MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director

DATE: May 24, 2000

SUBJECT: Steller Sea Lion Protection

ESTIMATED TIME
6 HOURS

ACTION REQUIRED

(a) Status report on Pacific cod fisheries and Steller sea lion concerns.
(b) Status report on Russian sea lion research and management.

BACKGROUND

(a) Pacific Cod Interactions

The 1999 biological opinion on TAC specifications for Alaskan groundfish fisheries suggested areas of concern about potential competition between cod fisheries and Steller sea lions. At the April meeting, NMFS staff provided the Council with notice that it was preparing an analyses to further evaluate the issue. At this meeting, NMFS staff will present their findings. If the analysis indicates that these cod fisheries may be competing for Steller sea lion prey, the Council may be requested to recommend appropriate measures to alleviate those concerns prior to the 2001 fisheries. A special September meeting may be required to review analyses of measures, if necessary.

(b) U.S.-Russia Sea Lion Research

In April the Council received a status report on Russian sea lion research. The Council requested NMFS to provide additional details on Russian sea lion research, management, information on herring stocks, and sea lion-fisheries interactions in the Russian EEZ.

AGENDA C-4
JUNE 2000
Supplemental

RECEIVED
MAY 17 2000
N.P.F.M.C

IS IT ARROWTOOTH?

I never thought much about arrowtooth flounder until I made a routine stop at the processing plant which was processing the Peggy Jo's arrowtooth delivery. I watched the arrowtooth going through the processing line and it struck me that each large arrowtooth flounder looked to be full of feed. I was curious what the arrowtooth were eating so I pulled out my pocket knife and slit open an arrowtooth flounder. The stomach was full of pollock. I talked to several other fishermen who fished other areas and who said they also noticed a lot of pollock in the arrowtooth stomachs. The size of the pollock in the arrowtooth stomachs ranged from 8 to 18 inches.

Though I never thought much about arrowtooth flounder, I do think a lot about Pollock and crab. I opened more arrowtooth stomachs from the processing line and stomachs onboard the boat. There was pollock in every stomach and quite a bit of crab also.

Thinking about pollock lead me to think about sea lions which made me curious about just how much pollock and crab arrowtooth might be eating.

The 1999 National Marine Fishery Service's Central/Western Gulf of Alaska biennial survey estimated arrowtooth flounder exploitable biomass for the year 2000 at 1,571,000 MT and the exploitable pollock biomass at 588,000 MT.

There is not data to determine how much pollock arrowtooth eat. We would need to know how long it takes an arrowtooth to digest a pollock and whether arrowtooth eat Pollock all year or just part of the year. To date most of the research has been done in the spring/summer period.

In 1990 National Marine Fisheries Service looked at summer arrowtooth stomach contents in the Central/Western Gulf. 1,144 stomachs were examined. Of those stomachs 57.26% contained food and 42.74% were empty. Pollock accounted for 66.43% of the total weight of all food items found in the stomach. In 1990 the only crab found in the arrowtooth stomachs was hermit crab. However, what I saw in the arrowtooth stomachs this year included more species of crab than were seen in 1990.

Just to get some idea how much pollock arrowtooth might be eating I figured that the average weight of arrowtooth flounder was around 7.5 lbs. If an arrowtooth ate 0.1 lb of pollock per week (which I feel is a low estimate) from April thru August. The exploitable biomass in lbs. is 3,463,426,600 the number of arrowtooth would be 461,790,213 fish. If each of those arrowtooth eats 0.1 lbs. of pollock each week April to August (22 weeks) the total consumption of Pollock by arrowtooth would be 1,015,938,469 lbs. or 460,827 MT, which equals 78% of the estimated exploitable pollock biomass. I find these numbers staggering.

When I was talking to different people about arrowtooth I asked if arrowtooth had always been a major part of the Central/Western Gulf. As it turns out the early years of the regime shift which were 1973 thru 1976 when sea lions were high the biomass of arrowtooth was estimated at only 145,744 MT. The next survey was in 1984 and the arrowtooth flounder biomass was estimated at 979,335 MT - an increase of more than 6 times more than in the early years of the regime shift. The arrowtooth Gulf of Alaska biomass estimate for the year 2000 is 1,262,797 MT. I also learned that there is little arrowtooth in Southeast Alaska where the sea lion population is considered to be increasing.

I'm a fisherman, not a biologist, but I would bet that there is some tie between arrowtooth abundance and sea lion declines and I wonder why all the concern about sea lions is focused on the fishermen and no attention paid to arrowtooth flounder. If localized depletion of pollock is the problem, I suspect arrowtooth flounder are creating more localized depletion day in and day out than occurs during the short quarterly pollock opening.

The Central Gulf year 2000 share of the pollock is 58,860 MT. The allowable biological catch for arrowtooth is 97,710 MT but the catch is usually around 12,000 MT.

This is just another point of view from a harvester that has been involved in the Gulf of Alaska fisheries for the past 34 years.

Thank you Douglas W. Hoedel

Doug Hoedel
F/V Tradition
F/V Peggy Jo

Sources

1. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. November 1999. Available from the North Pacific Fisheries Management Council.
2. Food Habitats of the Commericially Important Groundfishes in the Gulf of Alaska in 1990. By Mei-Sun. Alaska Fisheries Science Center.

A DISCUSSION PAPER ON POTENTIAL INTERACTIONS BETWEEN STELLER SEA LIONS AND THE BSAI AND GOA PACIFIC COD FISHERIES

National Marine Fisheries Service
Alaska Region

Protected Resources Division
Alaska Fisheries Science Center

June 6, 2000

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1.0 INTRODUCTION

1.1 Endangered Species Act Requirements

Section 7(a)(2) of the Endangered Species Act (ESA) requires

> "... every Federal agency ... to insure that any action it authorizes, funds, or carries out ... is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat."

The National Marine Fisheries Service's (NMFS) Office of Sustainable Fisheries (OSF) manages the groundfish fisheries of the Bering Sea/Aleutian Islands (BSAI) region and the Gulf of Alaska (GOA). Therefore, as an "action" agency, OSF is responsible for insuring that the fisheries do not jeopardize the continued existence of any listed species or destroy or adversely modify critical habitat[1].

The likelihoods of jeopardy and destruction/adverse modification are assessed by consultation between the action agency and an expert agency acting on behalf of the Secretary[2]. For issues pertaining to the western and eastern populations of Steller sea lions, the expert consulting agency is NMFS's Office of Protected Resources (OPR), acting on behalf of the Secretary of Commerce.

Section 7(b) of the ESA requires that the consultation be summarized as

> "... a written statement setting forth the Secretary's opinion detailing how the agency action affects listed species or critical habitat."

On December 23, 1999, OPR issued a biological opinion on

1) Authorization of the Bering Sea/Aleutian Islands (BSAI) groundfish fisheries based on Total Allowable Catch (TAC) specifications recommended by the North Pacific Fishery Management Council (Council) for 2000;

2) Authorization of the Gulf of Alaska (GOA) groundfish fisheries based on TAC specifications recommended by the Council for 2000; and

3) Authorization of both BSAI and GOA groundfish fisheries based on statutes, regulations, and management measures to implement the American Fisheries Act of 1998.

After reviewing the status of Steller sea lions and their critical habitat, the environmental baseline for the action area (including the extensive changes being implemented under the revised final reasonable and

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[1] For the remainder of this paper, all references to "critical habitat" pertain to habitat so designated for the western population of Steller sea lions.

[2] The "Secretary" is from either the Department of Commerce or the Department of the Interior, depending on the listed species or critical habitat involved.

prudent alternatives [RFRPAs]), and the cumulative effects reasonably likely to occur as a result of State, tribal, local, or private actions, NMFS determined that the actions as proposed for 1999 were not likely to (1) jeopardize the continued existence of the western population of Steller sea lions, or (2) destroy or adversely modify designated Steller sea lion critical habitat. However, the biological opinion also identified areas of concern with respect to the potential for competition between fisheries for Pacific cod (*Gadus macrocephalus*; Pacific cod) and the western population of Steller sea lions. Based on those concerns, the opinion included conservation recommendations to further investigate the potential for competition.

In addition to the December 23, 1999 Biological Opinion, OSF and OPR have initiated an FMP-level consultation to be completed prior to the 2001 groundfish fisheries. The resulting biological opinion will examine the entire suite of groundfish fisheries, including those for Pacific cod, authorized by the North Pacific Fishery Management Council (Council) to determine if those actions jeopardize the western population of Steller sea lions or destroy/adversely modify its critical habitat. The concerns identified with respect to the Pacific cod fisheries will be reexamined in light of any new pertinent information.

1.2 Purpose

The purpose of this discussion paper is to identify areas of concern that NMFS believes may increase significantly the likelihood of competition between the cod fisheries and the western population of Steller sea lions. The paper will first summarize background information on Pacific cod, Steller sea lions including their foraging patterns, and the Pacific cod fisheries. Next, the paper considers the available evidence for competition. Finally, three areas are identified where NMFS believes that precautionary measures are warranted to avoid the likelihood of competition and adverse changes to the foraging habitat of Steller sea lions.

2.0 BACKGROUND

2.1 Pacific Cod

Pacific cod is a demersal species that occurs on the continental shelf and upper slope from Santa Monica Bay, California through the GOA, Aleutian Islands, and EBS to Norton Sound (Bakkala 1984). The Bering Sea represents the center of greatest abundance, although Pacific cod are also abundant in the GOA and Aleutian Islands. Pacific cod stocks in the Gulf of Alaska, Bering Sea, and Aleutian Islands can not be distinguished genetically (Grant et al. 1987).

Tagging studies show that Pacific cod migrate seasonally over large areas (Shimada and Kimura 1994). The nature of those migratory movements remain largely undescribed. However, in the late winter, Pacific cod appear to converge (to an undetermined extent) in large spawning masses over relatively small areas. Shimada and Kimura (1994) suggest that major aggregations occur between Unalaska and Unimak Islands, southwest of the Pribilof Islands and near the Shumagin Islands in the western GOA.

At present, the summer distribution of Pacific cod biomass can be estimated for the EBS but not for the GOA due to inconsistent bottom types and limitations of the survey design (1995-99). The average summer biomass distribution for Pacific cod in the EBS (from 1995-99) was 6% in the area known as the

Steller sea lion conservation area (SCA), 48% east of the 170 W. longitude line, and 45% west of the 170 W. longitude line. While the results of Shimada and Kimura (1994) indicate a significant migration of Pacific cod into the SCA in the winter period, the extent of the migration cannot be quantified at the present without winter surveys for Pacific cod.

Pacific cod reach a maximum recorded age of 19. Estimates of natural annual mortality vary widely and range from 0.29 (Thompson and Shimada 1990) to 0.83-0.99 (Ketchen 1964). For stock assessment purposes, a value of 0.37 is used in both the BSAI (Thompson and Dorn 1999) and the GOA (Thompson et al. 1999). Pacific cod grow steadily in length, with an approximate maximum length probably around 1 m (Fig. 1). Approximately 50% of Pacific cod are mature by age six, at about 65-69 cm length and 4-5 kg in mass (Fig. 1; Thompson and Dorn 1999). Spawning takes place in the sublittoral-bathyal zone (40-290 m) near the bottom.

Pacific cod are omnivorous. Livingston (1991) characterized their diet in the BSAI and GOA as follows: "In terms of percent occurrence, the most important items were polychaetes, amphipods, and crangonid shrimp; in terms of numbers of individual organisms consumed, the most important items were euphausiids, miscellaneous fishes, and amphipods; and in terms of weight of organisms consumed, the most important items were pollock, fishery offal, and yellowfin sole. Small Pacific cod were found to feed mostly on invertebrates, while large Pacific cod are mainly piscivorous." Predators of Pacific cod include halibut, salmon shark, northern fur seals, Steller sea lions, harbor porpoises, various whale species, and tufted puffin (Westrheim 1996).

Annual trawl surveys in the EBS and triennial trawl surveys in the Aleutian Islands and Gulf are the primary fishery-independent sources of data for Pacific cod stock assessments (Thompson and Dorn 1999, Thompson *et al.* 1999). For the most recent assessments, fishery size compositions were available, by gear, for the years 1978 through the first part of 1999. Annual biomass estimates have varied from just over 0.5 mmt in the EBS to nearly 1.4 mmt, but are currently under 0.6 mmt (Fig. 2). In the GOA, biomass estimates have ranged from about 0.3 mmt to 0.6 mmt, and are currently at their lowest level since triennial surveys began (Fig. 2).

2.2 Steller Sea Lions

The Steller sea lion is distributed around the North Pacific rim from the Channel Islands off Southern California to northern Hokkaido, Japan. The species' distribution extends northward into the Bering Sea and the center of distribution has been considered to be in the GOA and the Aleutian Islands (NMFS 1992).

Counts of adult and juvenile sea lions in the western U.S. population (i.e., west of 144°W long.) fell from 109,880 animals in the late 1970s to 22,167 animals in 1996, a decline of 80% (Fig. 3; Hill and DeMaster 1998, based on NMFS 1995, Strick *et al.* 1997, Strick *et al. in press*). From the late 1970s to 1996, abundance estimates for the GOA dropped from 65,296 to 9,782 (85%), and for the BSAI region dropped from 44,584 to 12,385 (72%)(Fig. 3). The number of animals lost from the western population appears to have been far greater from the late 1970s to the early 1990s. Nevertheless, the rate of decline in the 1990s has remained relatively high: the 1996 count was 27% lower than the count in 1990. Counts conducted in 1998 suggest that the overall decline continues (Table 1; data from T. Loughlin, pers.

comm. and from Sease and Loughlin 1999, their Tables 4 and 5).

On 26 November 1990, the Steller sea lion was listed as threatened under the Endangered Species Act of 1973 (55 FR 49204). In 1997, the species was split into two separate stocks on the basis of demographic and genetic dissimilarities (Bickham *et al.* 1996, Loughlin 1997). The status of the eastern stock was left as threatened, but the status of the western stock was changed to endangered (62 FR 30772).

Much of the recent effort to understand the decline of Steller sea lions has been focused on juvenile survival, or has assumed that the most likely proximate explanation is a decrease in juvenile survival rates. This contention is supported by direct observations and a modeling study, and is consistent with the notion that juvenile animals are less adept at avoiding predators and obtaining sufficient resources (prey) for growth and survival.

In addition, however, evidence suggests that changes in reproduction of adult females have also contributed to the decline. The reproductive cycle includes mating, gestation, parturition, and nursing or post-natal care (Fig. 4). The reproductive success of an adult female is determined by a number of factors within a cycle and over time through multiple cycles. Those factors are largely related to the resources available to the female. The pupping and mating season is relatively short and synchronous, probably due to the strong seasonality of the sea lions' environment and the need to balance aggregation for reproductive purposes with dispersion to take advantage of distant food resources (Bartholomew 1970). In late May and early July, adult females arrive at the rookeries, where pregnant females give birth to a single pup. For females with a pup, the nursing period continues for months to several years. The pup's transition to nutritional independence may, therefore, occur over a period of months as it begins to develop essential foraging skills, and depends less and less on the adult female. The length of the nursing period may also vary as a function of the condition of the adult female. The nature and timing of weaning is important because it determines the resources available to the pup during the more demanding winter season and, conversely, the demands placed on the mother during the same period. The maintenance of the mother-offspring bond may also limit their distribution or the area used for foraging. Relatively little is known about the life history of sea lions during the juvenile years between weaning and maturity.

2.2.1 Steller Sea Lion Foraging Patterns

The foraging patterns of the Steller sea lion are central to any discussion of the potential for interaction between this species and fisheries. Foraging patterns are studied using a variety of methods, including observations, stomach and intestinal contents, scat (fecal) analysis, telemetry, captive studies, fatty acid analysis, and isotope analysis. At present, the primary method of identifying prey species consumed by Steller sea lions is through analysis of bony remains in scat collections. Scats provide a useful tool for monitoring trends in predator diets without killing animals to examine stomach contents. Using scat collections, specific prey can be identified on the basis of otoliths (ear bones) or other hard tissues that resist digestion. The relative importance of an individual prey species in the diet of Steller sea lions is based on the number of scats that contain that prey species and is referred to as "percent frequency of occurrence." Scat has been collected from Steller sea lion rookeries and haulout sites from the GOA and Aleutian Islands area since 1990, and twice yearly for seasonal comparisons since 1995 (Table 2).

While much remains to be learned about sea lion foraging, the available information is sufficient to begin a description of their foraging patterns. The emerging picture appears to be that:

- Steller sea lions are land-based predators but their attachment to land and foraging patterns/distribution may vary considerably as a function of age, sex, site, season, reproductive status, prey availability, and environmental conditions;
- Steller sea lions tend to be relatively shallow divers but are capable of (and apparently do) exploit deeper waters (e.g., to beyond the shelf break);
- Steller sea lions consume a variety of demersal, semi-demersal, and pelagic prey, with prey selection also varying by age, sex, site, season, reproductive status, prey availability; at present, pollock and Atka mackerel appear to be their most common prey; but (as explained below) Pacific cod is also an important prey item;
- diet diversity may influence status and growth of Steller sea lion populations;
- the life history and spatial/temporal distribution of important prey species are likely important determinants of sea lion foraging success;
- foraging sites relatively close to rookeries may be particularly important during the reproductive season when lactating females are limited by the nutritional requirements of their pups; and
- the broad distribution of sea lions sighted in the Platform-of-Opportunity Program indicates that sea lions also forage at sites distant from rookeries and haulouts (Fig. 5). The availability of prey at these other sites may be crucial in that they allow sea lions to take advantage of other food sources, thereby mitigating the potential for intraspecific competition for prey in the vicinity of rookeries and haulouts.

2.2.2 Pacific cod in the Steller Sea Lion diet

Pacific cod is among the top prey items for Steller sea lions during the winter period from December through March, occurring in 17%-40% of scats that contain identifiable prey items (Table 2, Fig. 6). These data are consistent with results from earlier studies (NMFS 1995; their Table 4, page 54). Highest occurrences (40%) of Pacific cod are from scats collected in the GOA. Pacific cod also occurs in the diet of Steller sea lions during summer months, but at lower frequencies (Table 2, Fig. 6). Percent frequency of occurrence values for 1995-1998 are provided in Figure 7.

Pacific cod is identified to species in scats based primarily on gill rakers. Size of the Pacific cod consumed is estimated by comparing gill rakers found in scats toknown age/length samples in museum collections. The best available evidence indicates that approximately 80% of the Pacific cod remains recovered from Steller sea lion scat during both the summer and winter months are from Pacific cod of 35 cm to 60 cm (Table 3, Fig. 7). The degree of erosion in the gill rakers due to digestion is accounted for in the estimation process. However, these large categories with such wide bands are not nearly as precise as required, and determination of size to any greater precision is impossible at this point in time. NMFS scientists are continuing research to provide more precise information of sizes of Pacific cod eaten by Steller sea lions.

2.3 Pacific Cod Fishery

Pacific cod is currently managed under tier 3 of the Council's ABC and OFL definitions. Catches in both the BSAI and the GOA have increased relatively steadily (moreso in the BSAI fishery) since the late 1970s (Table 4; Fig. 8). Currently, the Pacific cod fishery is the second largest Alaskan groundfish fishery. In 1999, the TACs for Pacific cod constituted 9% of combined groundfish TAC in the BSAI and 22% of the combined TAC in the GOA.

The fishery for Pacific cod is conducted with bottom trawl, longline, pot, and jig gear, generally at depths less than 150 m (Fig. 9). In the BSAI, 47% of the TAC is allocated to trawl fishing, 51% to longline and pot fishing combined, and 2% to jig fishing. In the GOA, Pacific cod is allocated between the processing components, 90% to inshore and 10% to offshore. Catch of Pacific cod occurs primarily in the winter months (January-April) in both the BSAI and GOA (Fig. 10)

The age at 50% recruitment to the fishery varies between regions. For trawl, longline, and pot gear, the age at 50% recruitment is 4 years in the EBS (Thompson and Dorn 1997) and 5 years in the GOA (Thompson *et al.* 1997). Size distributions of the catch range from 30-40 cm up to 90-100 cm (Fig. 11). In retrospect, overall harvest rates (catch [mt] divided by estimated biomass [age 3+]) have increased over time. The increase was not intended, but retrospective analyses indicate the harvest rates in earlier years of the fishery were lower than planned at the time quotas were set. The intended harvest rates have not changed over time, but earlier analyses underestimated stock biomass.

The Pacific cod fisheries often have been closed prior to reaching the TAC, due to bycatch of crab and halibut. In addition, Pacific cod is itself taken as bycatch in a number of trawl fisheries, including pollock, yellowfin sole, and rock sole in the EBS, Atka mackerel in the Aleutian Islands, and shallow-water flatfish, flathead sole, arrowtooth flounder, and other fisheries in the GOA. Prior to 1998, Pacific cod was also discarded in its own directed fisheries (specifically, the directed trawl fisheries in all three areas and the directed longline fisheries in the EBS and Aleutian Islands region). Since 1998, discarding has been prohibited except in the fisheries where Pacific cod can be taken as bycatch only.

2.2.1 BSAI Pacific cod fishery - spatial and temporal patterns

For purposes of analysis NMFS has split the calender year into three portions and will use the following defined seasons: (1) winter; January - April, (2) summer; May - August, and (3) fall; September - December.

In the BSAI, the amount of Pacific cod caught within critical habitat increased through the mid-1980s with a steep increase in the early 1990s, which has declined over the last two years (Figure 12). Concurrently, the relative amount taken within Steller sea lion critical habitat has also been increasing. In the 1980s, about 20-30% of the catch came from critical habitat, over the last 4 years the percentage has averaged about 55% of the total catch.

The BSAI Pacific cod fishery usually occurs from February to April, with a smaller fishery also occurring from September to October (Fig. 10). Generally, the fishery occurs to a greater extent in critical habitat in the winter than in the summer or fall, and appears to have been relatively consistent in the timing of the harvest from 1996 to 2000 (Fig. 13). Harvest amounts and rates for the summer in the BSAI indicate a concentration of effort in the SCA (Table 5), which is consistent with the overall concentration in critical habitat (Table 6).

Harvest of Pacific cod within critical habitat occurs primarily in the winter and has been taken mostly by the trawl sector (Figure 13). The overall amount of catch in critical habitat has been approximately 80,000-100,000 mt since 1996. Worth noting is the possible increase in critical habitat catch in the pot sector for the first part of 2000. This could be due to reported increased effort in that sector.

In the BSAI about 45% of the annual catch is taken inside critical habitat in the winter, which is largely attributed to the trawl fishery which occurs during the first few months of the year (Figure 14). Only about 5% of the annual catch is taken from critical habitat in the summer and fall seasons. If we look at the individual seasons, about 60% of the was taken from critical habitat in the winter, and about 10% of the summer and fall catches have come from critical habitat (Fig. 15).

2.2.2 GOA Pacific cod fishery - spatial and temporal patterns

In the GOA, catch within critical habitat has been between 30,000 and 60,000 mt over the past 10 years (Figure 16). The percentage of the total catch taken within critical habitat has ranged from about 80% in the early 1990s to just over 40% in 1999. Over the last two years there has been a decrease in the percentage (and actual amount) taken within critical habitat (1998-99).

The GOA Pacific cod fishery occurs primarily from February to March (Figs. 10 and 17). Since 1996, between 35% and 60% of the total catch has been taken from critical habitat during the winter (Fig. 18). Seasonally, the ratio of catch inside to outside of critical habitat appears to be consistent (e.g., no spike in the winter inside critical habitat)(Fig. 19).

Spatially, the trawl fishery is centered around the Shumagin Islands and south and east of Kodiak Island, while the longline fishery is located primarily in the vicinity of the Shumagins (Appendix 1, Fig. 6).

3.0 THE POTENTIAL FOR COMPETITION

In two previous cases, pollock and Atka mackerel, the question of competition was considered and determined to be likely given the available information. For Atka mackerel, it was demonstrated that it was a key prey item for Steller sea lions and that localized depletions inside critical habitat (Fritz, *in prep.*) removed prey on a spatial and temporal scale that would reduce the likelihood for the survival of the western population of Steller sea lions. For pollock, the evidence of localized depletion was based primarily on the concentration of the pollock harvest inside critical habitat. In the winter between 1992 and 1997, on average over 70% of the catch had been removed from critical habitat indicating to NMFS that there was a likelihood for localized depletions, which suggested that competition for prey was occurring.

The remaining focus of this paper will be to discuss the likelihood for competition between the fisheries and Steller sea lions (i.e., exploitative competition). In other words, do Pacific cod fisheries remove sufficient biomass (spatially and temporally) to appreciably reduce the foraging success of Steller sea lions or adversely modify their critical habitat?

Three questions must be addressed to evaluate the potential for competition:

(1) Are Steller sea lions food-limited?
(2) Do Steller sea lions and the Pacific cod fisheries utilize the same resource?
(3) Do fishery removals of Pacific cod affect the foraging success of Steller sea lions?

3.1 Are Steller sea lions food-limited?

This question was addressed by NMFS in its December 8, 1998 Biological Opinion on the pollock and Atka mackerel fisheries. In that document, NMFS examined the evidence that Steller sea lions are food-limited. The best available evidence indicates food limitation remains the primary hypothesis for the ongoing decline of the species.

3.2 Do Steller sea lions and the Pacific cod fisheries utilize the same resource?

3.2.1 Is Pacific cod an important prey item for Steller sea lions?

Pacific cod is a common prey item of Steller sea lions, as can be discerned from its occurrence in previous studies of the sea lion diet (NMFS 1999; their Table 5). Recent unpublished results from NMFS's National Marine Mammal Laboratory (NMML) indicate that Pacific cod is a significant or important prey item in the central and western GOA and the eastern Aleutian Islands, at least during winter months (Table 2, Fig. 6). The data are from scats collected in 1995 through 1998, and indicate that 20% (BSAI) to 40% (GOA) of the scats collected in these regions during the period from December to March contained hard parts from Pacific cod. Similar results are reported for stomach contents from the central and western Bering Sea in March of 1981 (NMFS 1995; their Table 4).

3.2.2 Do the fisheries and sea lions remove Pacific cod in overlapping depth ranges?

The depths of the Pacific cod fisheries in the BSAI and GOA are generally less than 150 m (Fig. 9), and are clearly within the diving capability of Steller sea lions. Therefore, on the basis of depth, the fishery and the sea lions may be using the same resource.

3.2.3 Do the size distributions of Pacific cod taken by fisheries and Steller sea lions overlap?

Table 3 and Fig. 7 indicate that the majority of Pacific cod taken by Steller sea lions are in the range of 35 cm to 60 cm in length. This size range is consistent with the lower size distribution of Pacific cod taken by the fisheries (Fig. 11). The overlap stretches from 35 cm (too small to be recruited in the fishery) to 60 cm (just below the peak in the size distribution taken by the fishery). This suggests some level of overlap which is presently difficult to quantify based on the current information. If all of the fish in this 35 cm to 60 cm category were close to the 60 cm size, then fishery removals would overlap considerably with Steller sea lion prey requirements. Conversely, if most of the Pacific cod consumed by Steller sea lions were 35 cm, then overlap with the fisheries would be seemingly very small. Based on the available information, we are unable to distinguish between these scenarios, and can only conclude that competition may occur.

3.2.4 Do fisheries remove Pacific cod from geographic areas also used by foraging sea lions?

The Pacific cod catch from Steller sea lion critical habitat in the BSAI region has increased from less than 30,000 mt in the mid 1980s to over 120,000 mt in 1997. The percent of the BSAI Pacific cod catch from critical habitat has increased from 11% - 38% through 1987 to about 55% in 1999 (Fig. 12). In the GOA, the amount of Pacific cod catch from Steller sea lion critical habitat increased from less than 12,000 mt prior to 1988 to about 40,000 mt for 1995 to 1998 (Fig. 16). The percent of the GOA Pacific cod catch from critical habitat has increased from less than 20% in the late 1970s to almost 80% in 1992, and then has varied between about 40% to 67% from 1994 to 1999 (Fig. 16).

The distributions of the Pacific cod catch in the BSAI and GOA are illustrated by gear type in Appendix 1. These figures indicate greater concentration in the BSAI of the trawl and pot fisheries in critical habitat compared to the longline fisheries, where the longline effort extends up the shelf break to the U.S.- Russian Convention Line. In the Aleutian Islands region, both the trawl and longline cod fisheries are concentrated within Steller sea lion critical habitat. The actual catches and percent catches by area for the GOA and BSAI regions for 1997-99 are listed in Table 6. These data are sufficient to demonstrate a considerable spatial overlap of the Pacific cod fisheries in the BSAI and GOA regions with Steller sea lion critical habitat. The overlap is most apparent with trawl and pot fisheries in the BSAI and all sectors in the GOA.

3.2.5 Are the fisheries concentrated temporally, particularly in the winter?

The December 8, 1998 Biological Opinion on the pollock and Atka mackerel fisheries emphasized the sensitivity of Steller sea lions to competition for prey during the winter. This emphasis was based on the importance of successful foraging for adult females that may be nursing a pup and supporting a developing fetus, for pups and juveniles that are learning to foraging during a period of greater environmental challenges. Steller sea lions are likely sensitive to competition for prey throughout the year, but the life cycle of the species, combined with harsher environmental conditions, likely makes them especially sensitive during the winter.

The temporal distribution of the Pacific cod fishery in the BSAI varies considerably by gear type. The longline fishery is relatively well dispersed throughout all but the summer months, when the fishery does not operate to avoid halibut bycatch (Fig. 13). The BSAI trawl fishery, and to a lesser extent, the BSAI pot fishery are more concentrated in the late winter/spring period to take advantage of aggregations of Pacific cod over the southeastern Bering Sea shelf. In the GOA, all three gear types tend to be concentrated in late winter and early spring, with considerably less trawling in the period from July to November (Fig. 17). Thus, in the BSAI region, the trawl and pot fisheries appear to be concentrated during the winter, whereas in the GOA, all gear types tend to be concentrated in winter.

3.3 Do fishery removals of Pacific cod affect the foraging success of Steller sea lions?

For competition to occur, the removal of Pacific cod by the fishery must reduce their availability to Steller sea lions. In the pollock and Atka mackerel cases, this concept was addressed by evaluating available information for evidence of localized depletion of the resource. The term "depletion" is intended to indicate a reduction in prey relative to the needs of Steller sea lions. As actual sea lion-prey dynamics can not be described with sufficient detail to identify such depletion, surrogate indices were used to judge whether such depletions occur. For the Atka mackerel fisheries, localized depletions were clearly demonstrated based on Leslie depletion analyses (Fritz, *in prep*). For the pollock fisheries, the potential for localized depletions was based on evidence of excessive harvest rates in Steller sea lion critical habitat.

For the BSAI, harvest of Pacific cod in critical habitat has been greatest during the winter, about 60% of the seasonal catch from 1996-2000. For the GOA, seasonal harvest inside critical habitat has been high in almost all seasons, with a range between 10% and 75% from 1996-2000. This information suggests to NMFS that there may be localized depletions of Pacific cod inside critical habitat in the winter which might affect the foraging success of Steller sea lions.

Although a direct link between fishery harvests of Pacific cod (localized depletions) and Steller sea lion foraging success cannot be described at this time, the above information along with the continued decline of the western population of Steller sea lions cannot be ignored.

The likelihood of fisheries-induced localized depletion are being evaluated further to determine whether removals by the fishery may reduce the foraging success of sea lions. Analyses of the potential for localized depletion may vary by gear type, and may not be possible for each gear type. Evidence of declining catch per unit effort may indicate localized depletion is occurring. For the BSAI, analysis of CPUE for the trawl fishery should be available before the September Council meeting. A similar analysis for the GOA will not be available due to limited survey information.

4.0 CONCLUSION

This information indicates to NMFS that:

- Pacific cod are a common prey of Steller sea lions, particularly in the winter,
- Relatively large portions of the fisheries occur in Steller sea lion critical habitat,
- The fisheries occur at relatively shallow depths well within the range of Steller sea lions, and
- Portions of the fisheries (trawl and pot fisheries in the BSAI, and trawl, pot, and longline fisheries in the GOA) are temporally concentrated in the winter period when sea lions may be particularly sensitive to reductions in availability of prey.

Given the current information available, NMFS believes there is a likelihood for competition between the Pacific cod fisheries and the endangered western population of Steller sea lions. NMFS is therefore requesting that the Council consider precautionary adjustments to the Pacific cod fisheries in the BSAI and GOA. The public has indicated to NMFS that they desire to be an integral part of any discussions involving modifications to the Pacific cod fisheries. Public working meetings will be scheduled for July to discuss the development of alternatives to the status-quo. NMFS will return to the Council in September for review of an initial environmental assessment (EA). Final review will be scheduled for October.

The following areas are of specific concern:

BSAI

- The Pacific cod fisheries harvest about 70% of the annual TAC during the winter (Fig. 10),
- The winter catch is harvested primarily inside critical habitat (Fig. 15),
- Foraging areas around rookeries and haulouts may be exceptionally vulnerable to localized depletion

GOA

- The Pacific cod fisheries harvest about 70% of the annual TAC during the winter (Fig. 10),
- A significant portion of the winter catch is harvested inside critical habitat (Fig. 19),
- Foraging areas around rookeries and haulouts may be exceptionally vulnerable to localized depletion

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6.0 TABLES AND FIGURES

Table 1. Counts of adult and juvenile (non-pup) Steller sea lions at rookery and haulout trend sites by region (NMFS unpubl., Sease and Loughlin 1999). For the GOA, the eastern sector includes rookeries from Seal Rocks in Prince William Sound to Outer Island; the central sector extends from Sugarloaf and Marmot Islands to Chowiet Island; and the western sector extends from Atkins Island to Clubbing Rocks. For the Aleutian Islands, the eastern sector includes rookeries from Sea Lion Rock (near Amak Island) to Adugak Island; the central sector extends from Yunaska Island to Kiska Island; and the western sector extends from Buldir Island to Attu Island.

	Gulf of Alaska			Aleutian Islands			
Year	**Eastern**	**Central**	**Western**	**Eastern**	**Central**	**Western**	**Southeast Alaska**
1975				19,769			
1976	7,053	24,678	8,311	19,743			
1977				19,195			
1979					36,632	14,011	6,376
1982							6,898
1985		19,002	6,275	7,505	23,042		
1989	7,241	8,552	3,800	3,032	7,572		8,471
1990	5,444	7,050	3,915	3,801	7,988	2,327	7,629
1991	4,596	6,273	3,734	4,231	7,499	3,085	7,715
1992	3,738	5,721	3,720	4,839	6,399	2,869	7,558
1994	3,369	4,520	3,982	4,421	5,790	2,037	8,826
1996	2,133	3,915	3,741	4,716	5,528	2,190	8,231
1997		3,352	3,633				
1998		3,346	3,361	3,847	5,761	1,913	8,693

Table 2. Percent frequency of occurrence of prey items in Steller sea lion scats collected in 1995 through 1998 (NMFS unpubl. data).

Winter	**CGOA**	**WGOA**	**EAI**	**CAI**
sample size	n = 201	n = 437	n = 604	n = 122
Pacific cod	**40**	**40**	**20**	**17**
Pollock	**62**	**86**	**61**	**2**
Salmon	6	10	18	11
Atka mackerel	**1**	**4**	**23**	**69**
Arrowtooth flounder	20	10	4	3
Cephalopod	7	3	4	13
Cottidae (sculpins)	21	13	17	15
Flatfish	5	7	9	2
Herring	32	4	0	0
Rock greenling	0	0	1	26
Rock sole	11	7	2	2
Rockfish	4	4	5	2
Sandfish	6	1	14	1
Sandlance	22	9	2	0
Smooth lumpsucker	0	1	6	3
Snailfish	15	5	10	14
unidentified gadid	14	10	7	2
Summer	**CGOA**	**WGOA**	**EAI**	**CAI**
sample size	n = 130	n = 97	n = 258	n = 398
Pacific cod	**5**	**6**	**9**	**6**
Pollock	**60**	**87**	**53**	**12**
Salmon	52	69	40	24
Atka mackerel	**0**	**0**	**19**	**92**
Arrowtooth flounder	42	20	4	1
Capelin	5	1	3	0
Cephalopod	2	1	6	30
Cottidae (sculpins)	0	5	10	5
Herring	9	1	36	0
Poacher sp.	0	0	9	0
Rockfish	1	5	2	2
Rock sole	1	1	14	0
Sandfish	2	1	7	0
Sandlance	12	24	12	1
Skate	1	0	6	2
Smelt	11	1	0	0
unidentified flatfish	1	1	5	1
unidentified gadid	5	3	2	1

Table 3. Occurrence of Pacific cod in Steller sea lion scats collected in 1995 through 1998 (NMFS unpubl. data).

	Central GOA	**Western GOA**	**Aleutian**	**Combined**
Summer				
Sample size	130	97	660	887
% Frequency of occurrence	**5**	**6**	**6**	**6**
% 35-60 cm	67	100	83	83
% 28-34 cm	0	0	10	8
% <28 cm	34	0	6	8
Winter				
Sample size	201	437	726	1364
% Frequency of occurrence	**40**	**40**	**20**	**30**
% 35-60 cm	65	74	85	76
% 28-34 cm	28	16	9	16
% <28 cm	13	10	7	8

Table 4. Catches (mt) of Pacific cod in the BSAI and GOA groundfish fisheries, 1978 to 2000. Data are from Thompson and Dorn (1999), Thompson et al. (1999), and NMFS website (1999, and 2000 catch statistics as of May 19).

Year	BSAI catch	GOA catch
1978	42,543	12,190
1979	33,761	14,904
1980	45,947	35,345
1981	63,941	36,131
1982	69,501	29,465
1983	103,231	36,540
1984	133,084	23,898
1985	150,384	14,428
1986	142,511	25,012
1987	163,110	32,939
1988	208,236	33,802
1989	182,865	43,293
1990	179,608	72,517
1991	218,053	76,977
1992	205,311	80,100
1993	167,360	56,487
1994	196,664	47,384
1995	245,135	69,060
1996	240,673	68,280
1997	257,762	77,160
1998	195,648	72,320
1999	162,211	68,606
2000	120,819	49,128

Table 5a. Estimated Bering Sea summer biomass distribution based on bottom trawl survey results for 1995-99.

Adults	Year	SCA	E 170W	W 170W
Age 3+	1995	10%	51%	39%
	1996	5%	56%	39%
	1997	5%	43%	52%
	1998	4%	52%	44%
	1999	8%	41%	51%
	Average	6%	48%	45%

Juveniles	Year	SCA	E 170W	W 170W
	1995	1%	67%	32%
	1996	2%	84%	14%
	1997	2%	66%	31%
	1998	2%	72%	26%
	1999	5%	68%	28%
	Average	2%	72%	26%

Table 5b. Estimated Bering Sea summer harvest rates based on summer biomass distribution and summer catch (May-August) based on bottom trawl survey and stock assessment modeling results for 1996-99.

SCA

	Biomass	Catch	Harvest rate
1996	69,409	8,262	11.9%
1997	67,048	8,548	12.7%
1998	43,560	5,387	12.4%
1999	84,700	5,287	6.2%

E170

	Biomass	Catch	Harvest rate
1996	783,946	2,220	0.3%
1997	548,684	1,984	0.4%
1998	582,274	4,768	0.8%
1999	452,609	5,518	1.2%

W170

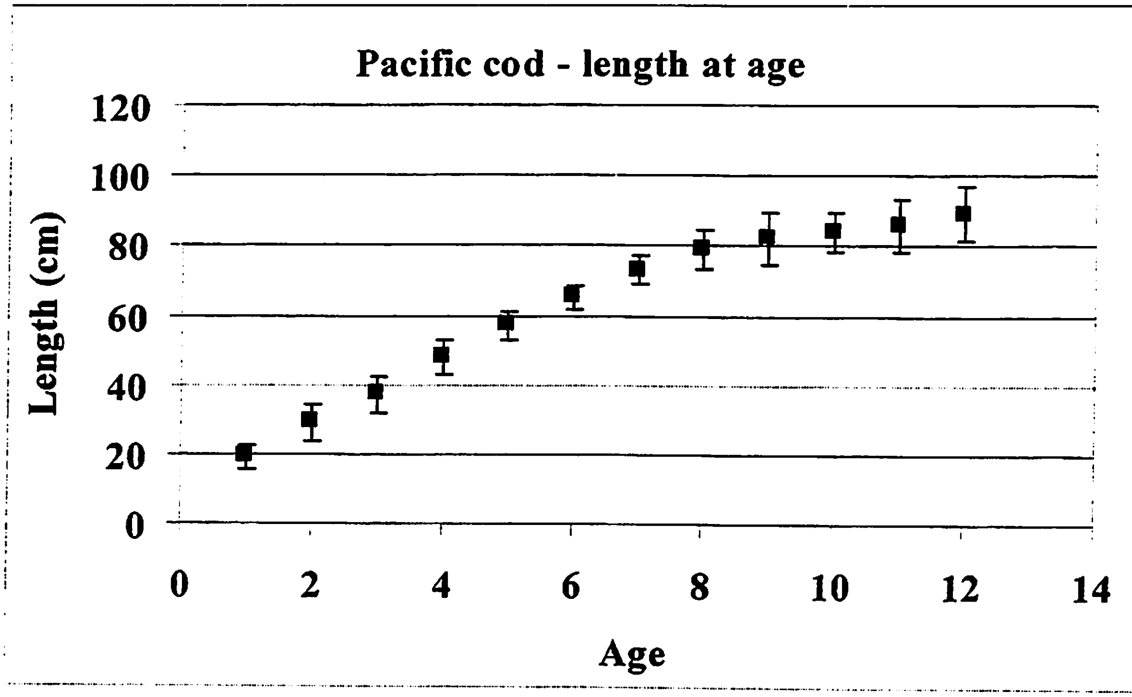
	Biomass	Catch	Harvest rate
1996	546,906	4,905	0.9%
1997	670,269	6,797	1.0%
1998	492,877	1,404	0.3%
1999	569,563	2,398	0.4%

Table 6. Spatial distribution of P. cod catch by quarter in the BSAI (top) and the GOA (bottom).

Year	Quarter	Within RFRPA sites	Rookeries and major haulouts (20 nm)	Foraging area	Total critical habitat	Outside critical habitat	Total BSAI	Percent within RFRPA sites	Percent within critical habitat	Percent by quarter
1997	1	21,369	24,852	45,993	70,845	53,451	124,296	17%	57%	48%
	2	23,561	17,502	25,240	42,742	26,574	69,316	34%	62%	27%
	3	1,172	1,465	1,486	2,951	13,718	16,669	7%	18%	6%
	4	3,598	4,700	5,319	10,019	37,201	47,220	8%	21%	18%
	total	49,700	48,518	78,039	126,557	130,943	257,500	19%	49%	
1998	1	14,935	26,475	26,856	53,331	44,729	98,060	15%	54%	50%
	2	11,963	13,632	12,447	26,080	15,689	41,768	29%	62%	21%
	3	863	1,895	1,932	3,827	10,477	14,304	6%	27%	7%
	4	1,729	8,087	6,417	14,504	26,491	40,995	4%	35%	21%
	total	29,490	50,090	47,652	97,742	97,385	195,127	15%	50%	
1999	1	14,521	30,736	28,574	59,310	36,185	95,494	15%	62%	59%
	2	8,141	13,539	7,893	19,293	14,798	34,092	24%	57%	21%
	3	646	3,470	1,302	4,223	14,747	18,970	3%	22%	12%
	4	779	3,112	879	3,499	10,155	13,655	6%	26%	8%
	total	24,086	56,624	38,648	86,326	75,885	162,211	15%	53%	
2000	Jan-Apr	24,054	30,736	32,012	80,784	40,035	120,819	67%		

Table 6. cont.

Year	Quarter	Within RFRPA sites	Rookeries and major haulouts (20 nm)	Foraging area	Total critical habitat	Outside critical habitat	Total GOA	Percent within RFRPA sites	Percent within critical habitat	Percent by quarter
1997	1	11,561	41,212	54	41,266	17,174	58,440	20%	71%	85%
	2	309	708	310	1,018	804	1,822	17%	56%	3%
	3	478	780	136	916	972	1,888	25%	49%	3%
	4	625	2,313	205	2,517	3,780	6,298	10%	40%	9%
	total	12,973	45,013	704	45,717	22,731	68,447	19%	67%	
1998	1	5,837	32,467	1,832	34,299	18,077	52,376	11%	65%	84%
	2	397	1,290	26	1,315	1,341	2,657	15%	50%	4%
	3	187	449	194	643	3,153	3,795	5%	17%	6%
	4	225	1,105	84	1,188	2,089	3,277	7%	36%	5%
	total	6,647	35,310	2,136	37,445	24,660	62,105	11%	60%	
1999	1	2,294	16,745	1,137	17,882	21,523	39,405	6%	45%	57%
	2	7,450	7,388	880	8,268	5,822	14,090	53%	59%	21%
	3	727	1,316	25	1,341	6,359	7,700	9%	17%	11%
	4	816	1,075	443	1,518	5,893	7,411	11%	20%	11%
		11,287	26,525	2,485	29,009	39,597	68,606	16%	42%	
2000	Jan-Apr	10,406	24,166	1,576	25,742	23,386	21%	52%		



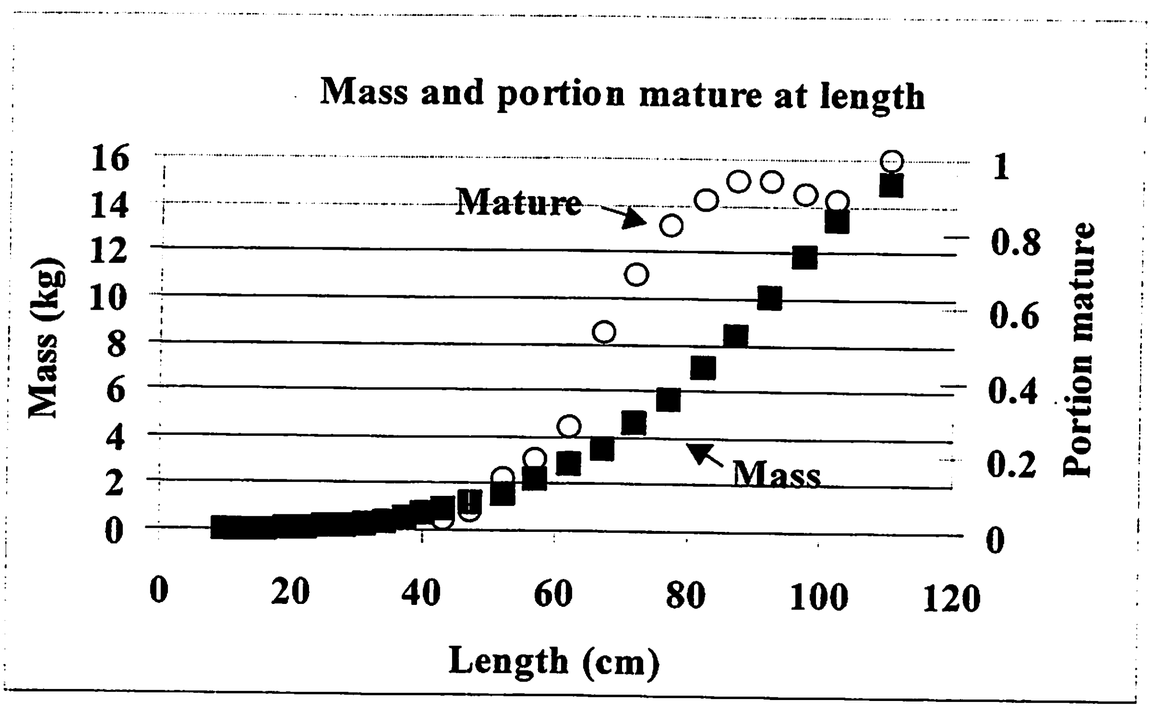


Figure 1. (Top) Growth of Pacific cod in mean length as a function of age. (Bottom) Mean mass of cod as a function of age, and portion mature as a function of age. Based on data from Thompson and Dorn (1999).

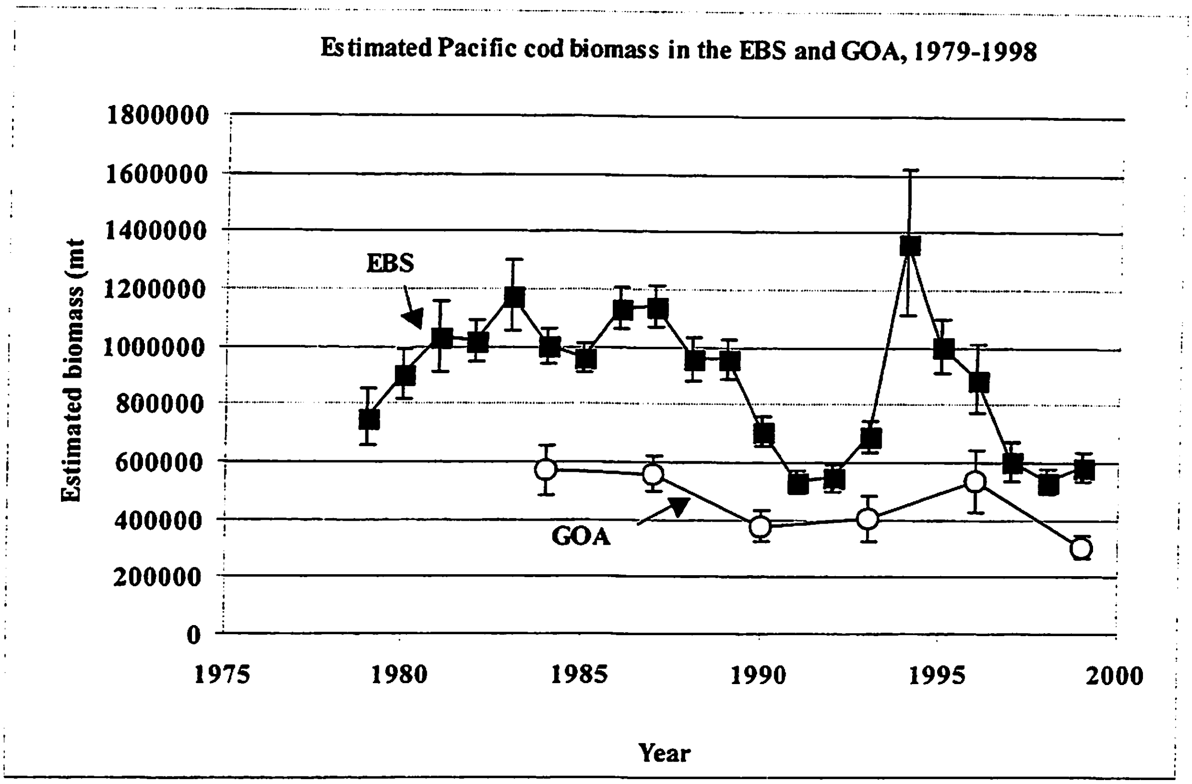


Figure 2. Estimated biomass of Pacific cod (±1 SE) in the EBS and GOA, 1979-1999.

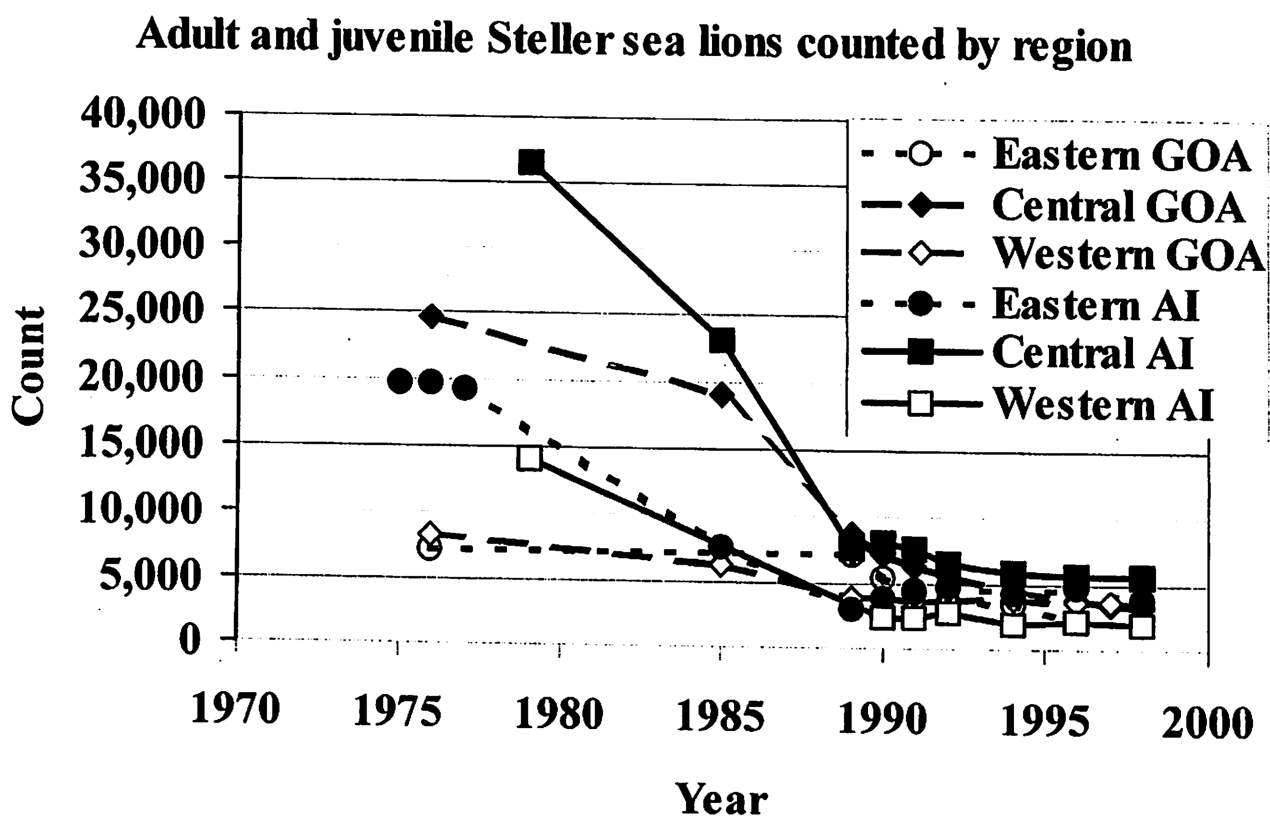


Figure 3. Counts of adult and juvenile Steller sea lions in the western population (by region) from the late 1970s to 1998.

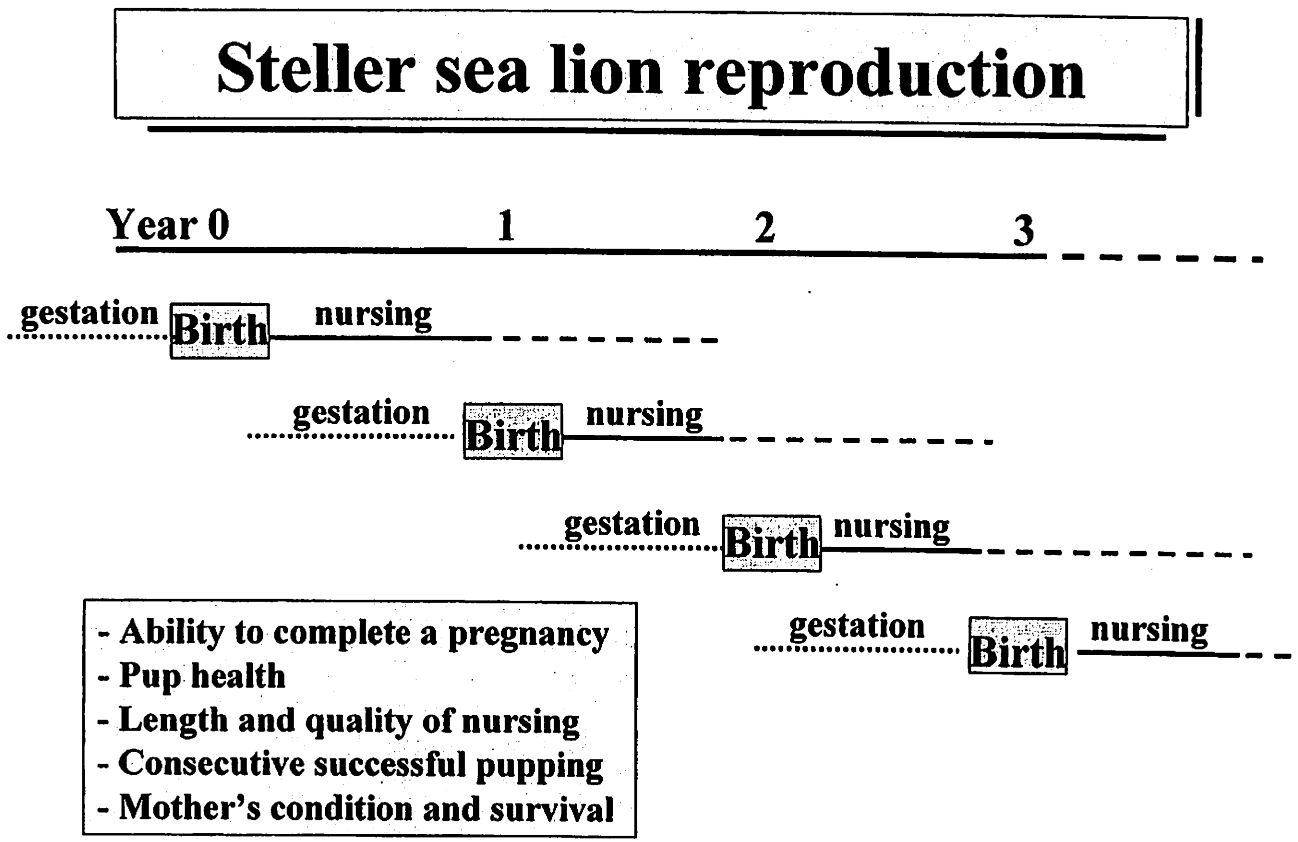
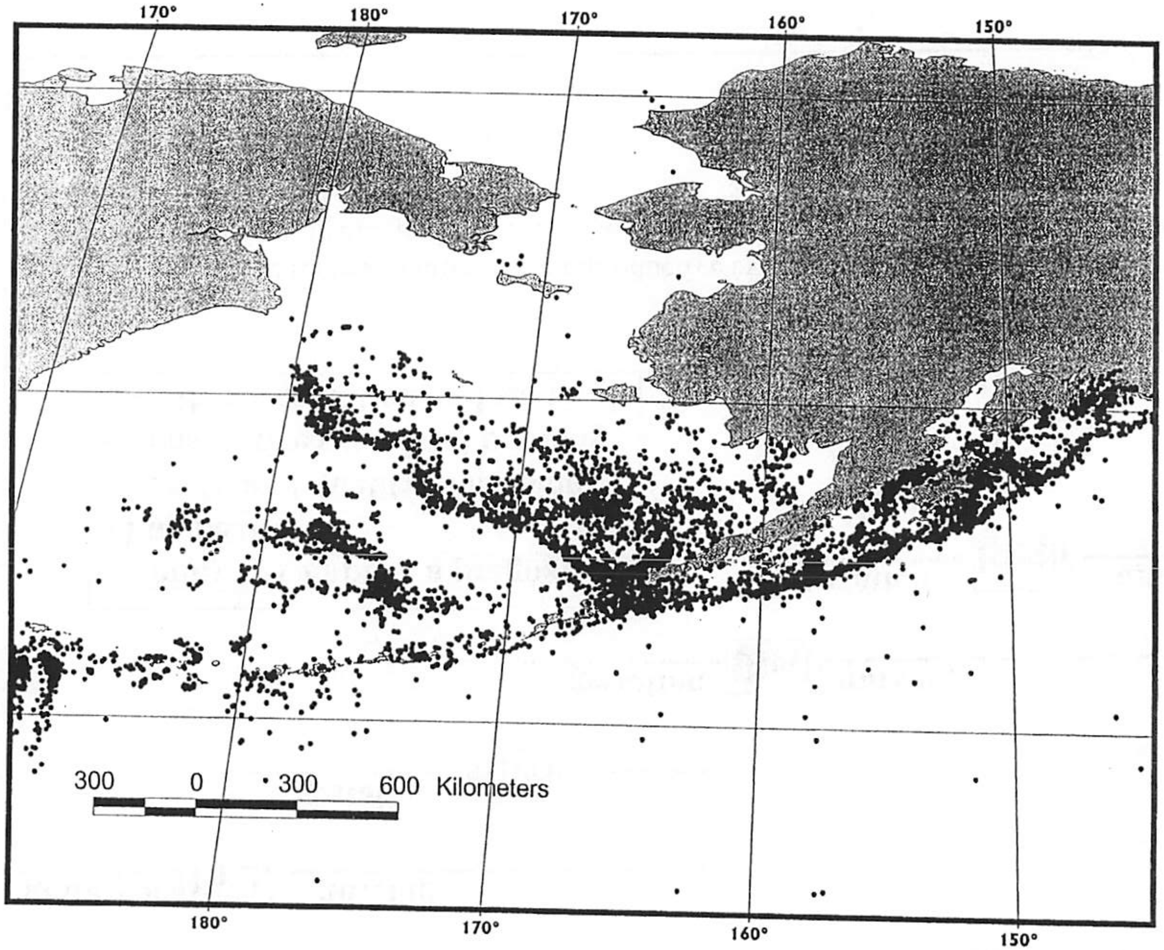


Figure 4. Schematic representation of the reproductive cycle of an adult female Steller sea lion over a period of year, indicating element s of the cycle that contribute to overall reproductive success and may be affected by nutritional stress.

Steller Sea Lion Sightings
Platforms of Opportunity Program Data 1958-1995



Source: POP data, 1958-1995; Mizroch, 4 Oct 99

Figure 3. Sighting locations for Steller sea lions in the BSAI and GOA based on data from the Platforms-of-Opportunity Program, 1958-1995.

Prey items in Steller Sea Lion Scat

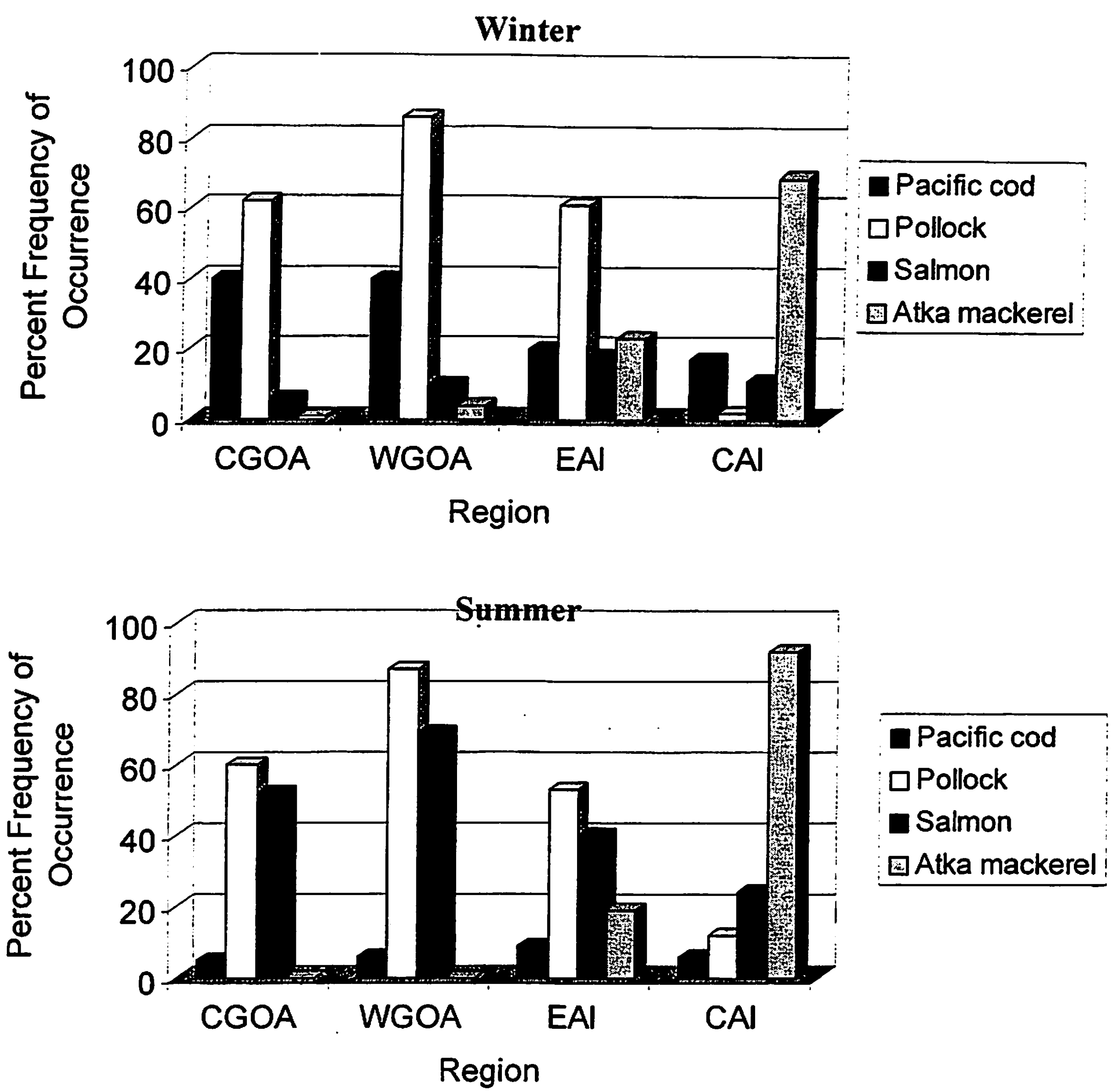


Figure 6. Percent frequency of occurrence of the top four prey items found in Steller sea lion scats from the GOA and the Aleutian Islands, 1990-98. (note: summary values differ from those given in Table 2 for 1995 - 1998.

Size Distribution of Pacific Cod in Steller Sea Lion Scat

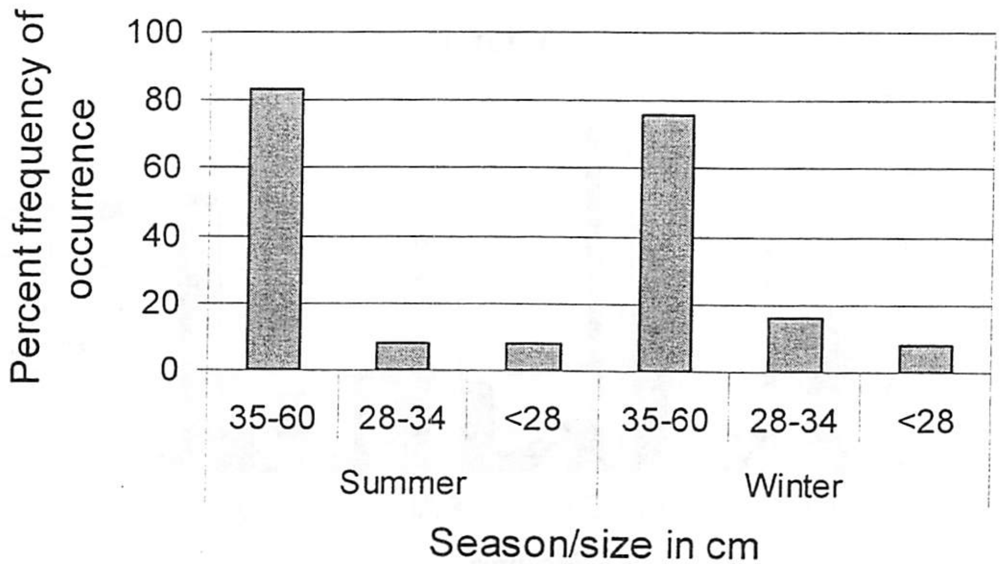
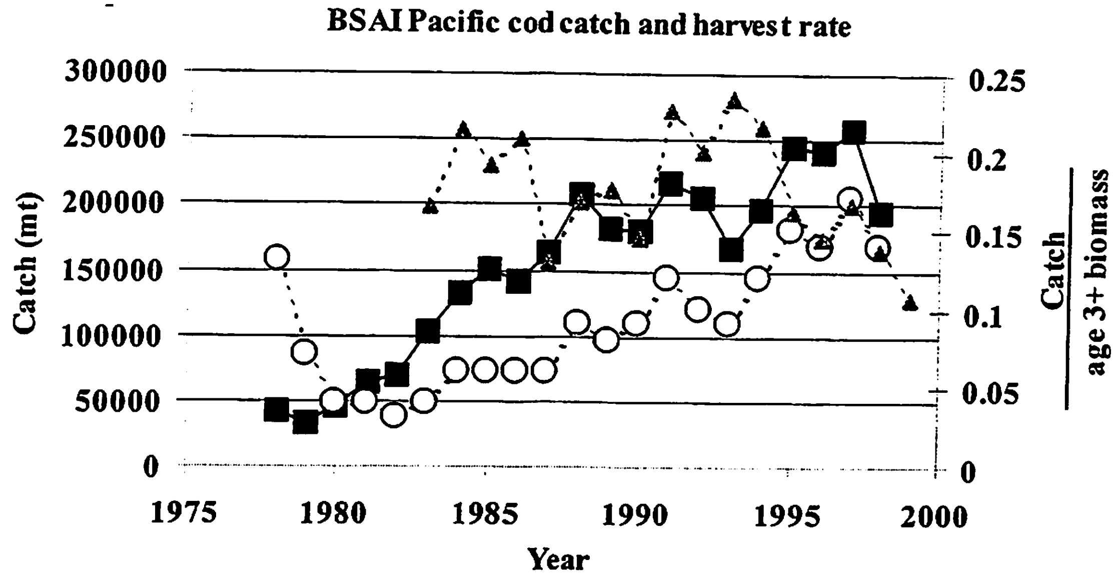


Figure 7. Percent frequency of occurrence of Pacific cod by body length category as identified in Steller sea lion scats collected from the GOA and Aleutian Islands from 1995-1998. (see Table 3 for data)



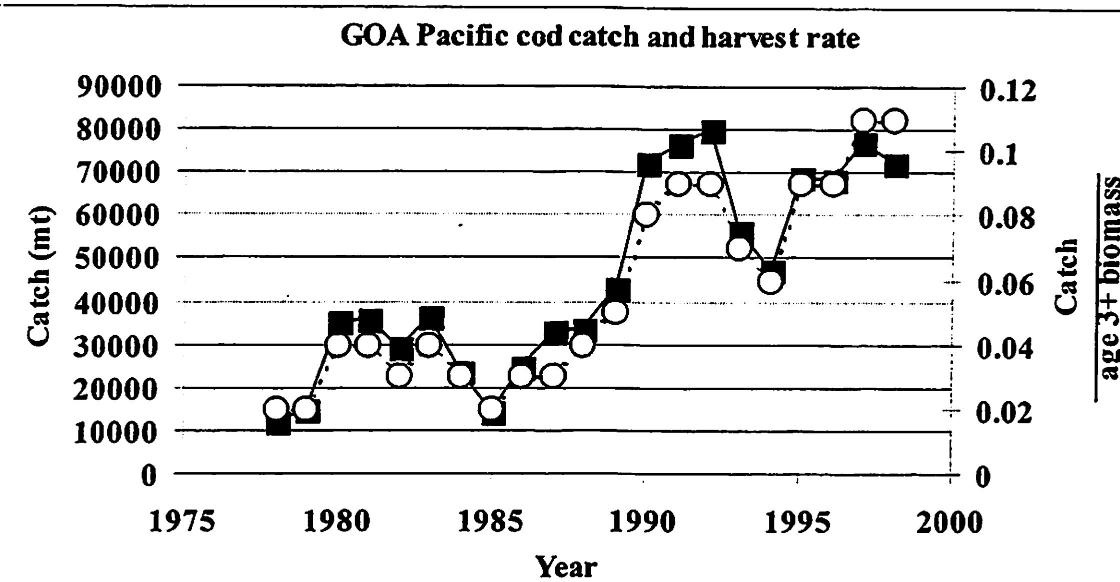


Figure 8. Pacific cod catch (filled squares) and harvest rates (hollow circles) in the BSAI (top) and GOA (bottom) from 1978 to 1998. In the top panel, the gray-shaded triangles (and dashed line) indicate the expected harvest rates at the time each annual TAC was set. The difference between the expected and observed harvest rates results from back correction of the estimated age 3+ biomass, based on more recent data and modeling.

Depth of Fishery Catch of Pacific Cod

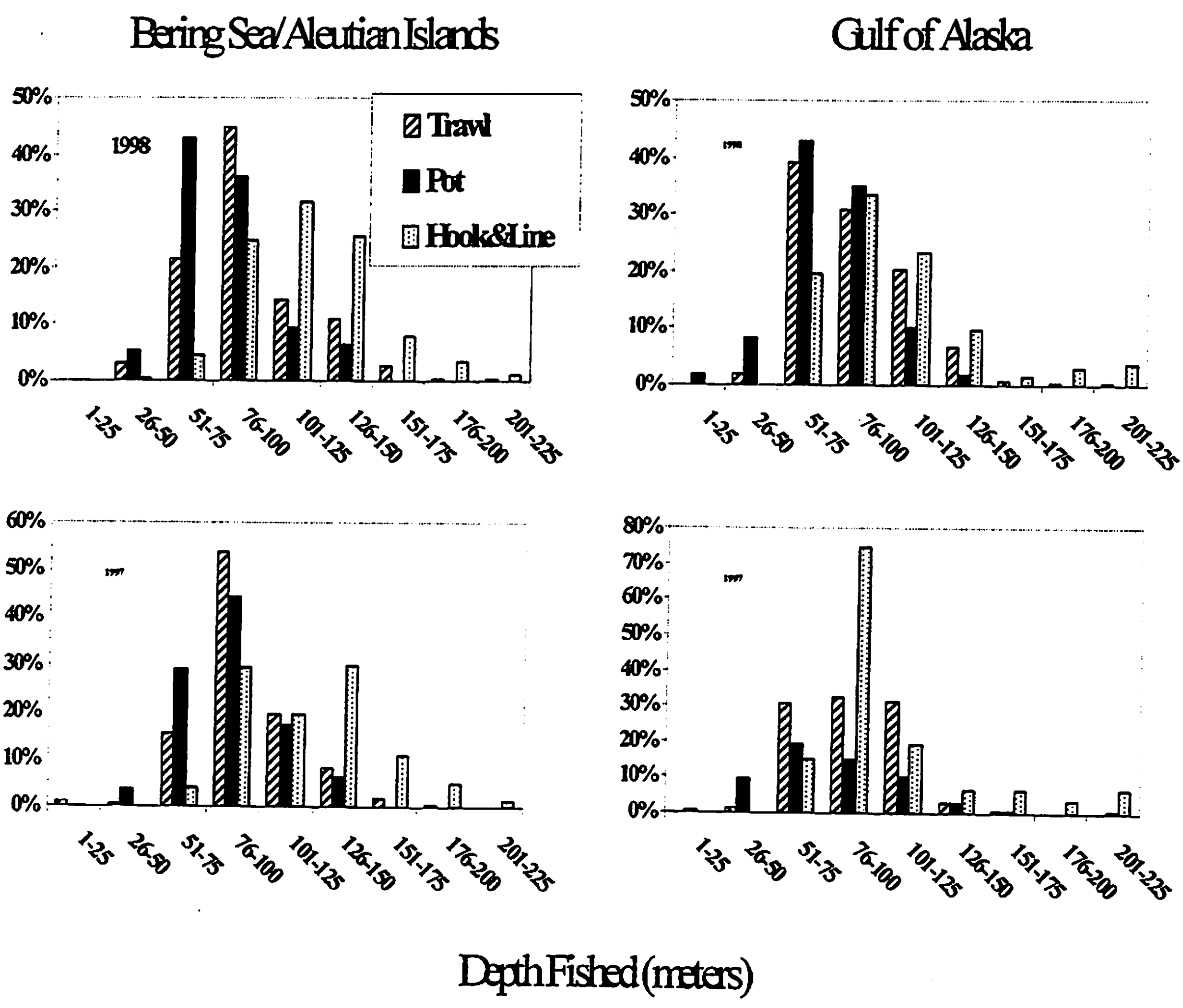


Figure 9. Depths of cod fishing by gear type in the BSAI and GOA.

Catch of Pacific Cod (mt) in the BSAI and GOA from 1996-2000.

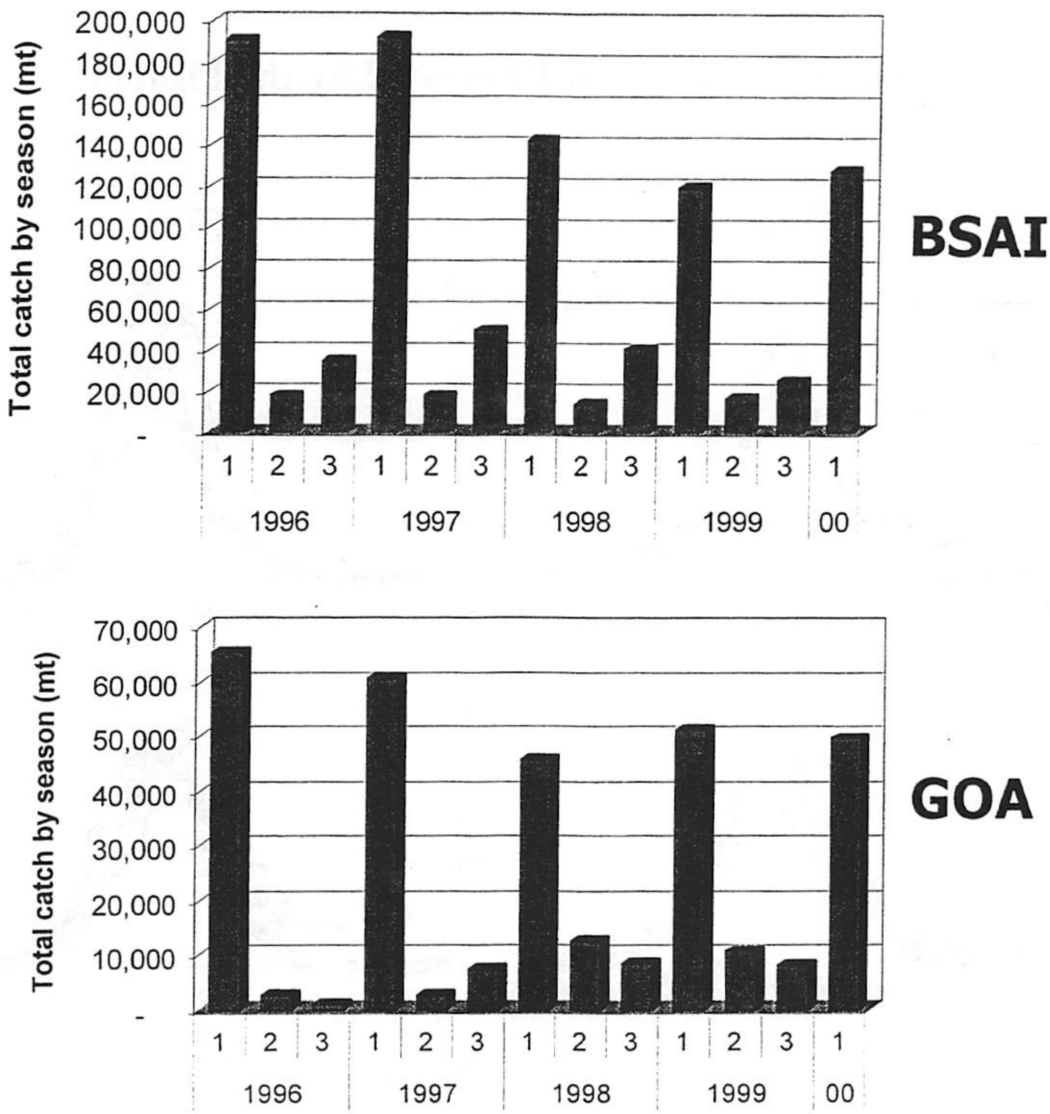


Figure 10. Total catch (mt) of Pacific cod by season in both the BSAI (top) and GOA (bottom) 1996-2000.

Size of Pacific Cod Harvested by the Fishery

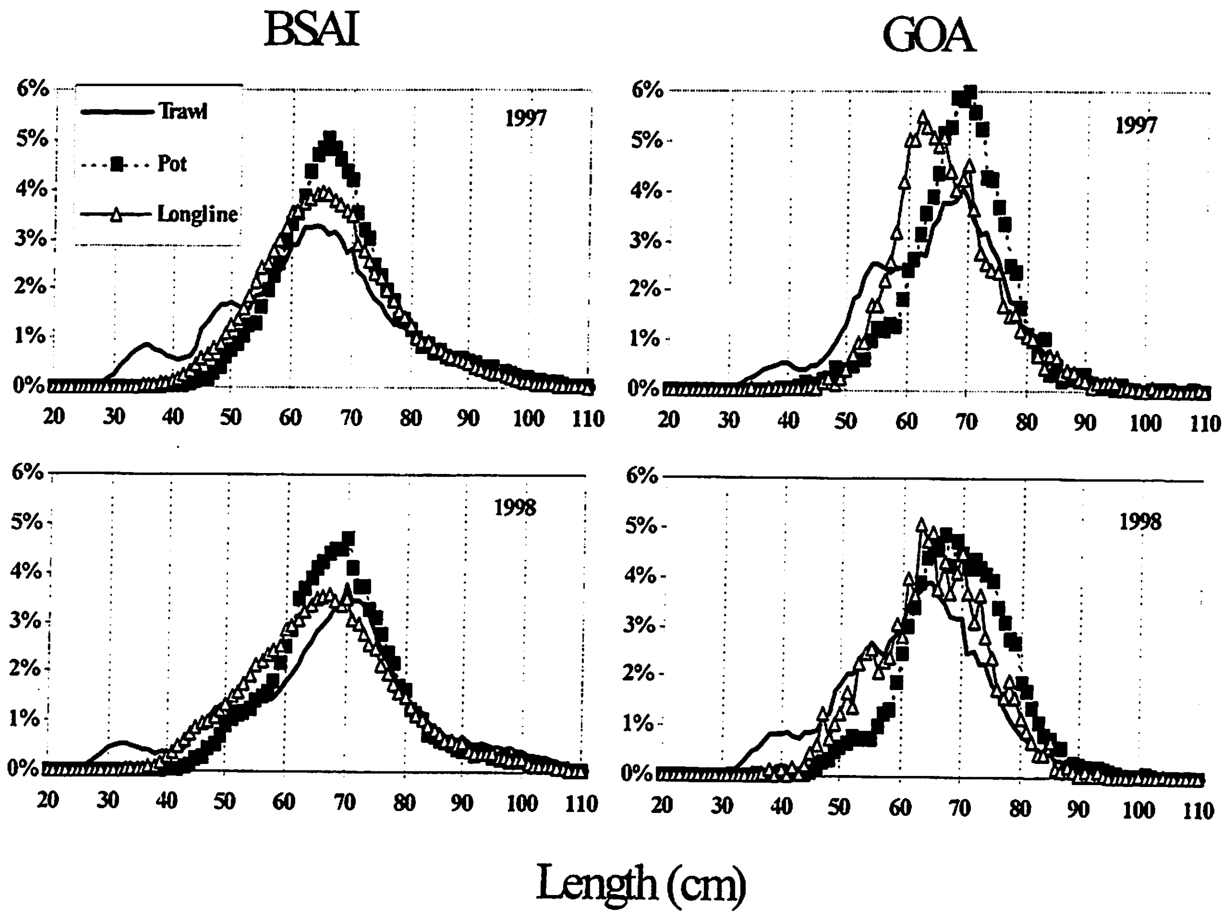
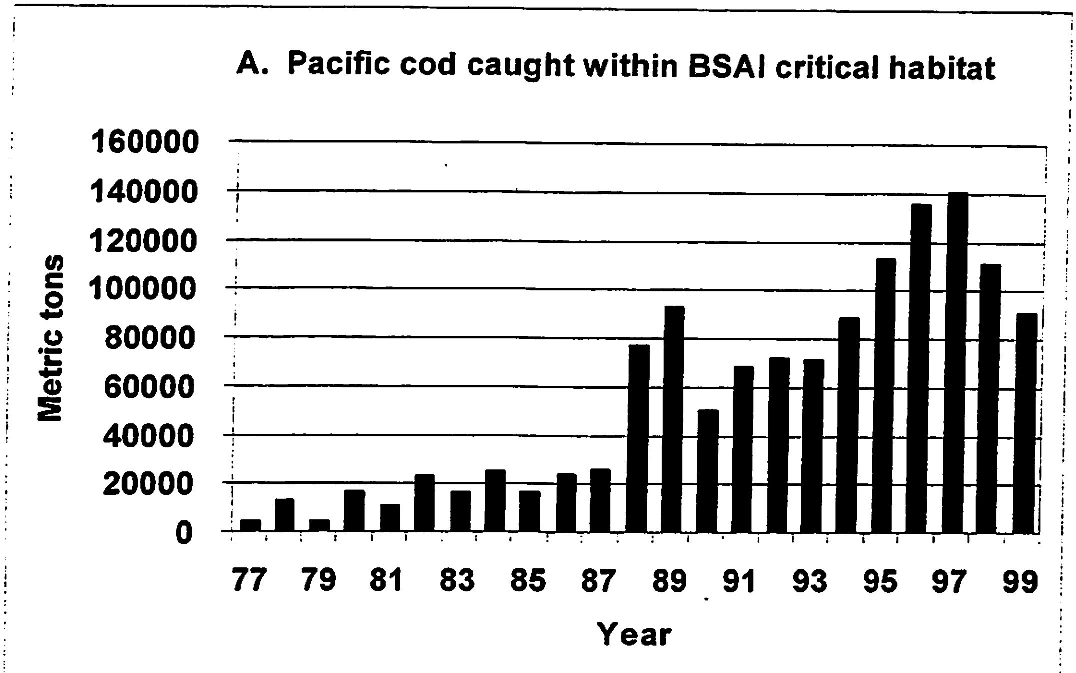


Figure 11. Size distributions of cod taken in the BSAI and GOA in 1997 (top) and 1998 (bottom) by gear type.



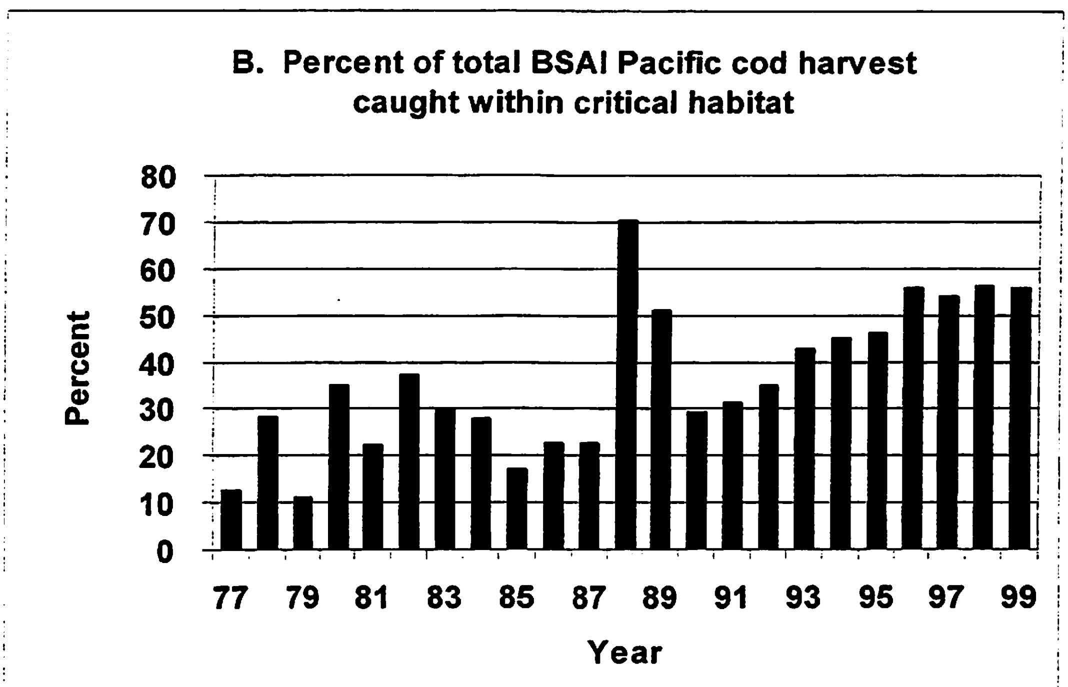


Figure 12. Metric tons of Pacific cod caught within BSAI Steller sea lion critical habitat 1977-99 (top), and percent of annual catch taken within critical habitat (bottom).

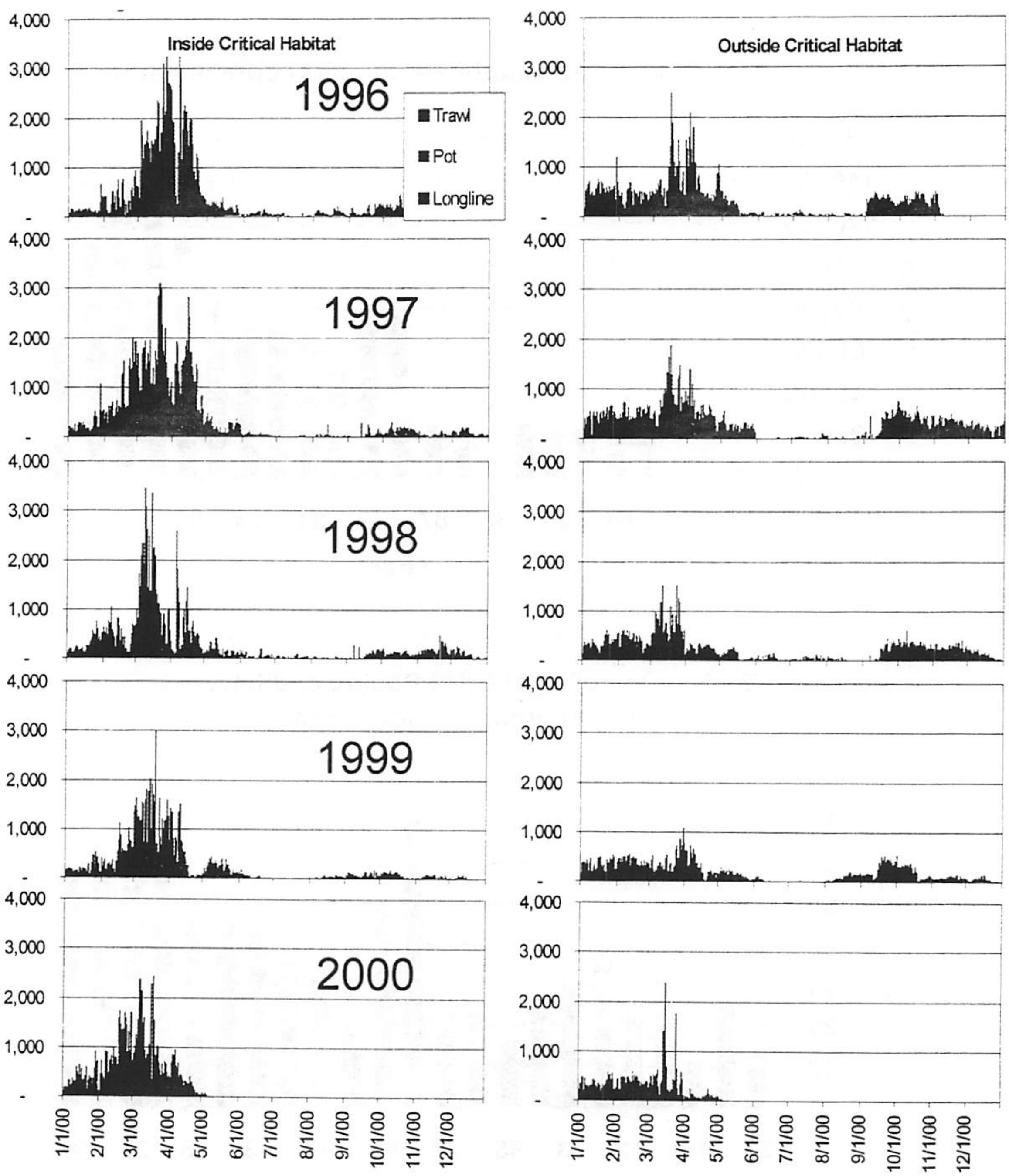


Figure 13. BSAI daily catch of Pacific cod by gear type inside and outside of Steller sea lion critical habitat from 1996-2000.

Pacific Cod Catch in the BSAI by Season (1996-2000)

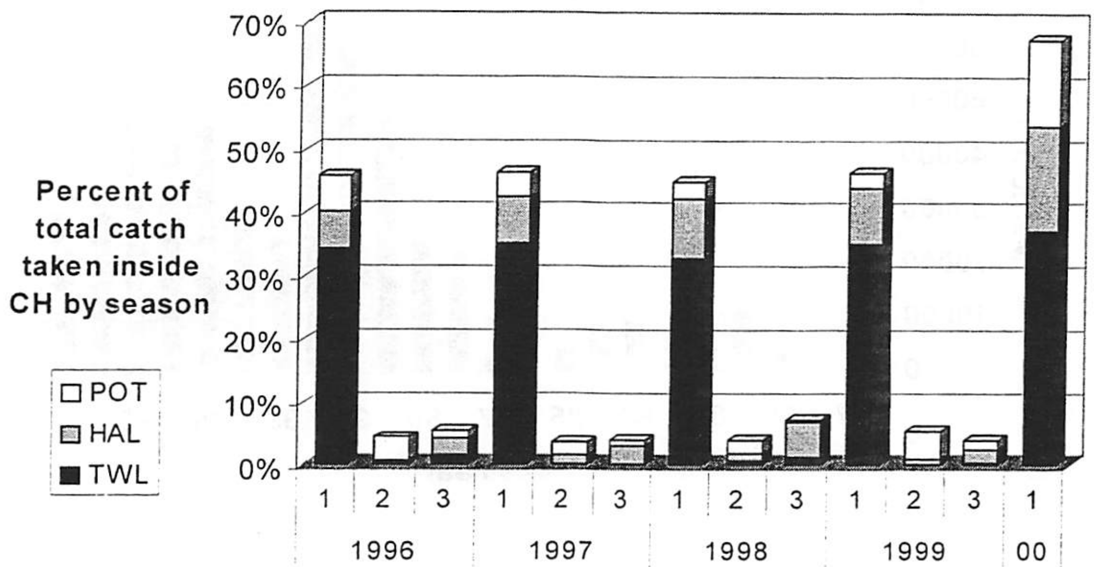


Figure 14. Percent of annual BSAI Pacific cod catch taken inside critical habitat by season and gear type 1996-2000.

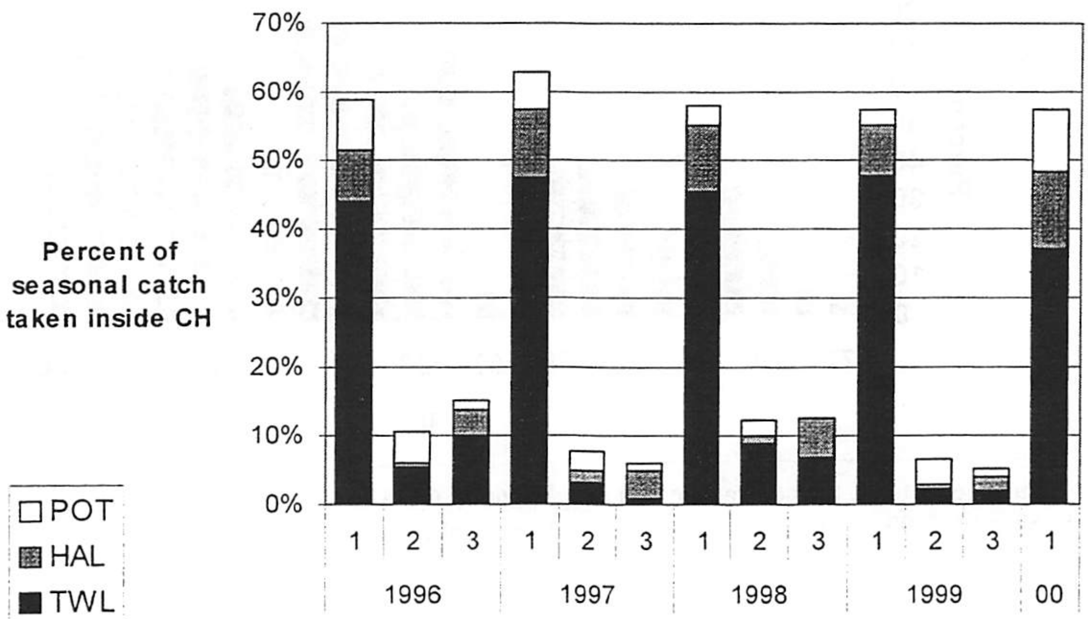
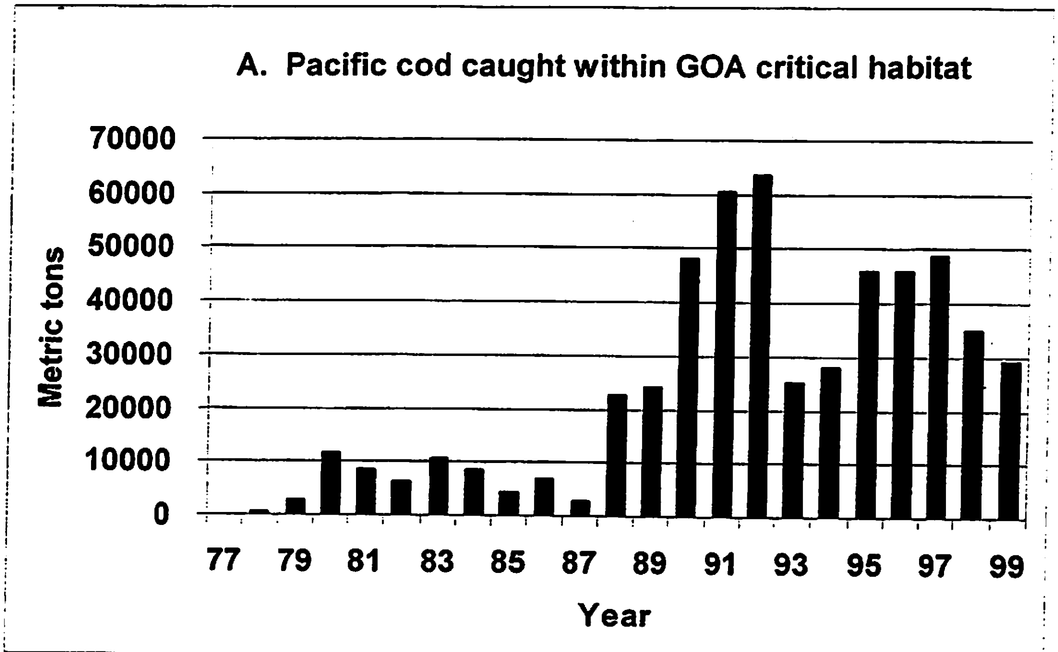


Figure 15. Percent of BSAI season Pacific cod catch taken inside critical habitat 1996-2000.

Figure 18. Percent of BSAI season Pacific cod catch taken inside critical habitat 1996-2000.



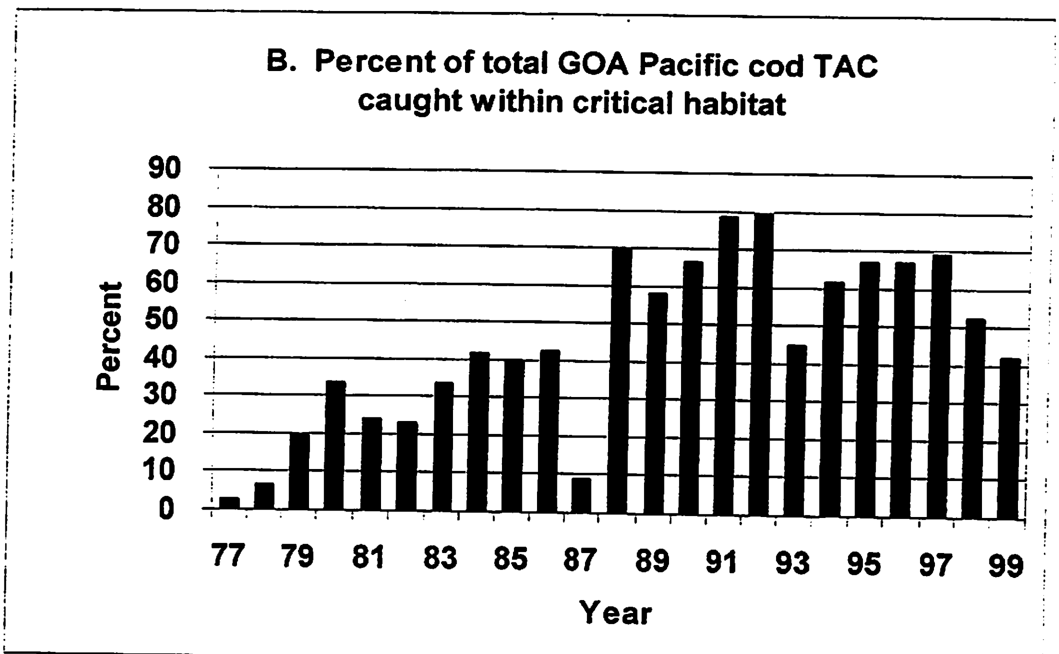


Figure 16. Metric tons of Pacific cod caught within GOA Steller sea lion critical habitat 1977-99 (top), and percent of annual catch taken within critical habitat (bottom).

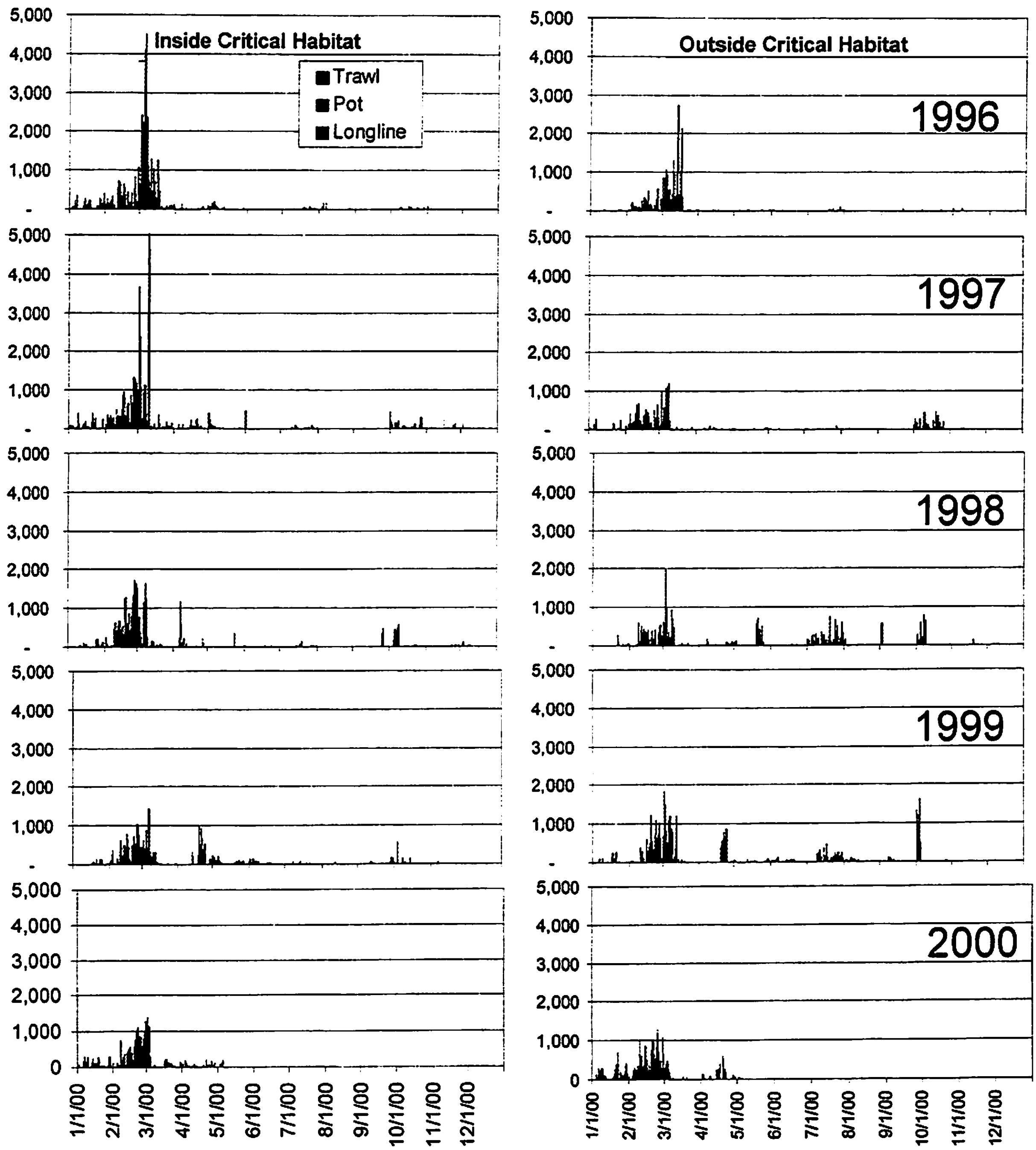


Figure 17. GOA daily catch of Pacific cod by gear type inside and outside of Steller sea lion critical habitat from 1996-2000.

Pacific Cod Catch in the GOA by Season (1996-2000)

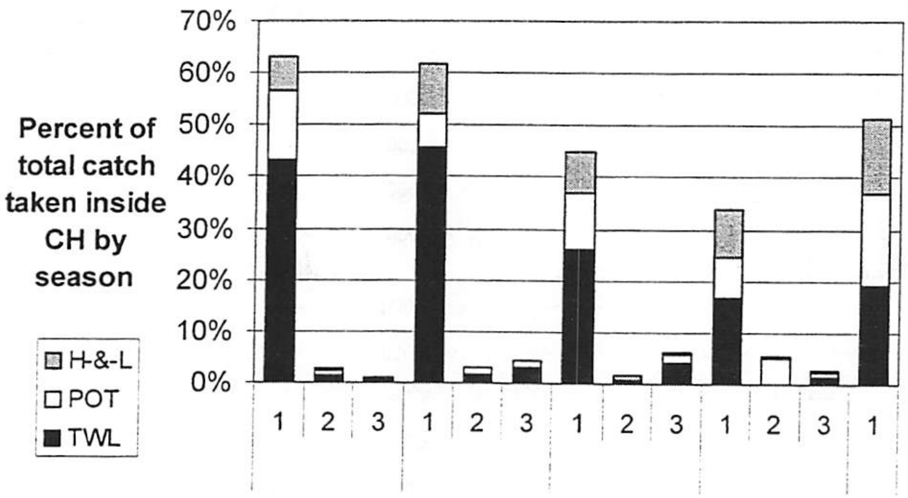


Figure 18. Percent of annual BSAI Pacific cod catch taken inside critical habitat by season and gear type 1996-2000.

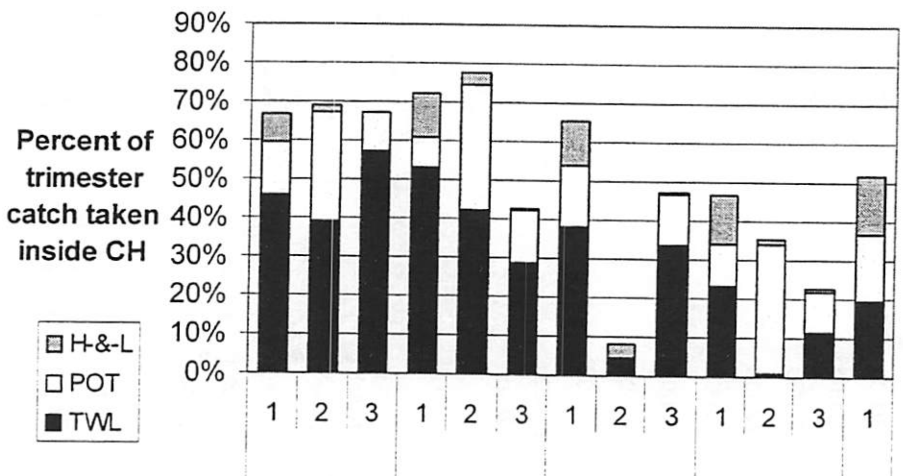


Figure 19. Percent of GOA season Pacific cod catch taken inside critical habitat 1996-2000.

Appendix 1– Additional Tables and Figures

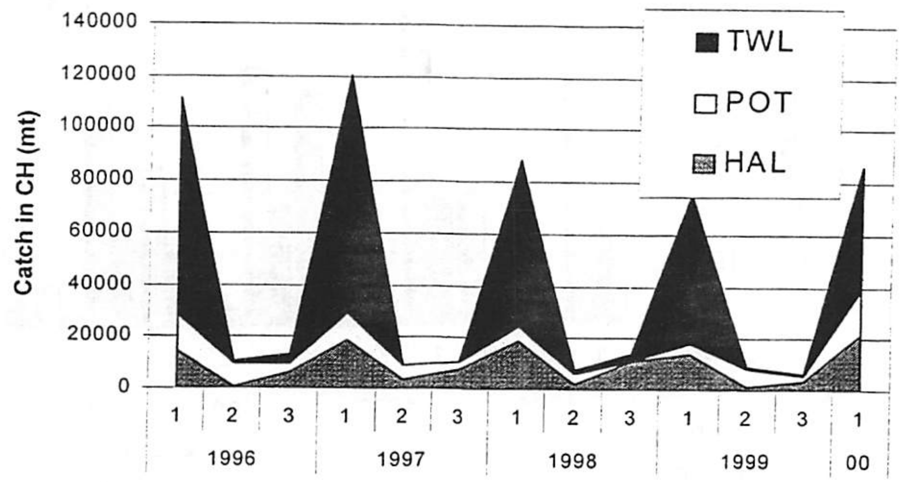


Figure 1. BSAI catch of Pacific cod inside critical habitat by season and by gear type from 1996-2000.

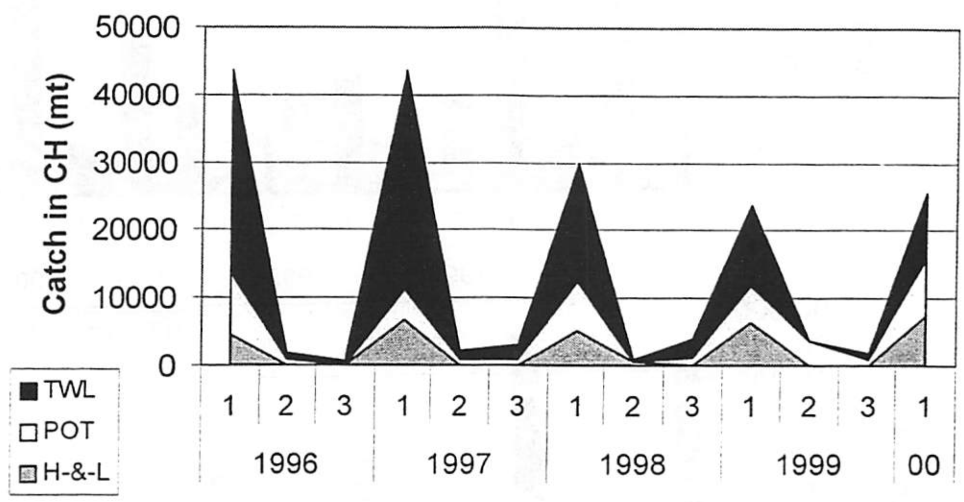


Figure 2. GOA catch of Pacific cod inside critical habitat by season and by gear type from 1996-2000.

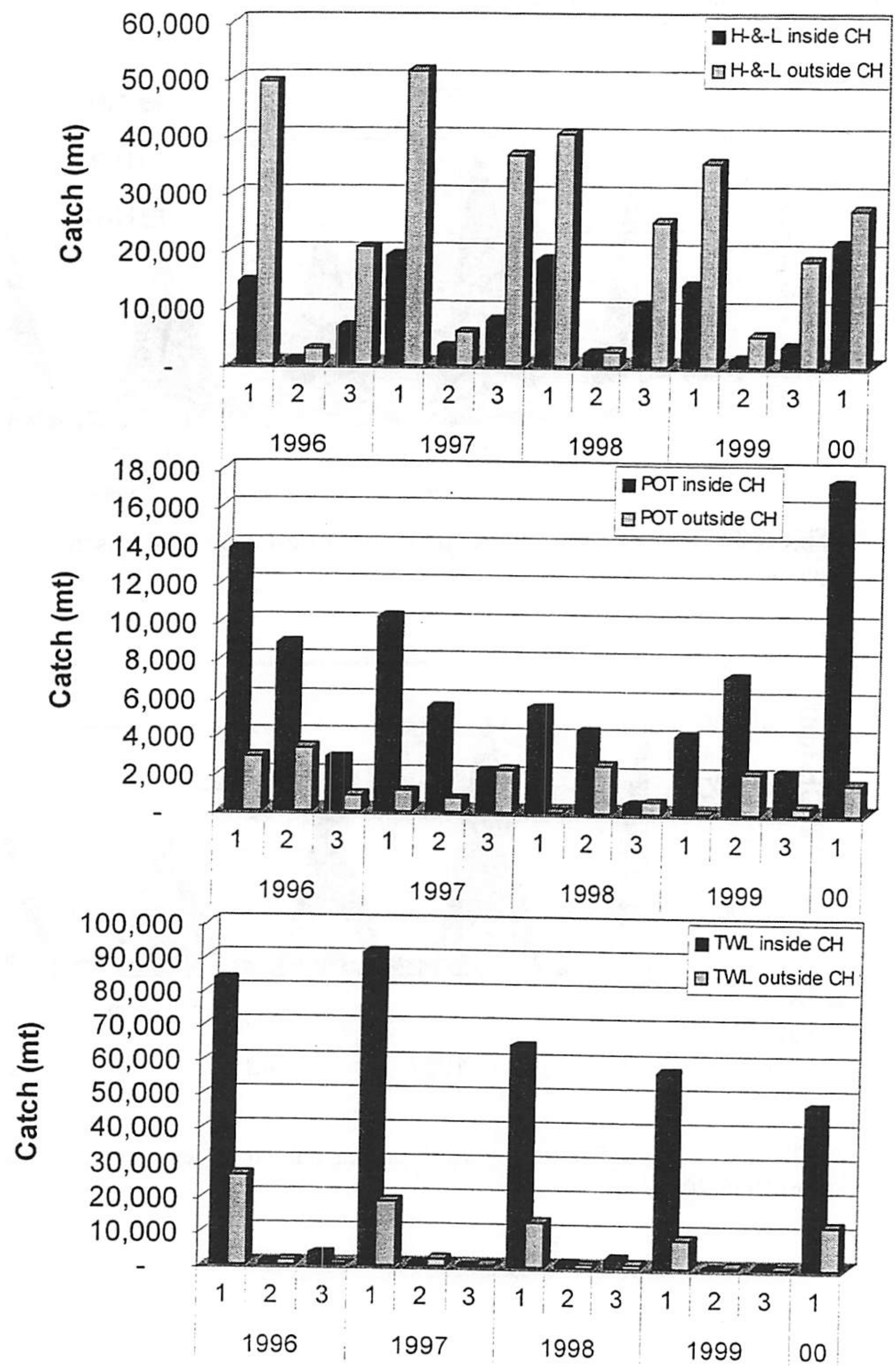


Figure 3. BSAI catch of Pacific cod inside and outside of critical habitat by season and by gear type from 1996-2000.

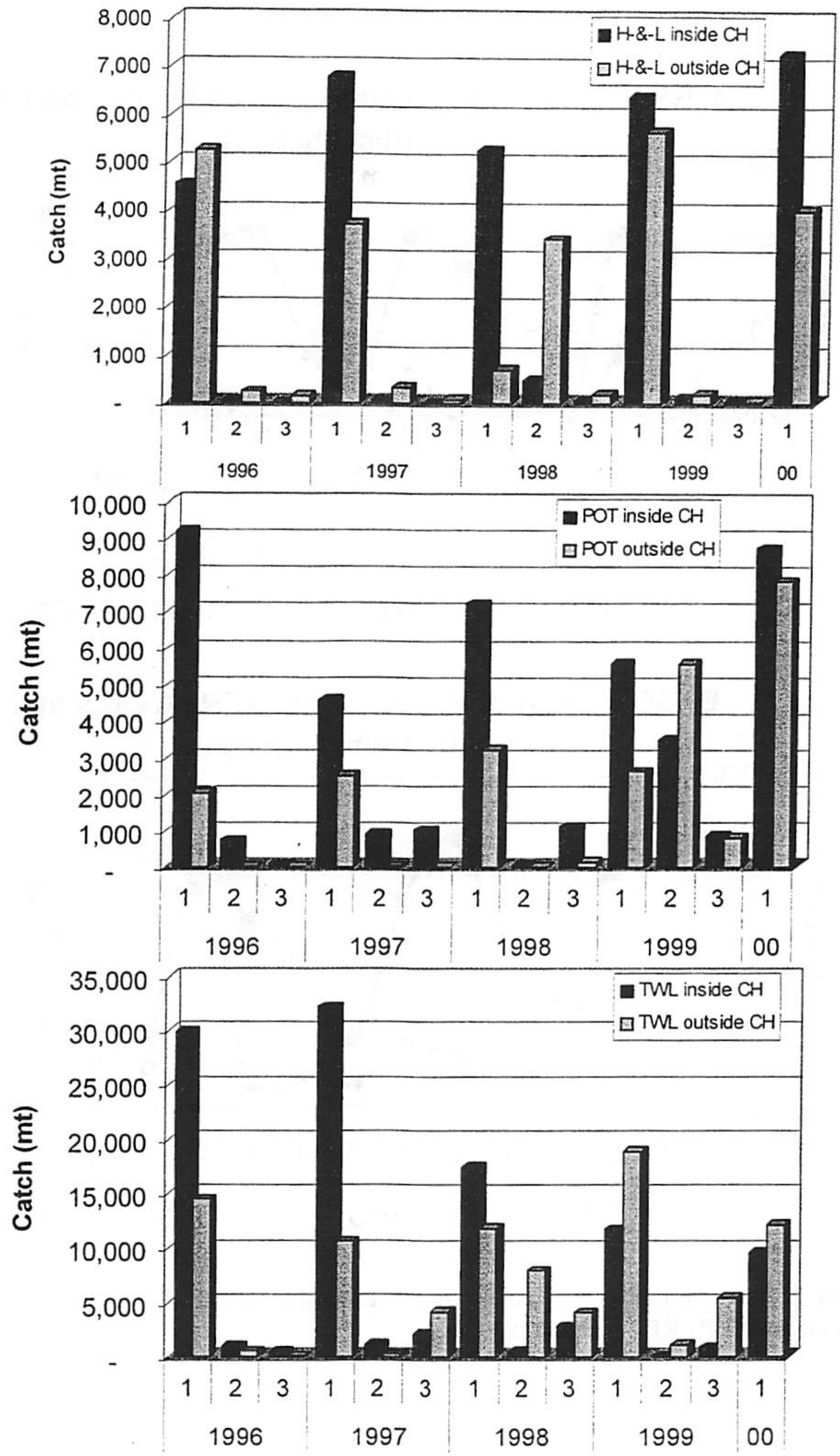


Figure 4. GOA catch of Pacific cod inside and outside of critical habitat by season and by gear type from 1996-2000.

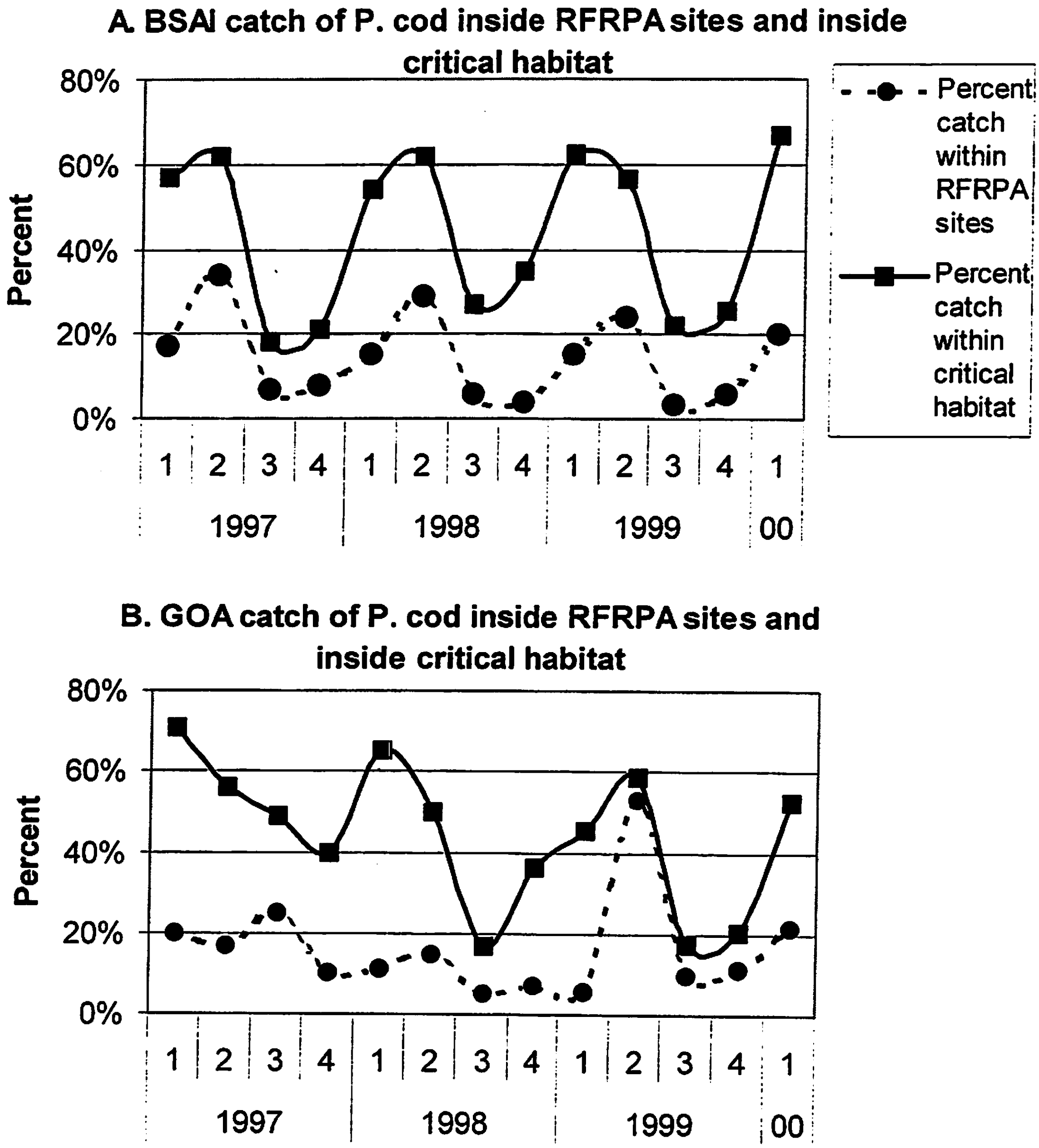


Figure 5. Variation of catch amounts inside critical habitat and inside restricted pollock trawl areas under the RFRPAs 1996-2000.

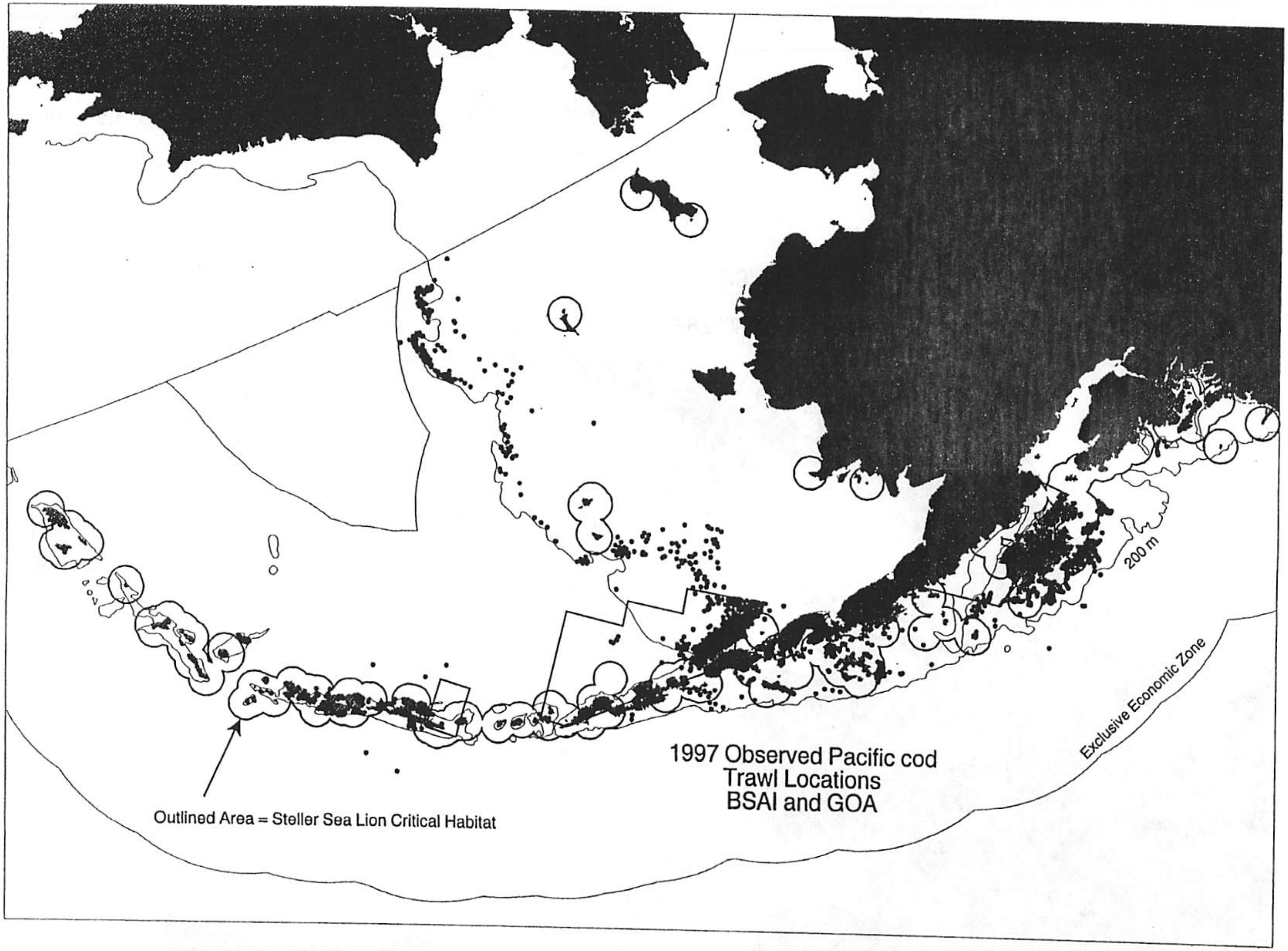


Figure 6a. Observed Pacific cod trawl fishing locations, BSAI and GOA in 1997.

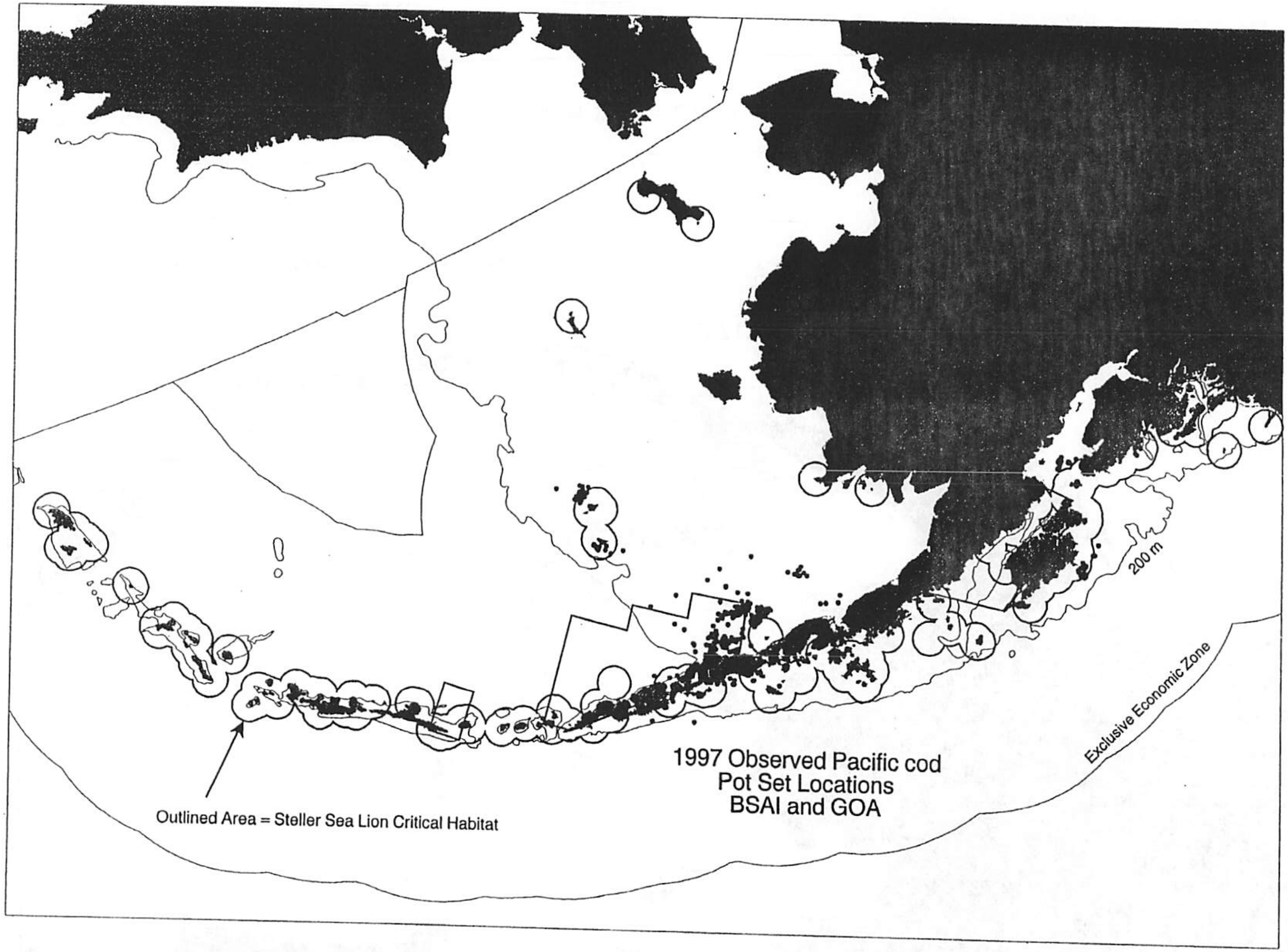


Figure 6b. Observed Pacific cod pot fishing locations, BSAI and GOA in 1997.

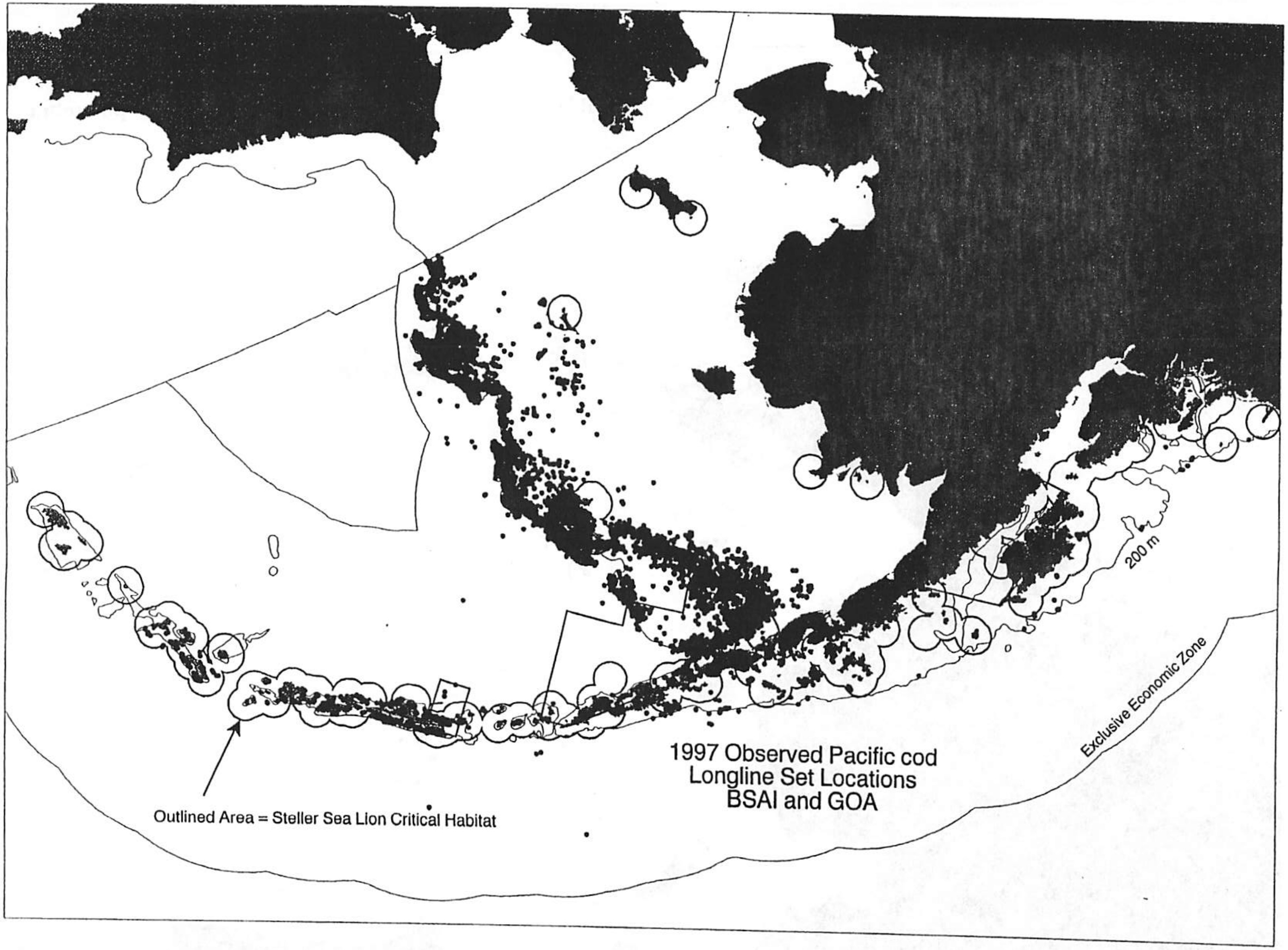


Figure 6c. Observed Pacific cod longline fishing locations, BSAI and GOA in 1997.

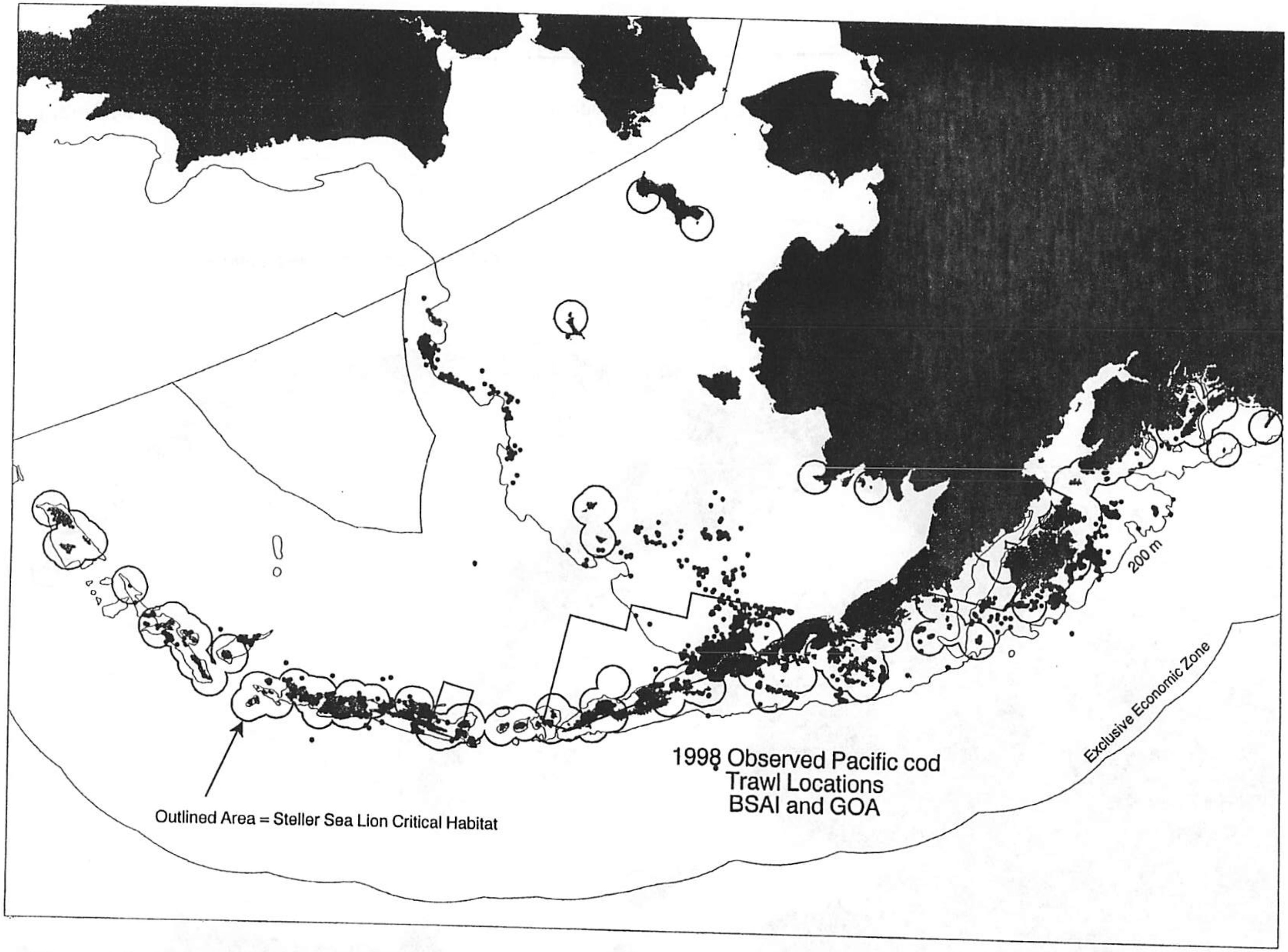


Figure 6d. Observed Pacific cod trawl fishing locations, BSAI and GOA in 1998.

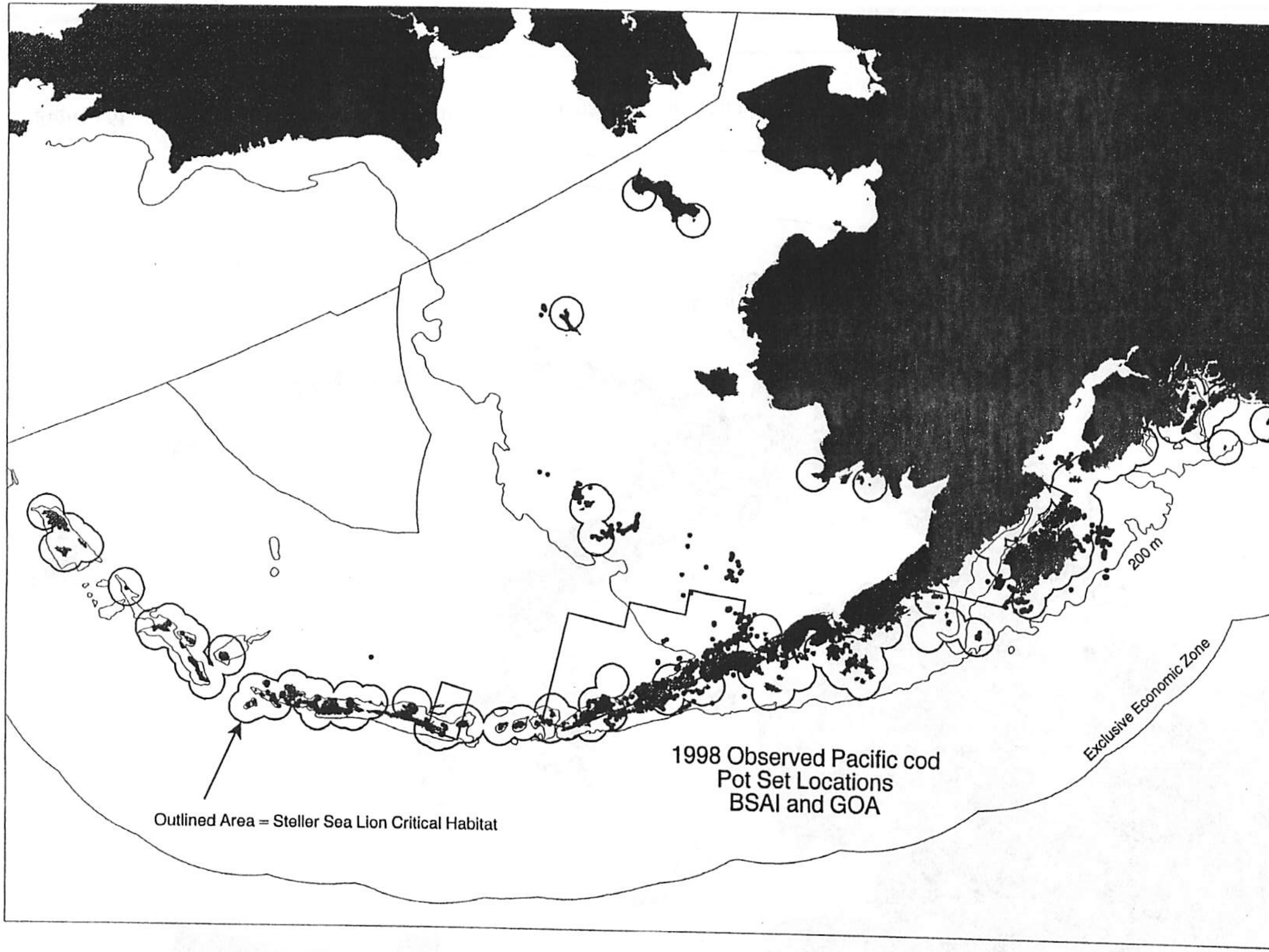


Figure 6e. Observed Pacific cod pot fishing locations, BSAI and GOA in 1998.

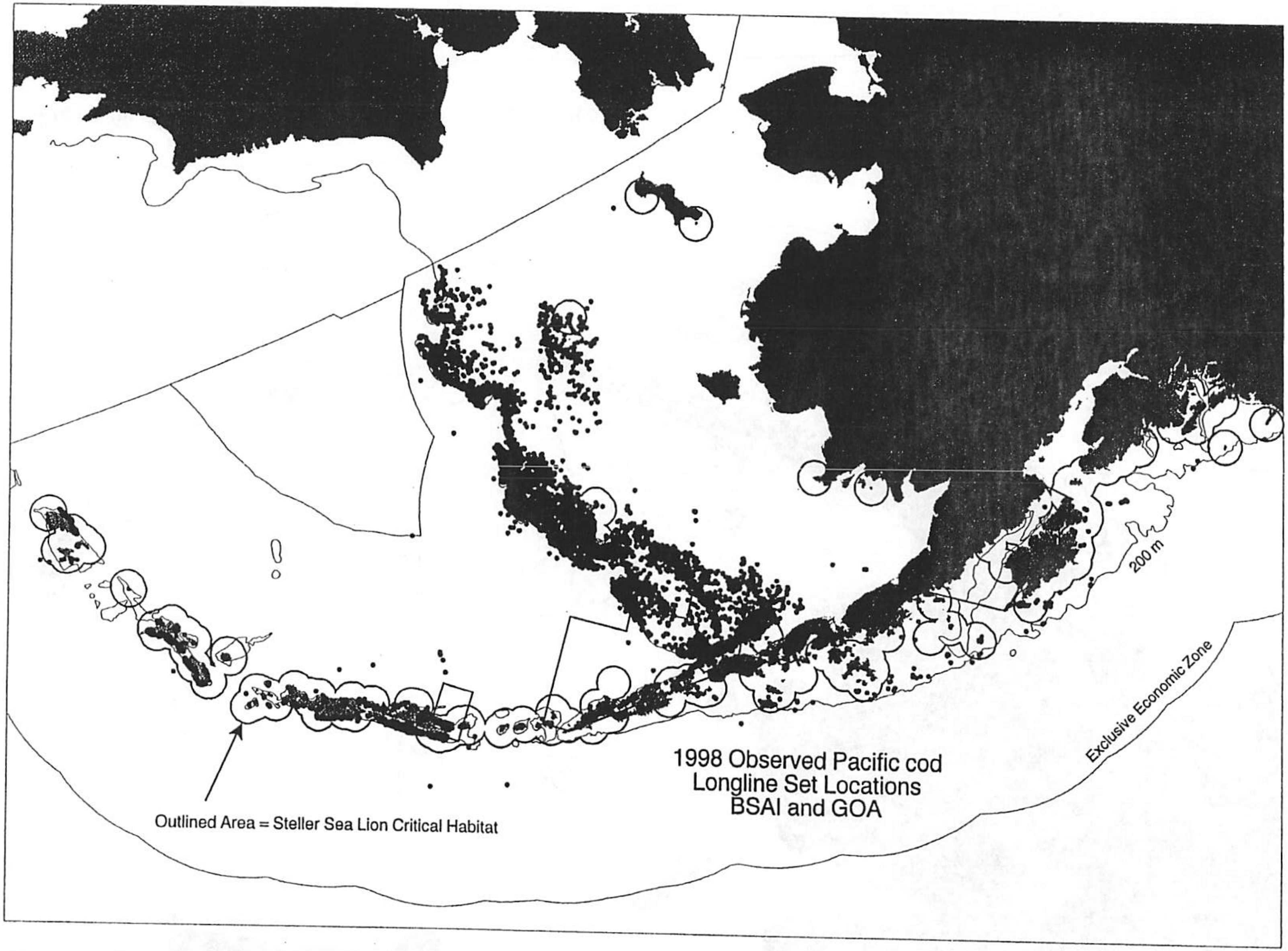


Figure 6f. Observed Pacific cod longline fishing locations, BSAI and GOA in 1998.

Table 1a. BSAI Pacific cod catch percentages inside and outside of critical habitat by gear type and season from 1996-2000. The "total" column represents the sum of all gear types. Each gear type is the percentage of the catch only for that gear type by season or year. Winter refers to January-April, summer from May-August, fall from September-December.

	BSAI PERCENT INSIDE CH				BSAI PERCENT OUTSIDE CH			
Season/year	HAL	POT	TWL	TOTAL	HAL	POT	TWL	TOTAL
JAN-APR	23%	83%	76%	59%	77%	17%	24%	41%
MAY-AUG	25%	73%	41%	59%	75%	27%	59%	41%
SEP-DEC	24%	77%	93%	37%	76%	23%	7%	63%
1996	23%	78%	76%	56%	77%	22%	24%	44%
JAN-APR	27%	90%	83%	63%	73%	10%	17%	37%
MAY-AUG	36%	89%	20%	52%	64%	11%	80%	48%
SEP-DEC	18%	50%	43%	21%	82%	50%	57%	79%
1997	24%	82%	81%	54%	76%	18%	19%	46%
JAN-APR	31%	100%	83%	62%	69%	0%	17%	38%
MAY-AUG	45%	63%	56%	56%	55%	37%	44%	44%
SEP-DEC	30%	46%	73%	35%	70%	54%	27%	65%
1998	32%	77%	82%	56%	68%	23%	18%	44%
JAN-APR	29%	99%	87%	63%	71%	1%	13%	37%
MAY-AUG	21%	77%	41%	52%	79%	23%	59%	48%
SEP-DEC	16%	84%	66%	24%	84%	16%	34%	76%
1999	24%	84%	86%	56%	76%	16%	14%	44%
Jan-May 6 2000	44%	92%	79%	68%	56%	8%	21%	32%

Table 1b. GQA Pacific cod catch percentages inside and outside of critical habitat by gear type and season from 1996-2000. The "total" column represents the sum of all gear types. Each gear type is the percentage of the catch only for that gear type by season or year.

	GOA PERCENT INSIDE CH				GOA PERCENT OUTSIDE CH			
Season/year	H-&-L	POT	TRAWL	TOTAL	H-&-L	POT	TRAWL	TOTAL
JAN-APR	46%	82%	67%	67%	54%	18%	33%	33%
MAY-AUG	16%	100%	64%	69%	84%	0%	36%	31%
SEP-DEC	0%	100%	80%	67%	100%	0%	20%	33%
1996	45%	83%	67%	67%	55%	17%	33%	33%
JAN-APR	65%	65%	75%	72%	35%	35%	25%	28%
MAY-AUG	20%	97%	82%	78%	80%	3%	18%	22%
SEP-DEC	15%	100%	33%	43%	85%	0%	67%	57%
1997	63%	72%	70%	69%	37%	28%	30%	31%
JAN-APR	88%	69%	60%	66%	12%	31%	40%	34%
MAY-AUG	12%	98%	6%	8%	88%	2%	94%	92%
SEP-DEC	23%	89%	41%	47%	77%	11%	59%	53%
1998	57%	71%	46%	53%	43%	29%	54%	47%
JAN-APR	53%	68%	38%	47%	47%	32%	62%	53%
MAY-AUG	43%	39%	9%	35%	57%	61%	91%	65%
SEP-DEC	62%	51%	15%	23%	38%	49%	85%	77%
1999	53%	53%	33%	42%	47%	47%	67%	58%
Jan-May 6 2000	64%	53%	44%	52%	36%	47%	56%	48%

Appendix 2 - The Principles for Avoiding Competition

In the December 3, 1998 biological opinion NMFS outlined a set of principles which were likely to reduce competition between fisheries and Steller sea lions. Those principles are described here with respect to the Pacific cod fishery. The three principles previously described were:

- Protection of prey resources adjacent to rookeries and haulouts,
- Temporal dispersion of the fishery, and
- Spatial dispersion of the fishery

NMFS has relied on these principles in guiding decision making with regard to the efficacy of fishery actions in subsequent biological opinions and may be an appropriate model to view the Pacific cod fisheries.

Protection of Prey Resources Adjacent to Rookeries and Haulouts

The objective of this principal was to ensure that competition would not occur between fisheries and certain segments of the Steller sea lion population. Successful reproduction for the species depends on the availability of rookery sites where animals can aggregate for sufficiently long periods of time to give birth, mate, and raise their young until the young are able to survive at sea. As the reproductive period requires at least several months, food supplies in the vicinity of the rookeries must be sufficient to meet the energetic needs of animals involved in reproduction (adult females and males and pups). Once the reproductive season and the need for social aggregation is over, and pups have gained sufficient competence at sea, then animals (including mothers with pups) may or may not disperse to other haulout sites. Throughout the remainder of the year, the local availability of prey remains a crucial factor (probably the most important factor) in determining their movements and distribution. Mothers with dependent pups are still likely to be constrained in their foraging distribution. All pups are susceptible because they have limited reserves compared to adult animals. Pups in the process of weaning are likely poor foragers that must be highly susceptible to reductions in prey availability. Weaned pups are likely dependent on nearshore prey resources while they make the difficult transition to independent foraging. Juveniles, older but still immature, must continue to develop their foraging skills over time, but probably remain particularly sensitive to reductions in available prey. Like other, older animals, they may range more widely, but their distribution and haulout patterns must be determined, in large part, by the availability of prey.

The foraging success of these animals, whether based on rookeries or haulouts, is determined by their ability to balance the gains from foraging with the costs of daily activities, including the act of foraging itself. If the prey resources around rookeries and haulouts are reduced or depleted relative to their needs, then they are forced to increase the time and energy expended to find sufficient prey. As a result, they are more likely to fail in securing the resources necessary for growth, reproduction, and survival. As reproduction by adult females and survival of young animals to maturity are essential for population recovery, and both reproduction and survival depend on successful foraging, the December 23, 1998 biological opinion concluded that prey resources should not be reduced by pollock fisheries around rookeries and major haulouts.

Temporal dispersion

The purpose of this principle is to insure that the harvest is well dispersed throughout the year to reduce the probability of short-term (within-year) depletions of prey resulting from concentrated or pulsed fishing.

The prey field – The foraging success of Steller sea lions is dependent on the characteristics of the prey field where they forage and the factors that influence that prey field. In a particular area, the prey field consists of multiple prey species, each with its own abundance or biomass, behavior, and distribution and dispersion patterns (e.g., dispersed versus aggregated or schooled). Over time, the prey field changes or shifts as a function of natural life history patterns of each prey species; i.e., individual growth, reproduction and recruitment, mortality, migration into the area, and migration out of the area. These changes may be more or less predictable, such as those resulting from the cyclic annual period, or they may relatively unpredictable, such as the regime shift. As a species, sea lions have persisted because they have developed successful foraging strategies or patterns for these prey fields as they have changed over time.

Fisheries alter these prey fields. They may have long-term consequences (over multiple years) such as changes in the local composition of biological communities. They also have immediate or short-term (within-year) consequences related simply to removal of prey. The fundamental assumption is that the fisheries removal of pollock throughout the course of a year would not appreciably diminish the prey field if the catch was well distributed in time and space so that the local harvest rate was the same as the overall harvest rate where Steller sea lions forage. If the catch was not well distributed in time and space, then the concentrated removal of pollock from the sea lion prey field could result in localized depletion.

Localized depletion -- As noted earlier, localized depletion is a relative term: the depletion is relative to the needs of individual foraging Steller sea lions. An individual sea lion must be able to satisfy its nutritional and energetic needs by balancing gains from foraging with the costs of daily activities, including the act of foraging itself. When a fishery operates within the sea lion prey field, the prey field must be diminished by removal of fish - in this case, Pacific cod. That such diminution occurs is clear. Such diminution occurs not only on the scale of individual fish patches, but also over larger scales. The evidence presented in this paper indicates that the harvest rate in critical habitat in the winter may be disproportionally high. Thus, the prey field may be diminished.

A central assumption of fisheries management is that the prey field recovers. Assuming this to be the case, the prey field must recover at some rate that is dependent on the amount of prey taken, the amount available for recovery, the effect of the fishing activity on prey aggregation and density, and the life history of the prey, including their behavior and movements during and after the period of fishing. The available information on these fisheries and prey communities is not sufficient to describe the recovery process. Under conditions typical of the Bering Sea and Gulf of Alaska, the rate of recovery must be slower than the rate of removal. Otherwise, fishing vessels in an area would not be required to search for pollock after they had found their first suitable fishing target; recovery would keep pace with removal. This is not the case. Recovery may take days, weeks, months, or longer.

The status of the prey field at any given moment, then, is dependent on its original or unfished state, and the balance between removal and recovery processes. If these two processes are concurrent, the balance will be determined by the rate at which prey are removed versus the rate of recovery. The larger the discrepancy between removal and recovery, the more likely that prey availability will be reduced to sea lions. Or, conversely, the slower the removal rate, the less likely that prey availability will be diminished appreciably to Steller sea lions.

This need to balance removal with recovery provides much of the rationale for dispersing the catch over time. By slowing the fisheries, management provides a greater opportunity for recovery to mitigate or balance the effects of removal. With a slower-paced fishery, more prey biomass is available to Steller sea lions and other consumers on a day-to-day basis, and localized depletions are less likely to occur. In the absence of the information necessary to evaluate the local effects of fishing, the fisheries should be managed in a precautionary manner.

As noted earlier, we cannot determine whether localized depletions occur for Pacific cod. Ongoing analyses expected before September should provide some information on CPUE for the trawl fishery, but will likely have limited utility for other gear types and areas. Given that the vast majority of the catch is taken in the first 4 months of the year in both the BSAI and GOA, it would be difficult to eliminate the possibility that localized depletions are occurring.

Spatial Dispersion

The purpose of this principle is to insure that the harvest is distributed over space in accordance with the distribution of the stock in all areas outside of those protected by no-trawl zones. If the harvest is distributed in such a manner, then local harvest rates should be the same as the overall harvest rate and the potential for localized depletion should be correspondingly reduced.

The principle of dispersing catch according to the distribution of the stock assumes that the distribution of the stock is known. The information on Pacific cod stock distribution in the winter and spring period is relatively limited. Yet, the fishery has been highly concentrated in critical habitat during the winter period. The uncertainty about the distribution of the stock during this season suggested that some precautionary limit needed to be set to avoid disproportionate harvesting until winter surveys could be incorporated into the stock assessment. For pollock, a guideline was added to the biological opinion to set a precautionary limit for the harvest of pollock in the SCA until better information was available. However, the lack of information about Pacific cod stock distribution throughout the year is a significant impediment to efforts to understand and resolve potential interactions between Steller sea lions and the fisheries, and argues strongly for more seasonal stock assessment surveys.

Status of Steller Sea Lion in Russian waters, 1989-99.

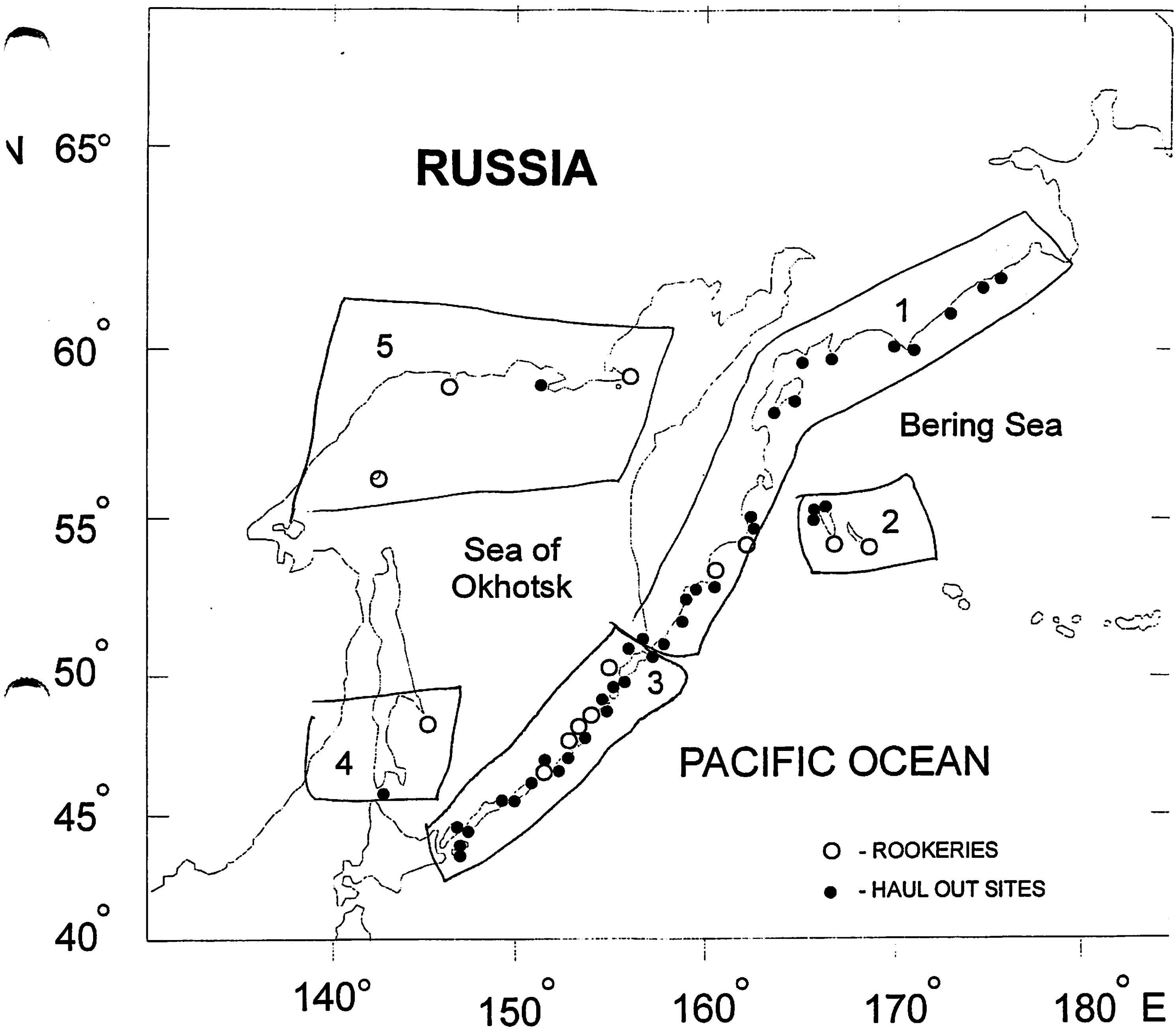
Alaska SeaLife Center
Vladimir Burkanov

Objectives:

- Comparable analyze of existed data of Steller sea lion (SSL) counts in Russian waters during last 10 years period (1989-99)

Data available:

- Direct counts of SSL on rookeries and haul out sites along Kamchatka, Commander and Kuril Is. and Iony I.
- Published data of SSL counts conducted Russian and American scientist on Kuril Islands (1989), along Sakhalin I. and Yamskie Is.
- Personal information of A. Kuzin and S.V. Zadal'sky of SSL counts on Tuleny I. and Yamskie Is. In 1999.



STELLER SEA LION SURVEY AREAS IN RUSSIAN WATERS.

1. KAMCHATKA.
2. COMMANDER ISLANDS.
3. KURIL ISLANDS.
4. SAKHALIN I.
5. NORTHERN SEA OF OKHOTSK.

Steller Sea Lion counts in Russian waters, 1989-99.

	Site	1989			1994(95)			1999		
		Date	non-pup	pups	Date	non-pup	pups	Date	non-pup	pups
Kamchatka										
1	Dyryaviy Cape	not surveyed			06/27/94	0		08/23/99	2	
2	Vitgenshteyna Cape	06/22/89	550		06/28/94	107		08/21/99	123	
3	Tymniy Cape	not surveyed			06/28/94	0		not surveyed		
4	Stupenchatiy Cape	06/19/89	225		06/28/94	2		07/09/99	5	
5	Irene Cape	not surveyed			06/28/94	0		07/09/99	0	
6	Govena Cape	06/21/89	9		06/28/94	0		07/09/99	0	
7	Verkhoturov I.	06/21/89	410		06/30/94	91		07/09/99	52	
8	Urie Cape	06/23/89	5		06/30/94	0		07/08/99	0	
9	Krasheninnikova Ca	06/23/89	387		06/30/94	200		07/08/99	47	
10	Sivuchiy Cape	06/20/09	3		06/30/94	0		not surveyed		
11	Afrika Cape	06/22/09	0		06/30/94	0		not surveyed		
12	Kamchatsky Cape	06/22/09	575		06/30/94	154		07/01/99	59	
13	Kronotskiy Cape	06/22/09	23		not surveyed			07/08/99	0	
14	Kozlova Cape	06/22/09	551		07/06/94	313	93	07/08/99	498	87
15	Zheleznaya Bay	06/22/09	43		07/06/94	10		07/08/99	51	1
16	Shipunskiy Cape	06/19/89	185		07/06/94	50		07/08/99	53	
17	Khalaktyrskiy Pillar	06/19/89	36		07/06/94	3		06/27/99	0	
18	Bezimyaniy Reef	07/05/89	0		not surveyed			06/27/99	0	
19	Kekurniy Cape	07/05/89	126		07/07/94	112		06/12/99	57	
20	Sivuchiy Rk	07/05/89	0		not surveyed			08/20/99	0	
21	Krestoviy Cape	07/05/89	0		not surveyed			08/20/99	0	
22	Gavrushkin Rk	07/05/89	0		07/08/94	3		not surveyed		
23	Sivuchiy Cape (west	07/05/89	4		08/01/94	42		06/27/99	0	
Kamchatka total			*3,132*			*1,087*	*93*		*947*	*88*
Area total comparable			*3,106*			*1,084*	*93*		*945*	*88*
Area reproductive comparable			*594*			*323*	*93*		*549*	*87*

Steller Sea Lion counts in Russian waters, 1989-99.

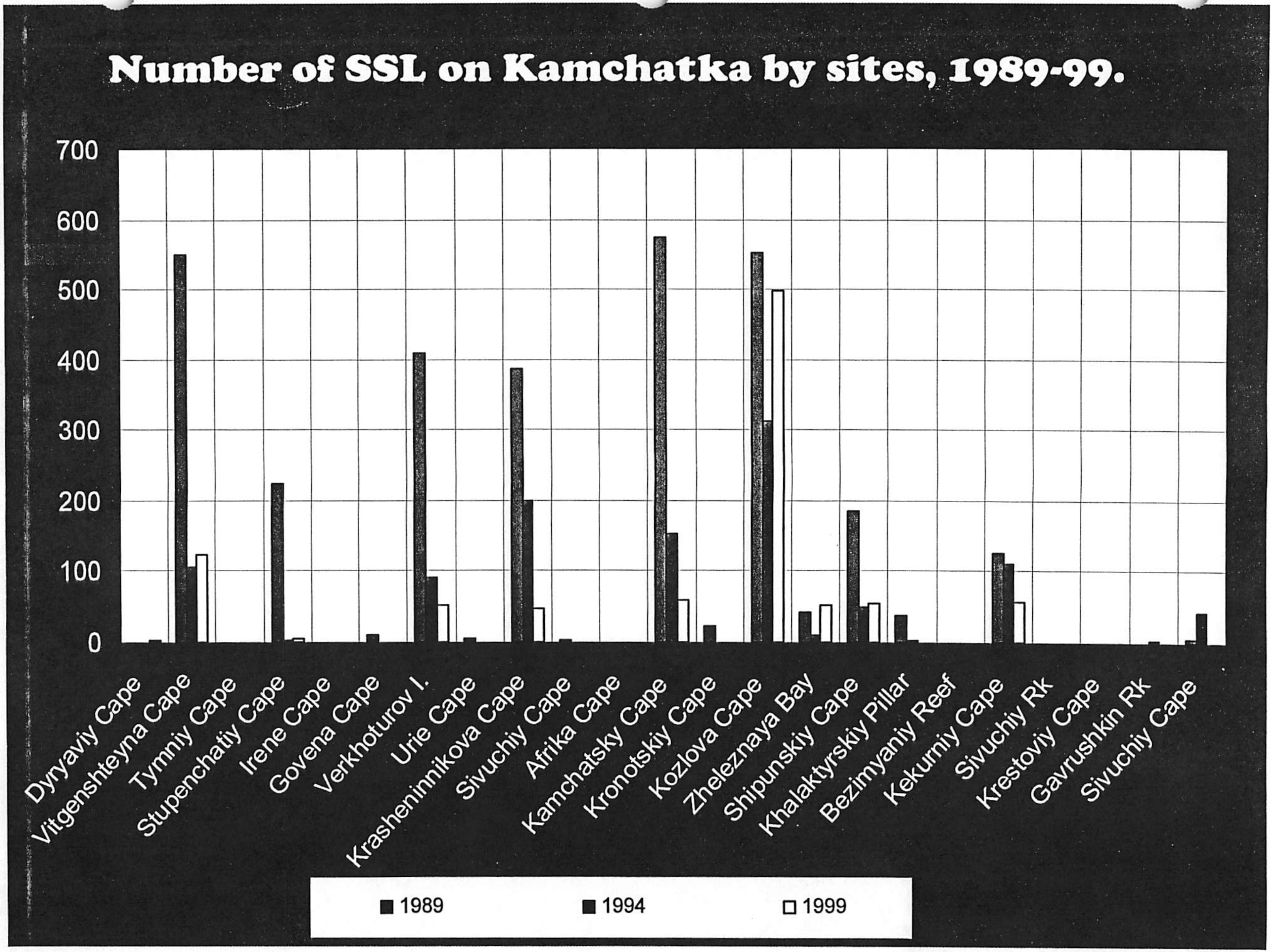
Site		1989			1994(95)			1999		
		Date	non-pu	pups	Date	non-pup	pups	Date	non-pup	pups
Commander Islands:										
Bering Island:										
24	Ariy Kamen'	06/29/89	1		05/26/94	3		not surveyed		
25	North-west Cape	07/14/89	36		06/30/94	3		not surveyed		
26	Iushina Cape	07/14/89	18		06/22/94	8		not surveyed		
27	Manati Cape	07/13/89	410	8	07/01/94	142	2	not surveyed		
Medny Island:										
29	South-east Cape	07/02/89	426	177	06.25-07.10	368	224	06.23-07.10.99	725	269
Commander Islands total:			***891***	***185***		***525***	***226***		***725***	***269***
Area total comparable			***426***	***177***		***368***	***224***		***725***	***269***

Steller Sea Lion counts in Russian waters, 1989-99.

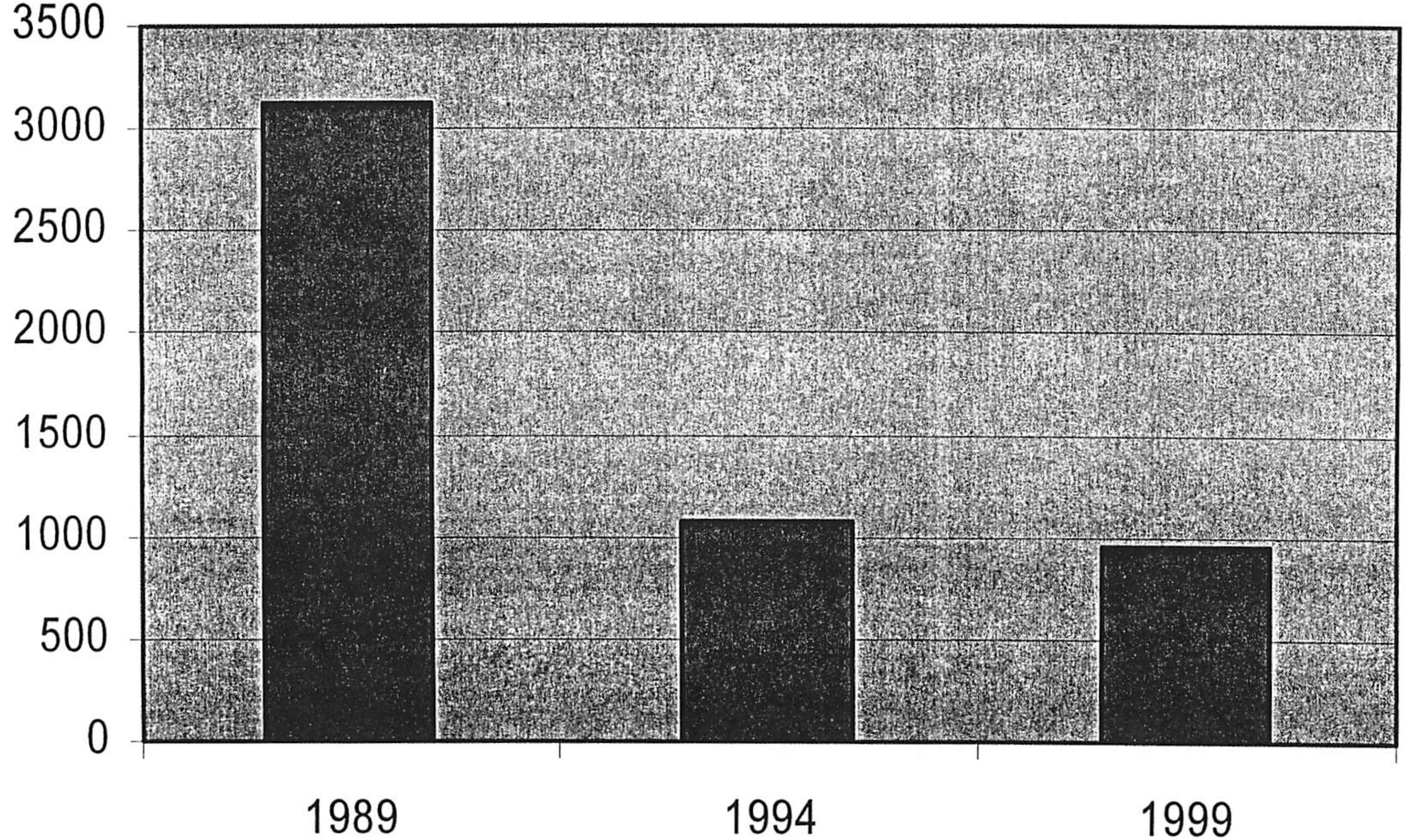
Site		1989			1994(95)			1999		
		Date	non-pu	pups	Date	non-pup	pups	Date	non-pup	pups
Kurils Islands:										
1	Vladimira Rk.	not surveyed			07/07/95	0	0	not surveyed		
2	Atlasova I.	07/11/89	194	0	06/29/95	19	0	not surveyed		
3	Paramushir I.	not surveyed			07/06/95	74	0	not surveyed		
4	Antsiferova I.	07/10/89	542	224	06/30/95	642	222	06/27/99	651	211
5	Onekotan I	07/11/89	42	0	07/05/95	82	0	not surveyed		
6	Avos' Rk.	07/10/89	18	0	07/05/95	23	0	not surveyed		
7	Shiashkotan I.	07/07/89	642	0	07/04/95	65	0	not surveyed		
8	Lovushki I.	06/19/89	760	381	07/02/95	1,033	660	06/29/99	829	240
9	Raykoke I.	06/21/89	266	162	07/01/95	398	279	06/29/99	338	255
10	Matua I.	not surveyed			07/02/95	40	0	06.29.99	0	
11	Rasshua I.	not surveyed			07/01/95	66	0	06/30/99	17	0
12	Srednego I.	06/22/89	566	433	07/01/95	443	470	07/08/99	548	200
13	Ushishir I.	not surveyed			07/01/95	1	0	not surveyed		
14	Ketoy I.	07/03/89	430	2	not surveyed			not surveyed		
15	Simushir I.	07/02/89	219	1	not surveyed			07/04/99	80	0
16	Brat Chirpoev I.	06/24/89	585	276	07/08/96	733	390	07/07/99	433	329
17	Iturup I.	06/28/89	244	0	not surveyed			not surveyed		
Kuril Islands total			*4,508*	*1,479*		*3,619*	*2,021*		*2,896*	*1,235*
Area total comparable			*2,719*	*1,476*		*3,249*	*2,021*		*2,799*	*1,235*

Steller Sea Lion counts in Russian waters, 1989-99.

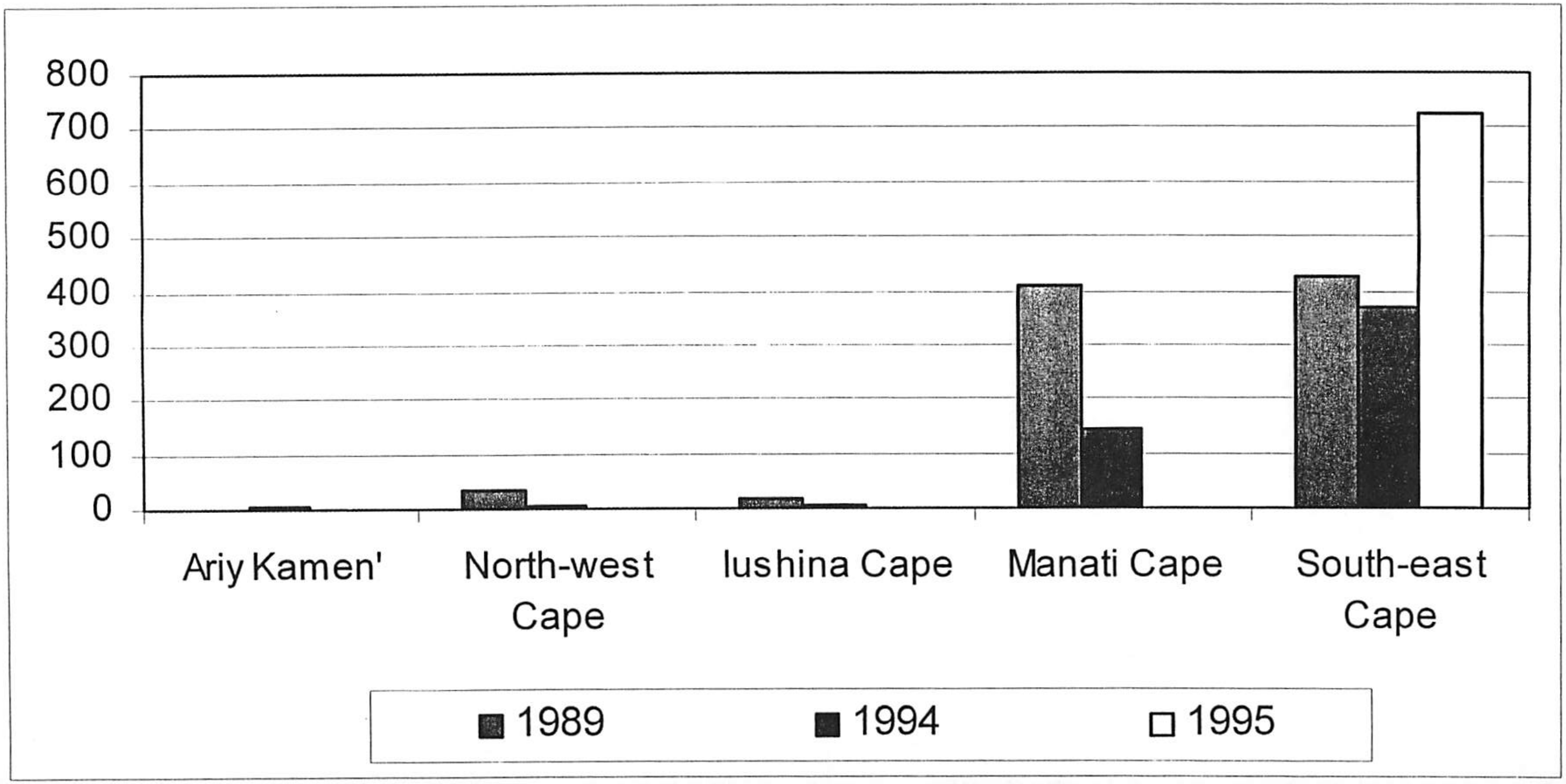
Site		1989			1994(95)			1999		
		Date	non-pu	pups	Date	non-pup	pups	Date	non-pup	pups
Sakhalin Island:										
1	Tuleniy I.	1989	200	45	1994	548	144	1999	696	291
2	Opastnoski Rk.	July, 1991	300	0		NA	NA		NA	NA
Sakhalin I. total			***500***	***45***		***548***	***144***		***696***	***291***
Area total comparable			***200***	***45***		***548***	***144***		***696***	***291***
Sea of Okhotsk, northern part:										
49	Yamskie Isls.	1988	650	230	1994	655	185	1998	628	200
50	Zav'yalova I.		NC	NC		NC	NC	unknown	115	0
51	Lisyanskogo peninsula		NC	NC		NC	NC	7/21/97	212	20
52	Iony I.	unknown	1,038	462		1,234	772	06/30-07/01/97	1,430	1,082
Sea of Okhotsk, northern part:			***1,688***	***692***		*1,889*	*957*		***2,385***	***1,302***
Area total comparable			***1,688***	***692***		*1,889*	*957*		***2,058***	***1,282***


Number of SSL on Kamchatka by sites, 1989-99.
700
600
500
400
300
200
100
0
Dyryaviy Cape
Vitgenshteyna Cape
Tymniy Cape
Stupenchatiy Cape
Irene Cape
Govena Cape
Verkhoturov I.
Urie Cape
Krasheninnikova Cape
Sivuchiy Cape
Afrika Cape
Kamchatsky Cape
Kronotskiy Cape
Kozlova Cape
Zheleznaya Bay
Shipunskiy Cape
Khalaktyrskiy Pillar
Bezimyaniy Reef
Kekurniy Cape
Sivuchiy Rk
Krestoviy Cape
Gavrushkin Rk
Sivuchiy Cape
1989
1994
1999

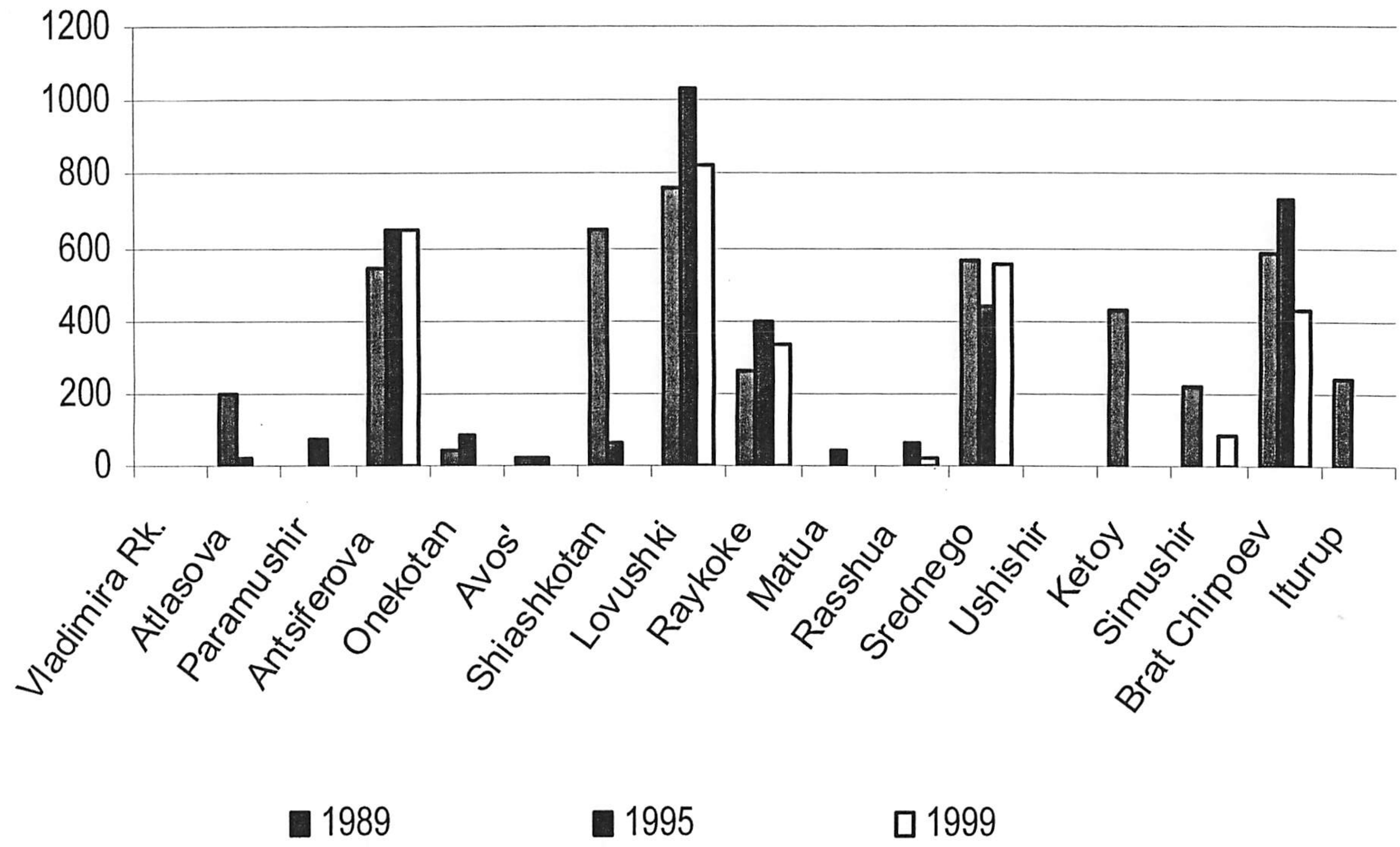
Total number of SSL on Kamchatka, 1989-99.



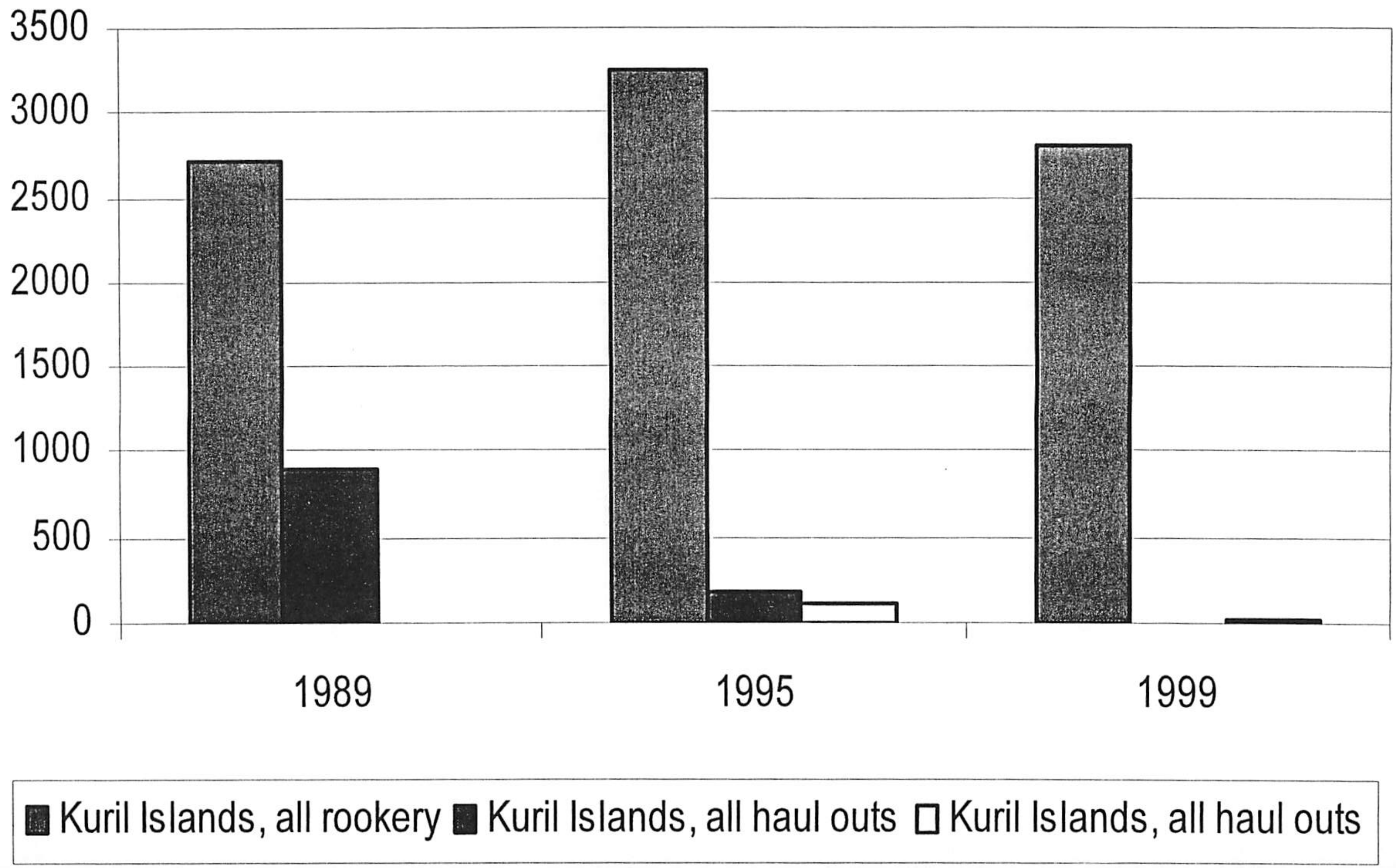
Number of SSL on Commander Islands by sites, 1989-99.



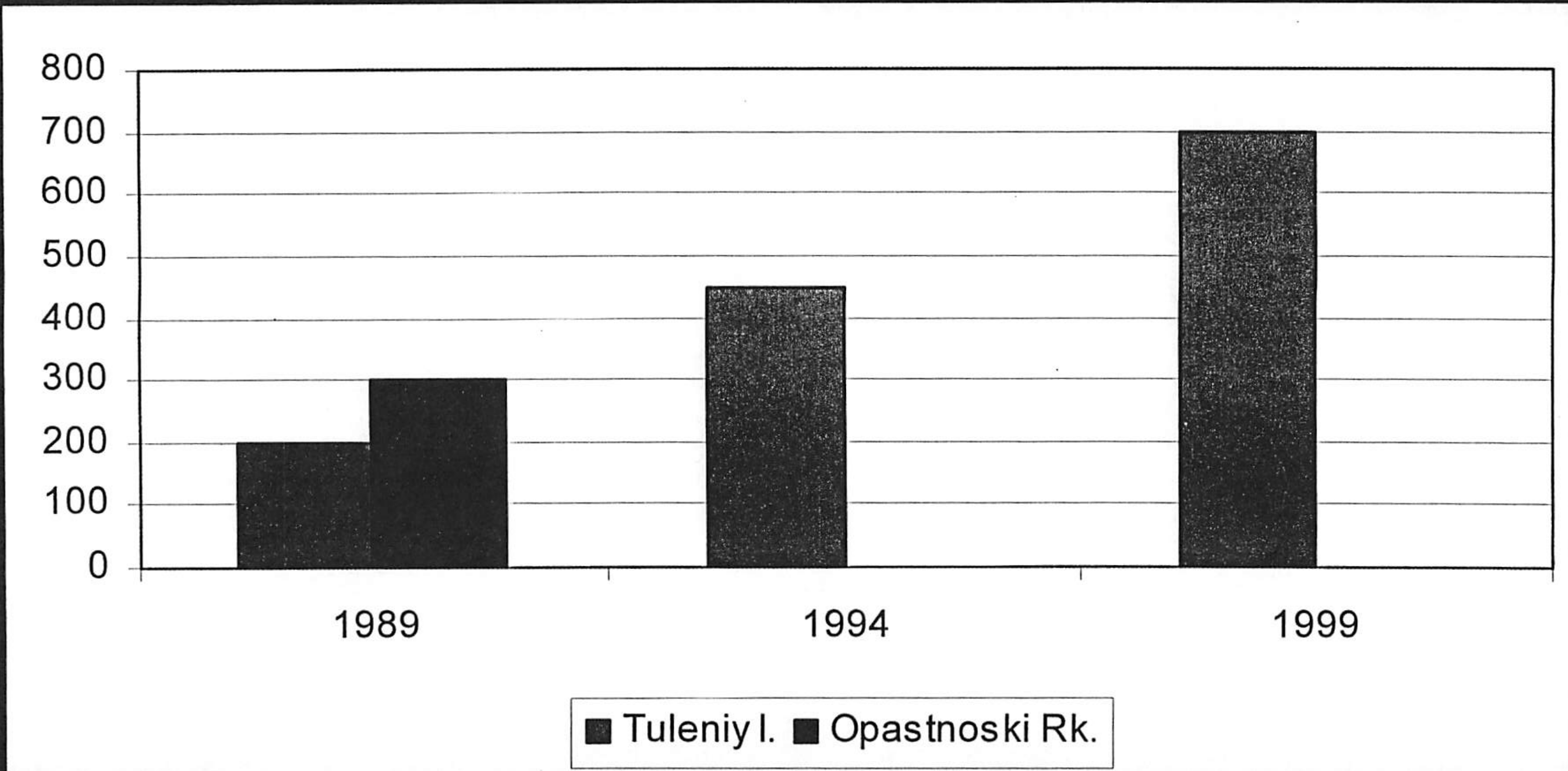
Number of SSL on Kuril Islands by sites, 1989-99.



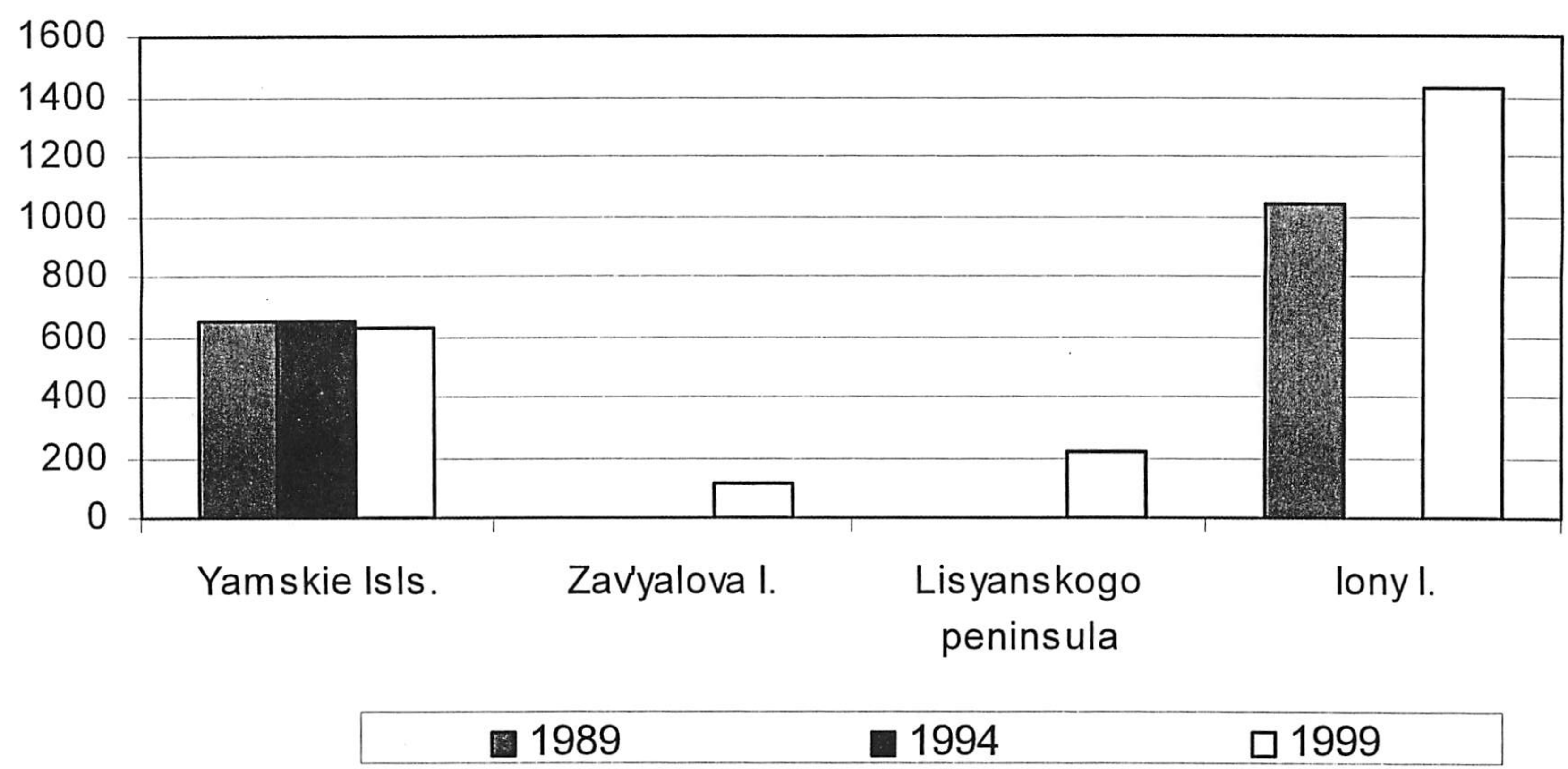
Total number of SSL on Kuril Islands by sites, 1989-99.



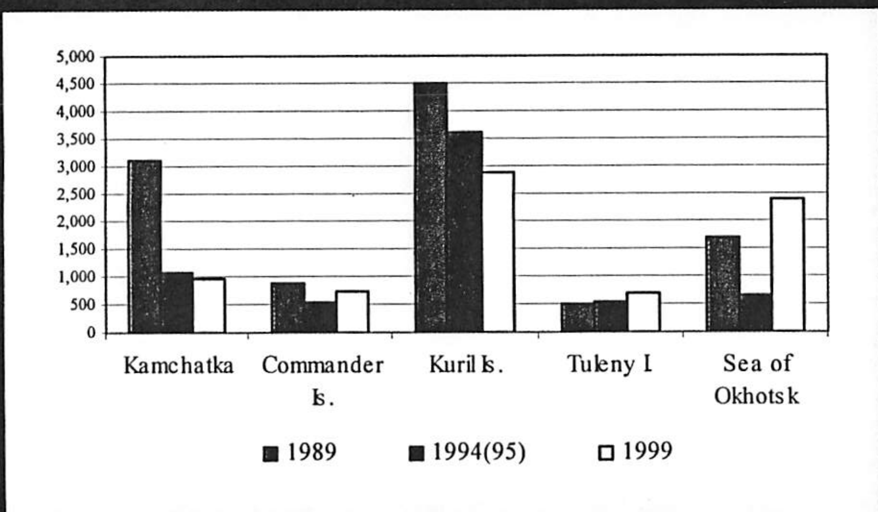
Number of SSL on Sakhalin Island by sites, 1989-99.

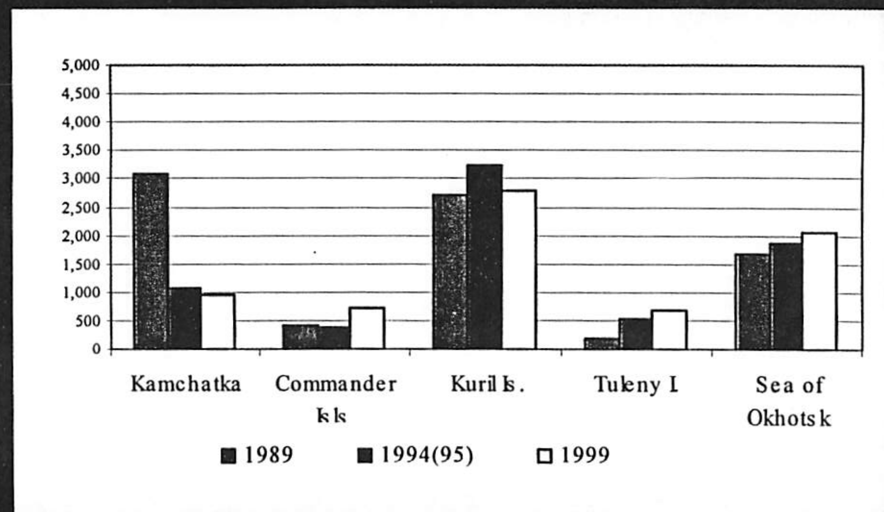


Number of SSL in Northern part the Sea of Okhotsk by sites, 1989-99.

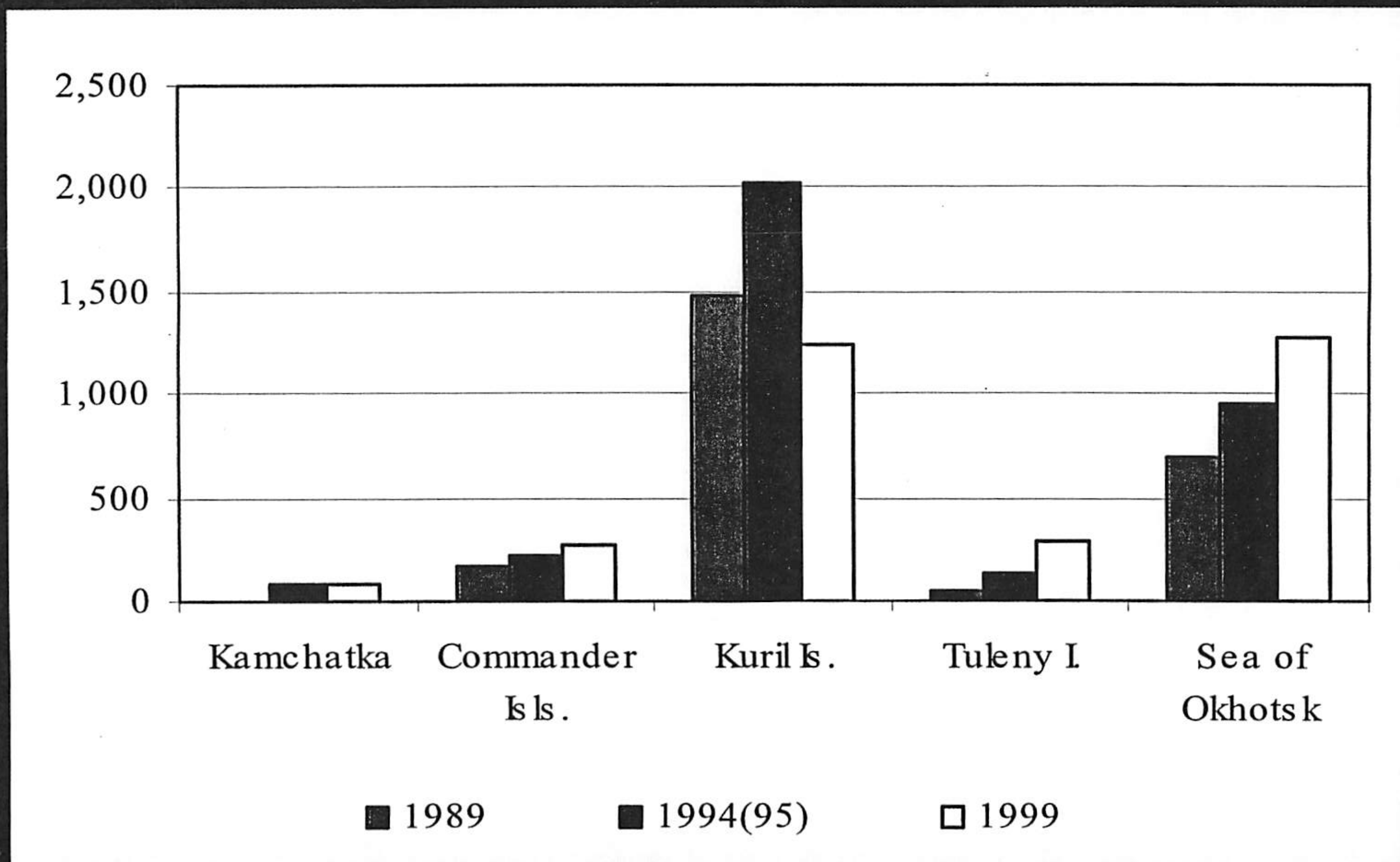


Number of SSL in Russian waters by area, 1989-99.

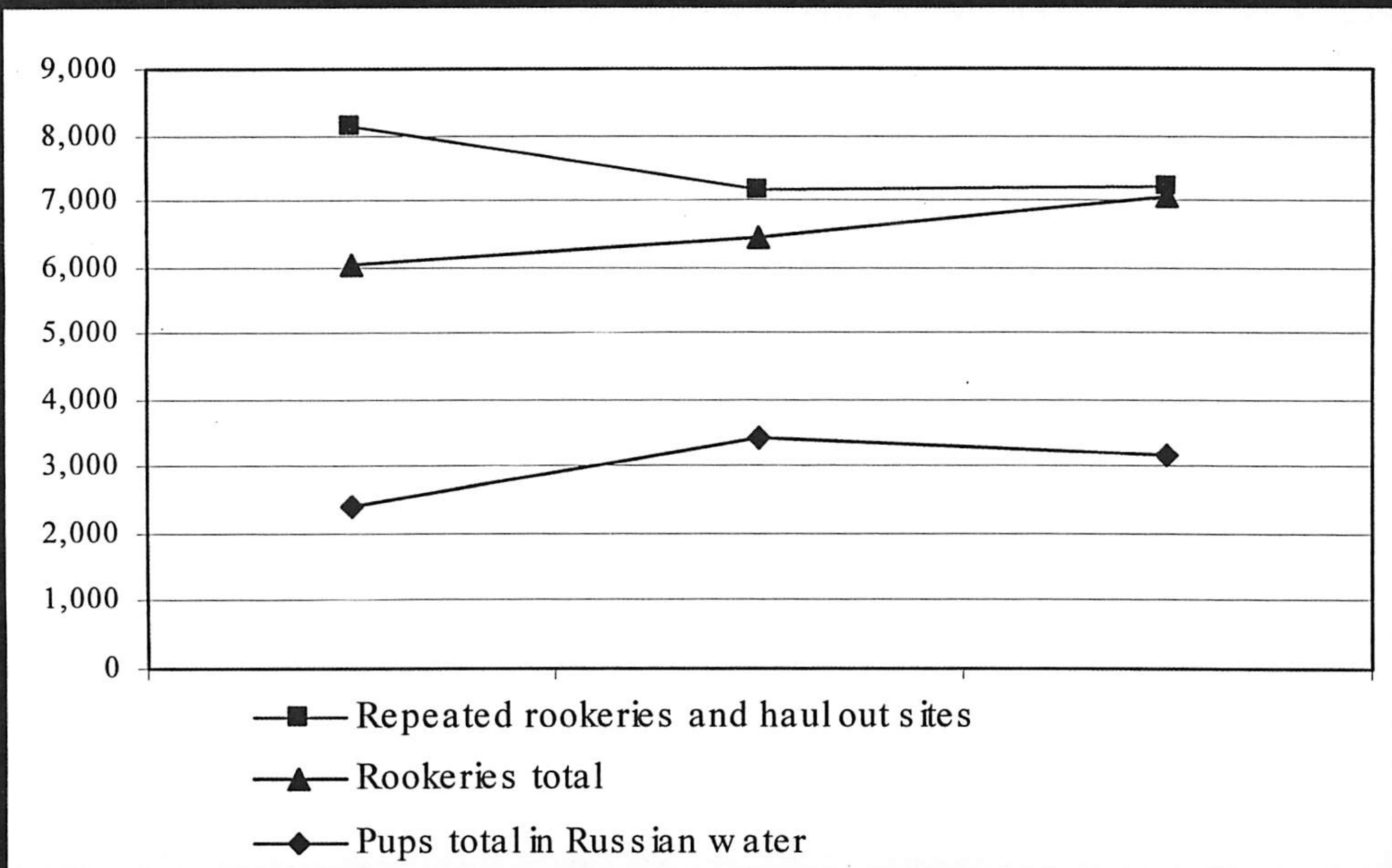




Number of new born pups of SSL in Russian waters by area, 1989-99.



Total number of SSL in Russian waters, 1989-99.



Conclusions:

- No regular range-wide SSL surveys conducted in Russian waters
- Population dynamic of SSL in Russian waters differs by area
- Number SSL of all ages increasing in northern part Sea of Okhotsk and Sakhalin I. areas

Conclusions:

Number SSL dramatically decreased on haul out sites of Kamchatka, Bering Island and northern half of Kuril range

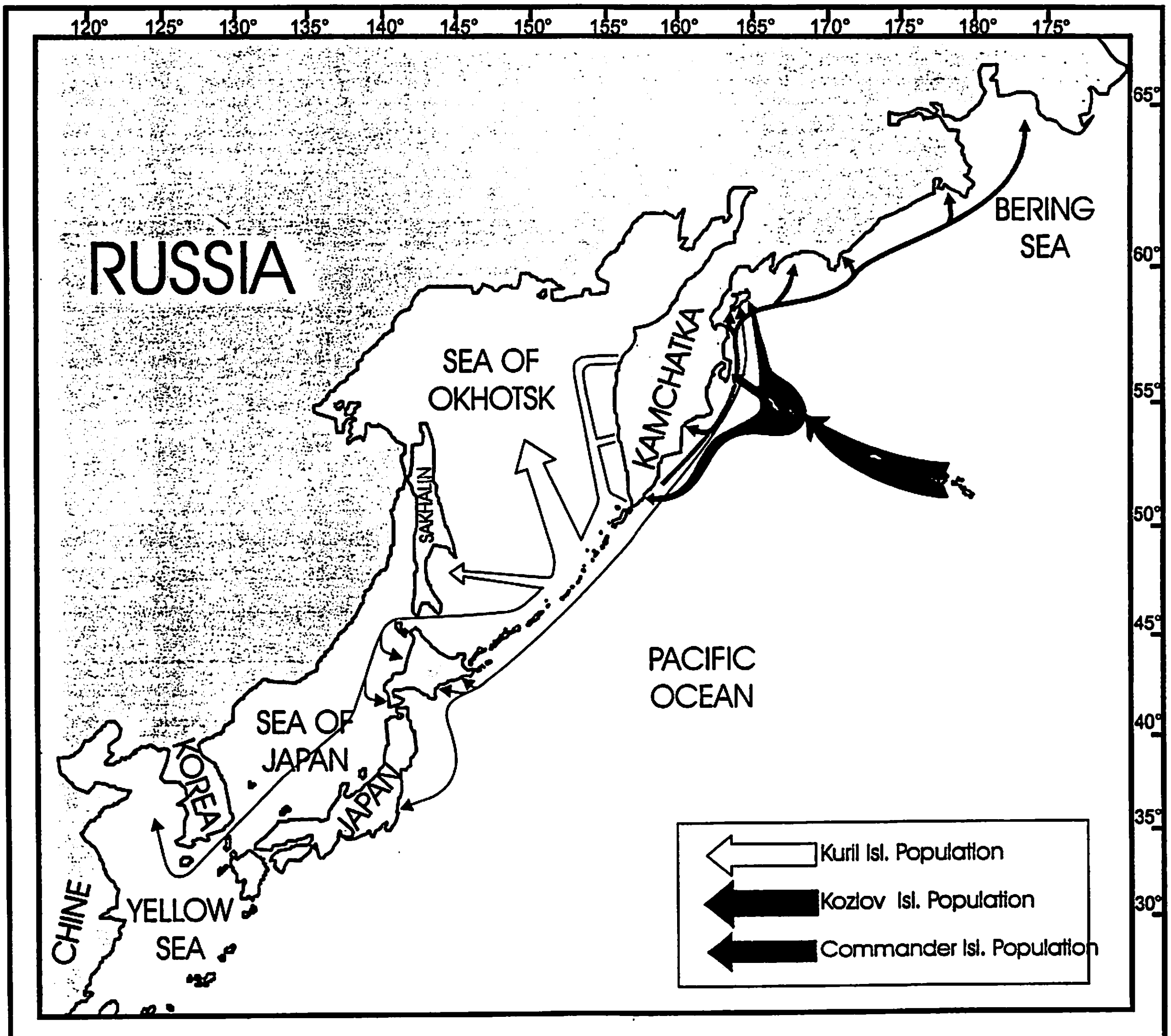
Number SSL age 1+ on the most rookeries in Russian waters slightly increases during last 10 years period (1-1.3% per year)

Conclusions:

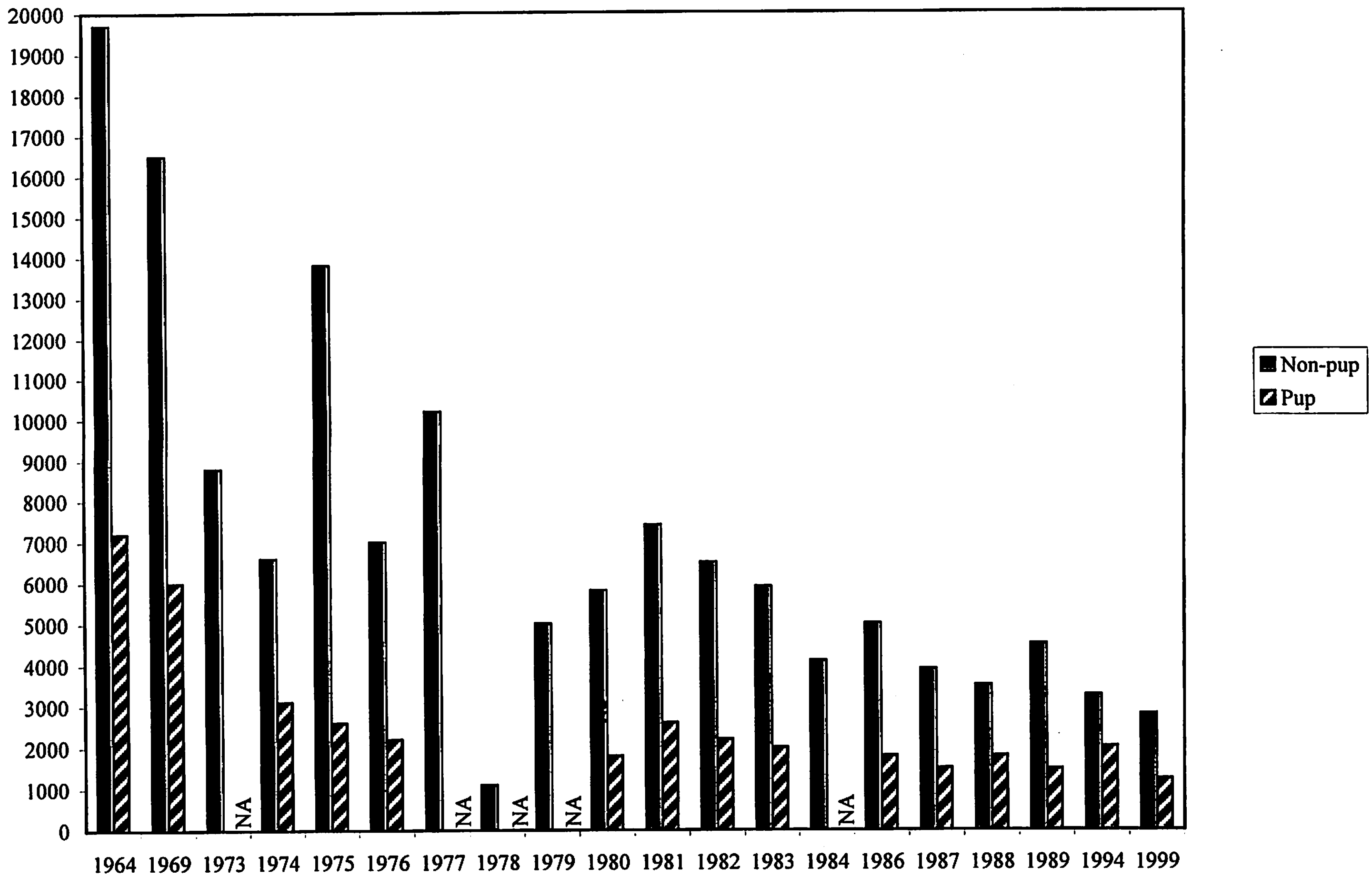
- Total number of new born pups of SSL increases in Russian waters in average 2.7% per year during last 10 years period

- It is necessary to conduct range –wide survey of SSL on all rookeries and haul out sites in Russian waters (along Kuril I. especially)

MIGRATION ROUTS OF STELLER SEA LIONS AT NORTH-WEST PACIFIC



Steller Sea Lion Counts for the Kuril Islands, 1964-1999



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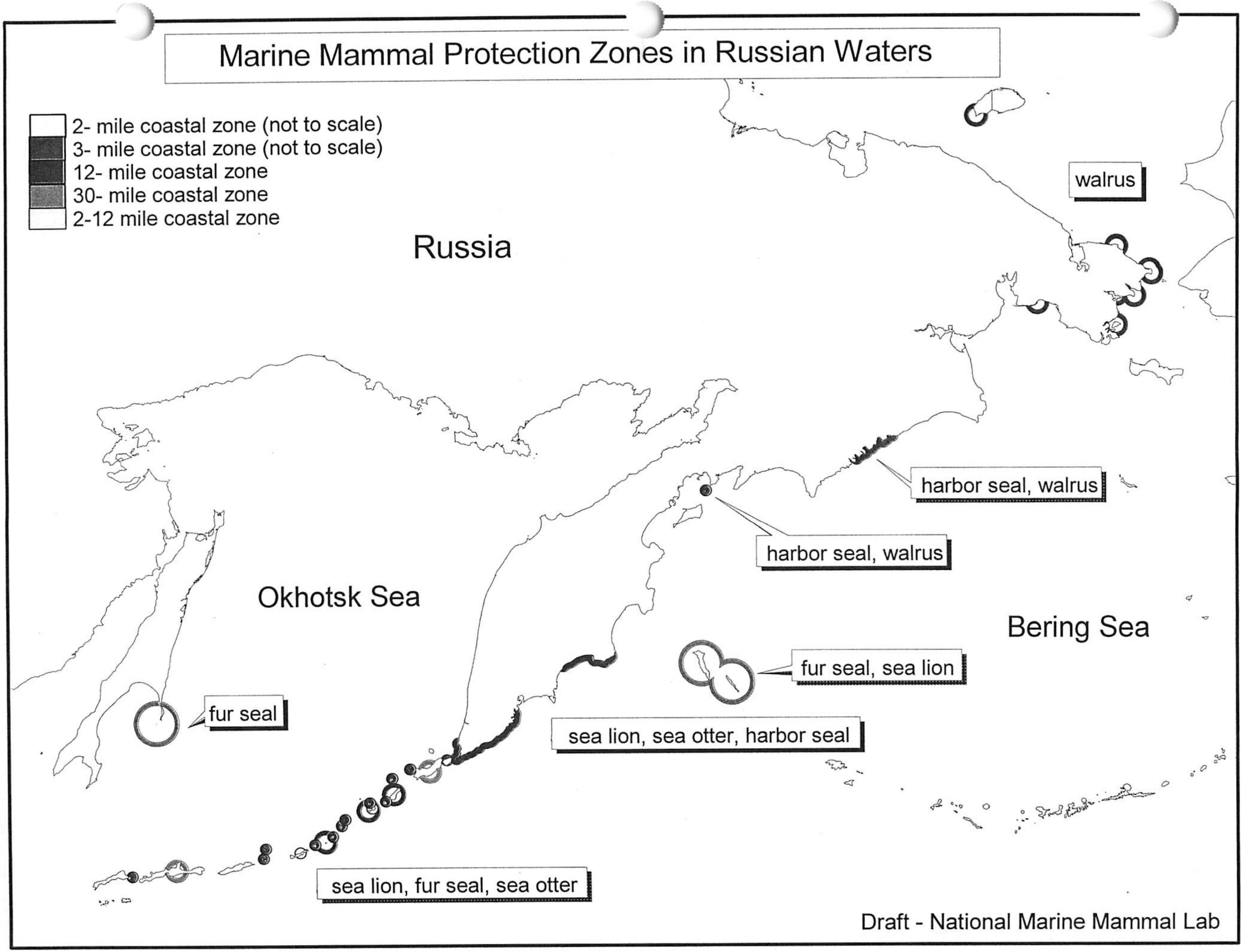
Marine Mammal Protection Zones in Russian Waters
2- mile coastal zone (not to scale)
3- mile coastal zone (not to scale)
12- mile coastal zone
30- mile coastal zone
2-12 mile coastal zone
Russia
walrus
harbor seal, walrus
harbor seal, walrus
Okhotsk Sea
Bering Sea
fur seal, sea lion
fur seal
sea lion, sea otter, harbor seal
sea lion, fur seal, sea otter
Draft - National Marine Mammal Lab

US/RUSSIA STUDIES

- Original agreement signed 23 May 1972 by President Nixon and Chairman Podgorniy with the title "Agreement between the United States of America and the Government of the Union of Soviet Socialists Republics on Cooperation in the Field of Environment Protection"

- Revised agreement signed 23 June 1994 by Vice President Gore and Prime Minister Chernomyrdin with the title "Agreement between the Government of the United States of America and the Government of the Russian Federation on Cooperation in the Field of Protection of the Environment and Natural Resources"

- Original agreement contained eleven areas of focus (Table 1.). New agreement contains only Area V.

- Major flaw of the agreement is that it contained no funding provisions; all activities must be funded by the agencies or investigators involved.

- Joint activities under Area V are sanctioned by the two governments when they sign a Protocol at the annual meeting.
    - Alternate countries each year for Area V meeting. Last was in Moscow in March 2000 and one before that was in Seattle in February 1999.
    - Protocol is signed by US Fish and Wildlife Service and the State Committee of the Russian Federation for Environmental Protection.

- The Area V annual meeting consists of presentations by the Project Leaders of accomplishments over the past year from each country and agreed upon proposed joint work.

- Some Projects meet only during the Area V annual meeting; others may meet at varying time intervals outside the Area V meetings. The Marine Mammal Poject meets about every 12-18 months.

Table 1. Organization of activities under the US/USSR Environmental Protection Agreement. The program was administered by the Joint Committee, made up of American and Soviet Chairmen and Executive Secretaries.

Area

I. Prevention of air pollution
II. Prevention of water pollution
III. Prevention of pollution associated with agricultural production
IV. Enhancement of the urban environment
V. Protection of nature and the organization of preserves
VI. Protection of the marine environment from pollution
VII. Biological and genetic effects of environmental pollution
VIII. Influence of environmental changes on climate
IX. Earthquake prediction
X. Arctic and subarctic ecological systems
XI. Legal and administrative measures for protecting environmental quality

Projects under Area V.

1. Conservation of wild species of flora and fauna
2. Protection of northern ecosystems
3. Reclamation and revegetation of disturbed land
4. Biosphere reserves
5. Arid ecosystems
6. **Marine mammals**
7. Plant and animal ecology
8. Icthyology and aquaculture

PROJECT 02.05-6 – MARINE MAMMALS

- Project Leaders are Drs. Thomas R. Loughlin (NMFS,AFSC, NMML) and Valeriy Vladimirov (VNIRO, Moscow). Loughlin is second; Vladimirov is the third.

- Project meets about every 12-18 months in alternate countries.

    - First meeting was in January 1973; most recent was in November 1999 in Petropavlovsk-Kamchatka

- On the US side, a 9-member Steering/Planning Committee reviews proposals made by scientists throughout the marine mammal research community and assists in developing a package for presentation at Project meetings

    - Steering Committee consists of: Dr. R. Brownell (NMFS, La Jolla), Dr. E. Knudsen (BRD, Anchorage), Dr. B. Kelly (UA, Juneau), Mr. S. Kohl (USFWS, Wshington, DC), Dr. T. Loughlin (chair), Mr. L. Lowry (ADFG, Fairbanks), Dr. R. Mehan (USFWS, Anchorage), Dr. W. Perrin, (NMFS, La Jolla), and Dr. B. Stewart (Hubbs Sea World).

- Project consists of four levels of activity
    - Exchange of published information
    - Exchange of unpublished data from joint projects
    - Coordination of research
    - Joint research expeditions.

Third and fourth levels have been the substantive parts of the Project.

- Over the years, the focus and level of activity fluctuates depending on funding, participation, and national interests.

- First projects focused on walrus and ice seal morphology, physiology, taxonomy, and distribution

- Cetacean projects began in 1975 in the eastern and central tropical Pacific but has since focused more on northern waters

- During the 27 years of existence, the Project has completed over 20 joint cruises, probably 40 or more joint field studies on both cetaceans and pinnipeds, and upwards of 25 or more laboratory studies.
    - These 85 or more scientific activities have involved exchange of probably over 300 scientists of the two countries.

STELLER SEA LION PROJECTS UNDER AREA V

Year	Location	Project
1981	Bering Sea	Life history, morphology
1984	Bering Sea	Life history, morphology
1985	Marmot Island	Pop. dynamics and behavior
1988	Marmot Island	Pup marking
1989	Kuril Islands	Foraging ecology, pup marking for vital rates
1989	Alaska	Aerial survey
1990	Southeast Alaska	Foraging ecology, distribution
1991	Kuril Islands	Foraging ecology and pup counts
1992	Aleutian Islands/ GOA	Pop. dynamics, pup size
1996	Kuril Islands	Pop. dynamics, pup marking for vital rates
1998	AI/GOA; cancelled–passport problems	
1999	SEA; cancelled– logistical problems	
2000	Seward	Analysis of video data
2000	Aleutians/GOA	Pup counts and marking for vital rates

** Continuous exchange of distribution, count, and branding data at Project meetings and exchange of tissue samples for genetic studies

OTHER RUSSIAN PROJECTS NOT UNDER MARINE MAMMAL PROJECT

- NMML has contracted with Natural Resources Consultants, Inc., to review Steller sea lion counts by age and sex group at each of the Russian rookeries in the Kuril Islands Commander Islands, and Kamchatka Peninsula. These will then be analyzed for trends by area and compared to Russian protective zones around different sites and comparisons made.

- NMFS-F/PR contracted individual Russian scientists in 1998 to prepare a summary of species for which they are considered experts. Two of these accounts were prepared for Steller sea lions. The work was completed in 1999; however the reports were submitted in Russian. NMML has received a commitment from the US Marine Mammal Commission to have these reports translated into English.

  - Russian Steller sea lion studies: 1991-97 by V. Burkanov

  - Steller sea lion research of TINRO: 1930-90.