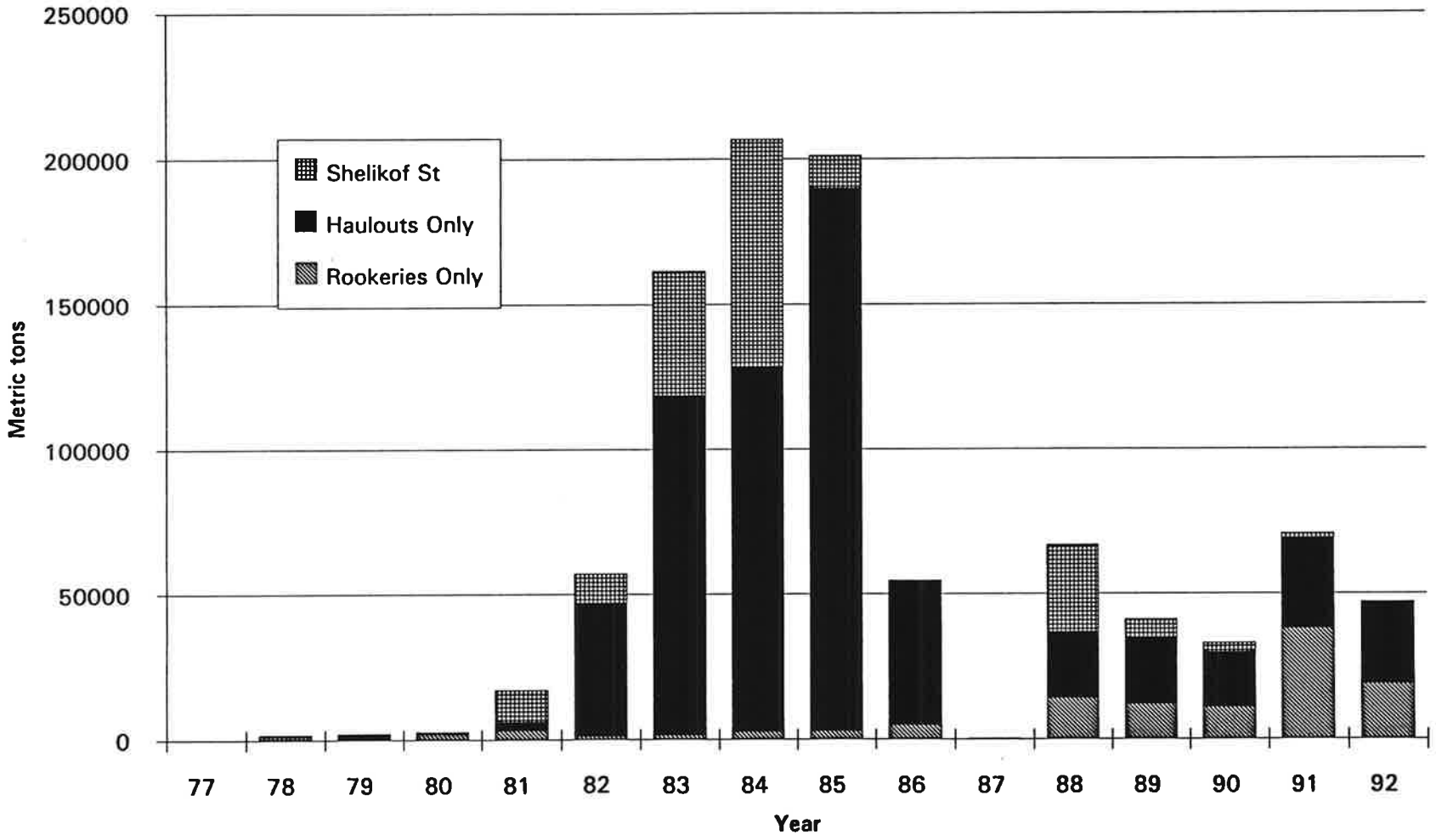


Fig. 49. 1st Quarter Pollock, Cod and Atka Mackerel Catches in GOA Critical Habitat

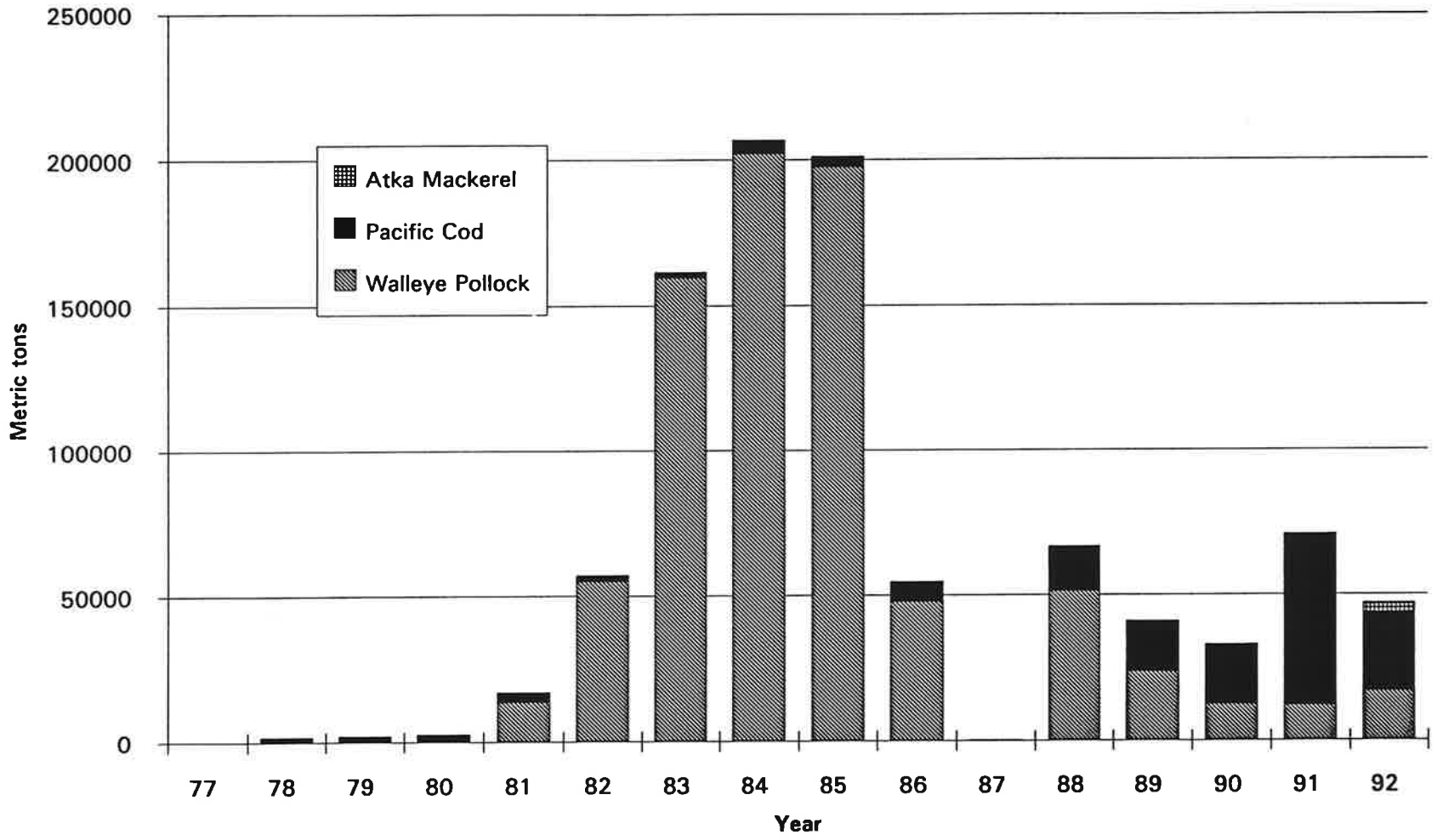


Table 1. List of rookeries (R) and major haulouts (H) of Steller sea lions in the Bering Sea/Aleutian Islands and Gulf of Alaska west of 144°W used in analysis and in critical habitat designation. Abbreviation refers to data in tables in AFSC Processed Report 93-07. Critical habitat is defined as all area 20 nm seaward and 3000 feet landward of each site. Sites are listed from east to west within each region. If the abbreviation is preceded by a '&', '$', or '*', then the 20 nm zone around each site is within or intersects with the following aquatic critical habitat areas (see Figures 1-3):

1) '&' - Bogoslof or eastern Bering Sea;
2) '$' - Seguam Pass
3) '*' - Shelikof Strait

A. Bering Sea and Aleutian Islands Rookeries and Haulouts

Rookery or Haulout Name	Abbreviation and Designation	
Amak Island	AMAK	H
Sea Lion Rock	SLION RK	R
Tanginak Island	&TANGINK	H
Ugamak Island	&UGAMAK	R
Tigalda Island	&TIGALDA	H
Akun Island (Billings Head)	&AKUN	R
Akutan Island		
Cape Morgan	&AKUTAN	R
Reef-Lava	&AKUTAN	H
Old Man Rocks	&OLD MAN	H
Emerald Island	&EMERALD	H
Polivnoi Rock	&POLIVNI	H
Bogoslof Island	&BOGOSLF	R
Cape Sedanka and Island	&SEDANKA	H
Umnak Island	&UMNAK	H
Adugak Island	&ADUGAK	R
Kagamil Island	&KAGAMIL	H
Chuginadak Island	&CHU-DAK	H
Uliaga Island	&ULIAGA	H
Walrus Island	WALRUS	R
Round Island	ROUND	H
Cape Newenham	NEWENHAM	H
Yunaska Island	YUNASKA	R
Chagulak Island	CHAGULAK	H
Amukta Island and Rocks	AMUKTA	H
Seguam Island		
Finch Point	$FINCH	H
South	$S SEGUM	H
Saddleridge	$SEGUAM	R
Agligadak Island	$AGL-DAK	R
Tanadak Island (near Amlia I.)	$TANDK-W	H
Amlia Island		
East Point	$AMLIA	H
Sviechnikof Harbor	$SVIECH	H

Table 1. (continued)

A. Bering Sea and Aleutian Islands Rookeries and Haulouts

Rookery or Haulout Name	Abbreviation and Designation	
Sagigik Island	$SAGIGIK	H
Atka Island	ATKA	H
Kasatochi Island	KASA-CHI	R
Anagaksik Island	ANAG-SIK	H
Great Sitkin Island	G SITKIN	H
Little Tanaga Island	L TANAGA	H
Adak Island (Lake Point)	ADAK	R
Kanaga Island		
North Cape	N CAPE	H
Ship Rock	SHIPROCK	H
Tanaga Island	TANAGA	H
Delarof Islands		
Gramp Rock	GRAMP RK	R
Ugidak Island	UGIDAK	H
Tag Island	TAG	R
Kavalga Island	KAVALVA	H
Ulak Island	ULAK	R
Unalga Island and Dinkum Rocks	UNAL-DIN	H
Semisopochnoi Island		
Pochnoi Point	SEMISO-I	R
Tuman Point	SEMIS-II	R
Amchitka Island		
East Cape	AMCHIT-I	R
Column Rock	AMCHI-II	R
Little Sitkin Island	L SITKIN	H
Ayugadak Island	AYUGADAK	R
Segula Island	SEGULA	H
Tanadak Island (near Kiska I.)	TANADK-E	H
Kiska Island		
Sobaka and Vega Points	KISKA-H	H
Lief Cove	KISKA-I	R
Cape St. Stephen	KISKA II	R
Buldir Island	BULDIR	R
Shemya Island	SHEMYA	H
Alaid Island	ALAID	H
Agattu Island		
Gillon Point	AGATTU-I	R
Cape Sabak	AGATT-II	R
Attu Island (Cape Wrangell)	ATTU	R

Table 1. (continued)

B. Central and Western Gulf of Alaska Rookeries and Haulouts

Rookery or Haulout Name	Abbreviation and Designation	
Cape St. Elias	ST ELIAS	H
Middleton Island	MIDDLETN	H
Hook Point	HOOK PT	H
Seal Rocks (Prince William Sound)	SEAL RKS	R
The Needle	NEEDLE	H
Wooded Island	WOODED	H
Point Elrington	ELRINGTN	H
Perry Island	PERRY	H
Point Eleanor	ELEANOR	H
Chiswell Island	CHISWELL	H
Seal Rocks (Kenai Peninsula)	SEAL RKS	H
Outer Island	OUTER IS	R
Gore Point	GORE PT	H
Nagahut Rocks	NAGAHUT	H
Sea Lion Rocks (near Marmot I.)	*SLIONRC	H
Marmot Island	*MARMOT	R
Sugarloaf Island	*SUGARLF	R
Cape Chiniak	CHINIAK	H
Sud Island	*SUD	H
Sea Otter Island	*S OTTER	H
Ugak Island	UGAK	H
Latax Rocks	*LATAX	H
Gull Point	GULL PT	H
Cape Barnabas	BARNABAS	H
Two-headed Island	2-HEADED	H
Shakun Island	*SHAKUN	H
Cape Ugat	*UGAT	H
Cape Sitkinak	*SITKNAK	H
Cape Kuliak	*KULIAK	H
Cape Gull	*C GULL	H
Takli Island	*TAKLI	H
Cape Ikolik	*IKOLIK	H
Puale Bay	*PUALE	H
Chirikof Island	CHIRIKOF	R
Nagai Rocks	NAGAI RK	H
Chowiet Island	CHOWIET	R
Sutwik Island	*SUTWIK	H
Lighthouse Rocks	LIGHTHSE	H
Spitz Island	SPITZ	H
Atkins Island	ATKINS	R
Castle Rock	CASTLE	H
Chernabura Island	CHRNBURA	R
Bird Island	BIRD	H
The Whaleback	WHALBACK	H
Nagai Island	NAGAI IS	H
Sea Lion Rocks (in Shumagin Is.)	SLIONRW	H
Jude Island	JUDE	H

Table 1. (continued)

B. Central and Western Gulf of Alaska Rookeries and Haulouts

Rookery or Haulout Name	Abbreviation and Designation	
Pinnacle Rock	PINNACLE	R
Caton Island	CATON	H
Clubbing Rocks	CLUBBING	R
South Rock	S ROCK	H
Tanginak Island	TANGINAK	H
Ugamak Island	UGAMAK	R
Tigalda Island	TIGALDA	H
Akun Island (Billings Head)	AKUN	R
Akutan Island		
Cape Morgan	AKUTAN	R
Reef-Lava	AKUTAN	H
Old Man Rocks	OLD MAN	H
Emerald Island	EMERALD	H
Polivnoi Rock	POLIVNOI	H
Cape Sedanka and Island	SEDANKA	H
Umnak Island	UMNAK	H
Ogchul Island	OGCHUL	R
Adugak Island	ADUGAK	R
Kagamil Island	KAGAMIL	H
Chuginadak Island	CHU-DAK	H
Uliaga Island	ULIAGA	H

Table 2. Adjustment factors to expand observed walleye pollock, Pacific cod and Atka mackerel catches by foreign/joint venture and domestic components of the fisheries in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) regions to total catches for the years 1977-92. Factors were calculated by dividing actual catch by observed catch for each year, species, region and fishery component.

	Walleye Pollock				Pacific cod				Atka Mackerel			
	Foreign/Joint Venture		Domestic		Foreign/Joint Venture		Domestic		Foreign/Joint Venture		Domestic	
Year	BSAI	GOA	BSAI	GOA	BSAI	GOA	BSAI	GOA	BSAI	GOA	BSAI	GOA
1977	3.17	44.40	--	--	4.58	13.80	--	--	15.93	218.60	--	--
1978	2.49	12.93	--	--	3.46	6.85	--	--	12.49	53.52	--	--
1979	2.44	10.40	--	--	2.72	7.64	--	--	9.80	10.19	--	--
1980	3.06	12.00	--	--	4.29	15.84	--	--	32.68	37.57	--	--
1981	3.56	9.20	--	--	5.79	13.80	--	--	14.51	19.09	--	--
1982	1.76	2.54	--	--	1.94	8.82	--	--	2.38	6.42	--	--
1983	1.63	1.43	--	--	1.97	2.54	--	--	1.46	6.55	--	--
1984	1.22	1.23	--	--	1.33	1.16	--	--	1.11	6.79	--	--
1985	1.42	1.88	--	--	1.54	1.08	--	--	1.70	1.26	--	--
1986	1.60	1.90	--	--	1.55	1.07	--	--	1.68	1.00	--	--
1987	1.94	2.02	--	86.15	1.37	1.28	--	334.70	1.67	1.00	--	0.00
1988	1.92	2.04	--	157.18	1.64	1.43	--	27.83	1.60	0.00	--	0.00
1989	1.59	--	9.12	11.71	1.51	--	18.40	277.84	1.27	--	20.18	--
1990	--	--	1.28	2.54	--	--	1.76	5.19	--	--	1.56	1.00
1991	--	--	1.41	2.16	--	--	1.46	4.57	--	--	1.36	1.49
1992	--	--	1.69	2.42	--	--	1.33	3.96	--	--	1.46	1.49