ABUNDANCE AND DISTRIBUTION OF MARINE MAMMALS IN NORTHERN BRISTOL BAY

--A Status Report of the 1991 Marine Mammal Monitoring Effort at Togiak National Wildlife Refuge

BY
LAURI A. JEMISON

MAY 1992

KEY WORDS:

Bristol Bay	haulout
Cape Newenham	northern sea lion
Cape Peirce	Pacific walrus
harbor seal	southwest Alaska

A COOPERATIVE EFFORT BETWEEN

U.S. Fish and Wildlife Service
Togiak National Wildlife Refuge
P.O. Box 270
Dillingham, Alaska 99576

and

Alaska Fish and Wildlife Research Center
Fairbanks Field Station
101-12 AVE N Box 20
Fairbanks, Alaska 99701

and

U.S. Fish and Wildlife Service
Marine Mammals Management
4230 University Drive, Suite 310
Anchorage, Alaska 99508

and

National Marine Fisheries Service
National Marine Mammal Laboratory
7600 Sand Point Way N.E., Bin C15700
Seattle, Washington 98115-0070

and

Alaska Department of Fish and Game
Division of Wildlife Conservation
P.O. Box 1030
Dillingham, Alaska 99576

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SUMMARY

The number of walruses hauled out at Cape Peirce was the highest since 1988, with a peak count of 4008 animals on 12 September. Fifteen haulout peaks occurred from June through September, with haulout periods ranging from 6 to 13 days. Opportunistic censuses of walrus haulout beaches at Cape Newenham produced a high count of 870 on 5 July. Fluctuations in haulout numbers at Cape Peirce and Round Island from 1987 through 1991 may be the result of disturbance from of yellow-fin sole vessels in northern Bristol Bay.

Walrus carcasses on the beach were counted and mapped during coastal survey flights in northern Bristol Bay. The highest concentration of carcasses occurred along the southwestern shores of the Nushagak Peninsula. Other concentrations occurred along the eastern shores of Hagemeister Island. The maximum number of carcasses observed during a single survey was 49.

Nanvak Bay near Cape Peirce continues to be the largest seal haulout in northern Bristol Bay. A peak count of 400 seals in Nanvak Bay was recorded on 3 September. This peak is significantly lower than the peak count of 3100 in 1975. This decline parallels harbor seal population trends throughout the state of Alaska; the causes of the decline are unknown and must be further investigated. Both spotted and harbor seal pups were observed, with a high of 21 pups recorded on 25 June.

In cooperation with the National Marine Fisheries Service, six surveys were flown of the northern Bristol Bay harbor seal haulout sites from 23 August through 5 September. The high count for the surveys was 953 seals on 29 August, with a mean count of 750 animals.

Cape Newenham continues to be an important haulout for the threatened northern sea lion. Monitoring effort continued in 1991 in cooperation with NMFS. The haulout was surveyed from the air and ground between late April and late October. The peak count of 1295 occurred on 16 May. Approximately 30 sea lions were also observed in December during an unrelated flight. Composition of sea lions at the haulout was variable, with the percent juveniles ranging from 8-23 throughout the season. Eight tagged sea lions were seen during ground observations; numbers were read from three of the tags.

INTRODUCTION

Togiak National Wildlife Refuge's (TNWR) rocky coast and sand beaches support a diverse and abundant marine mammal population. The Cape Peirce-Cape Newenham area and the Walrus Islands State Game Sanctuary are two areas particularly rich in marine mammals, providing haulout areas for walruses (Odobenus rosmarus divergens), harbor seals (Phoca vitulina), spotted seals (Phoca largha) and northern sea lions (Eumetopias jubatus).

Round Island and Cape Peirce are the only two regularly used terrestrial haulouts for Pacific walruses in the United States. Walruses periodically haul out at Cape Seniavin and Cape Newenham, however these areas are not used every year (Frost et al. 1982). The female and young walruses that winter in and near Bristol and Kuskokwim bays migrate north in the spring, however the males remain behind and haul out at Cape Peirce and Round Island (Fay 1982). Cape Peirce was historically used as a haulout but was abandoned sometime during the first half of this century (Taylor, pers. comm.). Walruses began reusing the haulout in 1981 and have returned every summer since (Annual Narrative, TNWR 1981).

In 1987 and 1988 the number of walruses hauling out at Cape Peirce and Round Island declined (Alaska Dep. of Fish and Game and TNWR unpub. data). During

this time fishing for yellow-fin sole in northern Bristol Bay began, with fishing activities concentrated in the Round Island area. Concern that the decline in the number of walruses hauling out might be related to the initiation of the yellow-fin sole fishery resulted in the National Pacific Fisheries Management Council's (NPFMC) decision to restrict yellow-fin sole fishing activities. In August of 1991 the NPFMC voted to continue indefinitely the 12-mile closure around Cape Peirce and Round Island with a three mile transit zone around Right Hand Point. The U.S. Fish and Wildlife Service (USFWS) has verbal agreements with the NPFMC, the National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADFG) to continue monitoring the walruses at Cape Peirce as part of the effort to assess the effects of the fishery.

Harbor (and some spotted) seals haul out along the Togiak NWR coast, with highest concentrations at Nanvak Bay and Hagemeister Island. Nanvak Bay is the northern-most pupping area and the largest haulout for harbor seals in northern Bristol Bay (Frost et al. 1982). The number of seals hauling out in Nanvak Bay has declined over the past 15 years (TNWR unpub. data, Jemison 1991). Population trends examined in the Gulf of Alaska indicate a similar population decline. Limited data from Prince William Sound and the southeastern Bering Sea also suggest that since the mid 1970s harbor seal numbers have declined (Pitcher 1990).

Cape Newenham and Round Island support the two largest sea lion haulouts in northern Bristol Bay. Sea lion populations have been monitored by ADFG staff at Round Island since the late 1970s. Monitoring of the sea lions at Cape Newenham began in 1990. In 1991 more concentrated efforts determined that juvenile and adult male and female sea lions use the Cape Newenham haulout, and that pupping is rare. From the late 1950s to the mid 1980s, sea lion numbers have declined in Alaska (Hoover 1988). In 1990 the northern sea lion was listed as a threatened species, making this a critical time to monitor sea lion haulout sites and rookeries.

During 1991, joint efforts between TNWR, Alaska Fish and Wildlife Research Center-Fairbanks (AFWRCF), Marine Mammals Management (MMM), NMFS, and ADFG have worked to determine abundance and distribution of walruses, seals, and northern sea lions in northern Bristol Bay. A continued cooperative effort will help insure responsible management of these species.

OBJECTIVES

1. Determine number of walruses, number and average length of haulout peaks, and long-term population trends at Cape Peirce.

2. Determine haulout locations and number of walruses at Cape Newenham.

3. Determine walrus behavioral response to aircraft and boats at Cape Peirce.

4. Determine changes in the number of walrus carcasses on the beaches of northern Bristol Bay.

5. Determine number, number of pups, peak numbers during pupping and molting periods and long-term population trends of harbor and spotted seals hauling out in Nanvak Bay.

6. Determine number of harbor seals in northern Bristol Bay during the molting period, in cooperation with NMFS.

7. Determine sex and age composition and seasonal fluctuations in number of sea lions at Cape Newenham. Determine number of pups born there.

STUDY AREA

The study area covers approximately 275 miles of coastline in southwest Alaska from the Igushik River in Nushagak Bay to Chagvan Bay (Fig. 1) and includes Hagemeister Island (Alaska Maritime National Wildlife Refuge) and Walrus Islands State Game Sanctuary (ADFG). The Cape Peirce-Cape Newenham area is located approximately 120 miles west-southwest of Dillingham within Togiak National Wildlife Refuge. Steep, jagged cliffs above rock and sand beaches characterize the coastline in this area. Nanvak Bay is located two miles north of Cape Peirce Point (Fig. 2).

METHODS

WALRUSES

Haulout

Cape Peirce: Beaches where marine mammals haulout at Cape Peirce were checked daily and the following information was recorded: date, time, weather (wind direction and speed, cloud cover, visibility, precipitation, temperature, barometric pressure), tide, beach conditions, number of animals hauled out, number of animals in the water, unusual scars or features on walruses.

Animals were counted using binoculars and a tally whacker from the same observation points each day to minimize inconsistencies. Each haulout was counted at least two times and the counts averaged. For smaller haulouts (<500 animals), if the two counts were not within 5% of each other the animals were counted a third time and the two closest counts were averaged. For larger haulouts (>500), at least four counts were made, the high and low counts discarded and the rest averaged. Haulouts of more than 200 animals were photographed with a 35mm Nikon camera, 200mm or 35-70mm lens, using black and white print film ASA 200 or 400. Prints were counted using a magnifying glass, each walrus marked with a felt marker when counted. Comparisons between the photographs and the ground counts have not been completed to date.

A VHF receiver was used from 14 June through 21 August to monitor the Cape Peirce haulouts for walruses that were fitted with VHF transmitters in 1990 and 1991. Haulouts were visually scanned each day for transmittered animals.

Radio contact was maintained with personnel on Round Island each night to compare walrus activity at the two haulouts.

Cape Newenham: Walruses were counted at Cape Newenham whenever possible, either from the cliff above the haulout using binoculars, during aerial surveys, or from photos and estimates made from the Refuge's 24-foot aluminum boat as it travelled approximately 1/2-3/4 mile offshore.

Round Island: The walrus haulout on Round Island was monitored by ADFG Wildlife Technicians from 30 April through 28 August. Three aerial surveys were flown over the island after camp was closed in August. Flights ranged from 3/4 to 1 mile offshore at an altitude of 1000-2000 feet.

Cape Seniavin: Data on the number of walruses hauling out at Cape Seniavin was collected opportunistically. The number of walruses was estimated by local pilots during flights along the Alaska Peninsula, or during harbor seal aerial surveys.

Behavioral Observations

Two types of observations were made in order to characterize walrus haulout behavior. Behavior definitions were adapted from R. E. Salter (1979) by P. Hessing (pers. comm.).

Scans: This type of observation looked at a few individual walruses during a specific time period. Scans were done at South Firebaugh Beach. At the start of each scan, and once every hour, weather data and the number of walruses hauled out and in the water was recorded. Five individual walruses were selected throughout the group (some from the edge, some from the center), and behavior of each animal was recorded every ten minutes. Each scan lasted two hours.

Behavior for each walrus was recorded using the following definitions:

Rest:	Recumbent and immobile
Awake:	Relatively inactive: grooming, shifting, fanning
Interactive:	Involved with other individuals to some degree: tusking/jabbing, visual threat, defending (holding flipper out against tusking walrus)

Beach Watch: Observations were made to document what types of stimuli cause walruses to exhibit synchronous behavior. Responses to both natural and human-related stimuli were recorded. Observations were made at South Firebaugh Beach; the following information was recorded at the start: weather conditions, number of walruses on the beach and the number in the water. Total number of walruses moving on and off the beach was recorded for each hour. When a group of walruses responded to a stimulus, the type of stimulus, the number of walruses responding, and the behavior exhibited were recorded. Each Beach Watch lasted two hours.

Stimuli Types:

Visitor
Observer
Plane: flying, landing
Boat: approaching, passing
Rockfall
Wildlife (note what type)
Walrus (use I for code)
Unknown
Non synchronous (double code or describe as necessary)

Behavioral Response to Human Activities

In the past at Cape Peirce, walruses have moved off the beach when boats or planes travel near hauled out animals (O'Neil and Haggblom 1987, Sheffield 1988, Jemison 1989 and 1991). Walrus response to boats and planes was collected opportunistically throughout the summer. In order to determine the degree of a response, walrus behavior was divided into three category levels, based on Salter (1979). The number of walruses responding at each level was recorded.

Level 1: Walruses raise heads or move bodies, seen as a wave or ripple within a group of walruses.

Level 3: Walruses move toward water, usually stopping on the beach or at the water line.

Level 5: Walruses move directly into water, usually do not mill, and do not haul again for at least several hours.

The number of walruses responding at a particular level is multiplied by the value of that level. The product of these numbers determines the index category and associated degree of response (Hessing & Sheffield 1989).

INDEX	DEGREE OF RESPONSE
0-100	LOW
101-1000	MODERATE
1000+	HIGH

AERIAL SURVEYS

Surveys were flown along the northern Bristol Bay coast from mid May through August, in a Cessna 185 on floats, at an altitude of 300-500 feet and an airspeed of 110 knots.

Carcasses

Marine mammal carcass locations were mapped and degree of decay was estimated. The coastline between the Igushik River and Chagvan Bay was divided into 32 areas based on beach type (sand/gravel or rocky) and/or exposure. Islands (except for Hagemeister) were considered separate, single areas. Two of the four surveys covered the area from the Igushik River to Tvativak Bay.

Three walrus carcasses were marked (using rope and spray paint) in August and September of 1990. The carcasses were photographed once a week through the end of September, 1990. One carcass remained on the beach throughout the winter and was photographed five times in 1991.

Marine Mammals

Location and numbers of marine mammals were recorded on maps (scale: 1:250000) of the coast. The sea lion haulout at Cape Newenham was photographed with a 35mm Nikon camera, 135mm zoom lens. Color slide film, ASA 200 was used. Slides were projected onto white paper and the number of sea lions counted.

SEALS

Haulout/Nanvak Bay

An observation point established on North Spit in 1990 was used again in 1991 to census the seals hauled out on the mid-bay bars in Nanvak Bay. A Klepper kayak was used to cross Nanvak channel to North Spit. A secondary observation point 1/3 mile east of Lee's Landing was used when bad weather (usually high winds) made channel crossing risky or when seals were present on North Spit. Counts were made at or close to the lowest tide of the day (usually in the late afternoon or evening), primarily with a 600mm spotting scope, or occasionally with a pair of 8 x 23 binoculars. Data recorded were: date, time, weather, tide, number of seals hauled out, number in the water, number of pups, wounded or scarred seals. Seal scat was collected from the mid-bay bars and North Spit, approximately twice a month. Scat was stored in zip-lock bags and frozen at 0 degrees F as soon as possible for later analysis.

Harbor Seal Survey

Six coastal surveys were flown in cooperation with NMFS to determine harbor seal numbers in northern Bristol Bay. Surveys were flown during the peak of the molt (23 August-5 September) beginning 1-2 hours before low tide. All but the second survey were flown in a Cessna 185 on floats; the second survey was flown in a Cessna 185 on wheels. Surveys were flown at an altitude of 300 to 500 feet and an airspeed of 110 knots. The haulout on the southwestern side of Hagemeister Island was photographed with a 35mm Nikon camera with a 135mm zoom lens and color slide film, ASA 200. Slides were projected onto white

paper and the number of seals counted.

The 23 August survey covered the coast from the Igushik River to Asigyukpak Spit, where poor weather conditions ended the survey. On 28 August the coast from Asigyukpak Spit to Chagvan Bay was surveyed. The goal of the first and second surveys was to identify all haulout locations as well as count the number of seals. Subsequent surveys covered only the areas identified as haulout locations.

NORTHERN SEA LIONS

Numbers

The number of sea lions hauling out at Cape Newenham was monitored during aerial surveys (visual estimates and slides) and ground counts.

Sex and Age Composition

Sex and age composition data was collected during ground surveys. Four observation points were established on the cliffs overlooking sea lion haulout areas at Cape Newenham. Observations were made with 8 x 23 binoculars, and data recorded were: date, time, weather conditions (wind direction and speed, cloud clover, precipitation), total number of animals, number of juveniles (animals 1 to 4 years old), and number of adult males. Females with nursing young, flipper-tagged animals and sea lions entangled in plastic or netting were recorded and photographed. Sea lions were photographed with a 35mm Nikon camera, a 300mm lens or a 35mm Ricoh camera with a 200mm lens. Color slide or print film, ASA 64 or 100, was used.

RESULTS

WALRUSES

Numbers/Haulout Patterns

Cape Peirce: Walrus haulout beaches were censused daily at Cape Peirce from 25 April-26 September. The census was not done on 5 days during this period. Walruses were first observed hauled out at Cape Peirce on 25 April, but the numbers were low and sporadic until 2 June, after which time 100 animals or more were usually present on at least one of the beaches. The maximum number of walruses was 4008 on 12 September. Fifteen peaks in the number of walruses hauled out occurred between 2 June and 26 September (Fig. 3). Length of haulout periods (the number of days from one low count to the next) ranged from 6 days to 13 days with a mean length of 8.1 days. Number of days between peaks ranged from 5 to 17 with a mean of 7.3 days. No VHF or satellite-linked radio transmitters were heard or seen at Cape Peirce this year.

Cape Newenham: Walruses were observed hauled out on the north side of Cape Newenham 22 times from 11 May-20 October (Table 1). The high count at Cape Newenham was 870 on 5 July. Walruses most often hauled out on the beaches in Bird Rock Cove, occasionally in Whitey Cove (Fig. 2).

Round Island: The peak walrus count was 4637 on 5 July (Van Daele, 1991). Three aerial surveys were flown over Round Island after ADFG closed camp. The estimated number of walruses hauled out: 350 on 21 September, 2000 on 28 September and 325 on 9 October. One satellite transmitter (no. 8427) that was deployed in 1990 was seen at Round Island on 7 July (Sheffield, pers. comm.).

Cape Seniavin: Walruses were observed at Cape Seniavin 11 times from 7 May through 12 December (Table 2). The high estimate for the year was 1500-2000 walruses on 6 November (Seybert, pers. comm.).

Behavioral Observations

Scans and Beach Watches: Nine Scans and nine Beach Watches were conducted between 12 June and 18 August. Data collected have not been analyzed.

Behavioral Response to Human Activities

Sixteen aircraft and ten boats travelled past hauled out walruses causing them to respond. Two occurrences were at Odobenus Cove, six on South Firebaugh Beach and eighteen on Maggy Beach. There were three degrees of response ranging from low to high (Table 3). One party hunted at Cape Peirce this season.

Aerial Surveys

Four aerial surveys of northern Bristol Bay were flown 16 May, 10 June, 17 July and 23-28 August. The first two surveys began at Tvativak Bay on the northwest edge of the Nushagak Peninsula; the last two surveys began at the Igushik River in Nushagak Bay. The coast from Chagvan Bay to Carter Spit was not surveyed this year.

Carcasses: The Cape Peirce and Round Island haulouts were not surveyed for carcasses during the aerial surveys. The Maggy Beach section of area 17 was surveyed from the ground on 1 August, when 29 carcasses were counted on the sand beach between the base of the cliffs and the mouth of Nanvak Bay.

Six areas were identified where walrus carcasses concentrate: area 1 (the tip of Cape Constantine), area 2 (the southwestern side of Cape Constantine), area 14 (Asigyukpak Spit to Shaiak Island), area 17 (Cape Peirce Point to the northern end of North Spit, during ground survey), area 25 (the southeastern side of Hagemeister Island), area 29 (Crooked Island) (Fig. 4). The highest concentration occurred along the southwestern side of Cape Constantine (mean: 13.5, standard deviation: 1.5). The maximum number of carcasses observed during a survey was 49 on the 23-28 August survey (Table 4). All the concentration areas were on sand/gravel beaches. Exposure varied at each concentration area: east, southeast, south, southwest and west.

Data collected on deposition, duration and decomposition of carcasses have not been analyzed.

SEALS

Nanvak Bay

Haulout Patterns: Seals hauling out in Nanvak Bay were censused daily from 24 April-26 September. The census was not done on 8 days during this period. Seals began hauling out on the mid-bay bars on 3 May. The bars were used exclusively until 17 August when seals began to use Channel Bar and 22 August when seals began to use North Spit. Mid-bay bars and North Spit were the most heavily used haulout areas from late August to late September.

Numbers: The number of seals in Nanvak Bay increased throughout the season (Fig. 5). In northern Bristol Bay, molting probably peaks in late August and early September (Johnson 1976). The peak haulout count for the molting period as well as the high count for the year occurred on 3 September with a total of 400 seals in Nanvak Bay. Both harbor and spotted seals haul out in Nanvak Bay, however the percentage of each was not determined in 1991. Six to ten seals were often seen hauled out on the rocks below Rugged Point east of Cape Peirce Point, though this area was not censused regularly. Seal scat collected in 1990 and 1991 has not yet been analyzed.

Pupping: The first spotted seal pup observed in Nanvak Bay was found dead on mid-bay bar on 21 May. The pup was probably born only a few hours before discovery; part of the placenta was still attached to the body. It is not known if the pup was born live as there were no signs in the sand that the pup had moved since birth. Both a boat and a plane disturbed the seals off the bars around the time the pup was born.

The first harbor seal pup was seen on 4 June. The number of pups increased until a high count of 21 was recorded on 25 June (Fig. 6). The peak haulout during the pupping period was 151 seals on 14 June.

Northern Bristol Bay Haulout Locations

The coastal surveys identified all haulout areas of harbor (and possibly spotted) seals in northern Bristol Bay (Fig. 7). Small (<100 animals), regularly-used hauling areas are: Metervik Bay, Rocky Point, Estus Point, Pyrite Point, Rugged Point, the northern and southern coast of Cape Newenham, the western coast of Security Cove, the north-eastern coast of Hagemeister Island, the western coast of Summit Island, the southern and western coasts of High Island, the southern end of Crooked Island and Black Rock. The two largest (>100 animals) haulout areas are in Nanvak Bay and on the south-western tip of Hagemeister Island.

Harbor Seal Survey

Six surveys were flown in cooperation with NMFS during the peak molting period (late August-early September) to determined the number of seals along the coast. The high count for the six surveys was 953 seals on 29 August, the mean was 750 seals.

NORTHERN SEA LIONS

Cape Newenham

Numbers: The northern sea lion haulout at the tip of Cape Newenham was surveyed twenty times from 3 April to 24 October. The peak sea lion count was 1295 on 16 May. The number of animals hauling out began declining after the peak, however there were still 600-800 sea lions using the area through late June (Table 5, Fig. 8). One mother and pup were seen three consecutive days on 3-5 July (Martin, pers. comm.). The pair was hauled out separately from the rest of the sea lions.

Sex and Age Composition: Sex and age composition data was collected during ground observations on three days in late June and again on three days in late July/early August. 10% to 23% of the total sea lions observed in late June were juveniles (1-4 years old). In late July/early August, the number of juveniles ranged from 8% to 17% (Table 6).

Total number of adult males present in late June ranged from 12 to 21. Two or three adult males were present in late July/early August. Sentry Point and White Rock haulout areas were used at least through early September. No animals were present on Solstice Beach or Lands End by late July.

Tagged Animals: Eight tagged sea lions were seen. All tags were red plastic and placed in the fore flippers. Numbers on the tags were extremely difficult to read, especially when dry. Only three times were numbers identified: #188 was observed on 22 June and 24 June, and # 203 was observed on 4 August. Both were males, tagged as pups on Ugamak Island on 2 July, 1990 (Merrick, pers. comm.). All but one of the tagged sea lions were seen from the White Rock observation point, the closest observation area to hauled out sea lions.

Other Observations: On four occasions female sea lions were seen nursing juveniles, 1-2 years old. Six times sea lions were observed with plastic or metal material encircling the neck (one individual was seen three consecutive days). In each case the material was cutting into the animal's neck, with folds of skin hanging over the band.

Cape Peirce

From 25 April through 11 August one to six sea lions were occasionally seen in the Cape Peirce Point-Odobenus Cove area. On two occasions one or two sea lions hauled out on the rocks in Odobenus Cove. On 11 August a sub-adult sea lion hauled out three times onto South Firebaugh Beach, in the middle of several hundred walruses. Each time the sea lion came ashore, it growled toward the walruses, then either got chased off the beach or left on its own. When in the water, the sea lion approached small groups of walruses, until it was chased. The sea lion circled and approached the walruses again. The sea lion remained in the cove for ten minutes before departing.

Chagvan Bay

During ground observations from 30 April through 11 May, 1-20 sea lions were observed swimming near the mouth of Chagvan Bay. On 11 May herring were seen in the bay along with 50-75 sea lions actively pursuing and feeding on the herring. Sixty sea lions were seen during a flight over the bay on 14 May, it appeared they were feeding.

Round Island

The peak sea lion count was 534 on 15 May (Sheffield, pers. comm.). Two surveys were flown over the sea lion haulout at Round Island after ADFG closed their camp. On 9 October approximately 180 sea lions were observed and on 21 September approximately 100. Two pups were born on the island; one died of unknown causes (Van Daele, 1991). Two flipper-tagged animals were observed, and there were 11 sightings of sea lions with debris around their necks (Van Daele, 1991).

DISCUSSION

WALRUSES

Limitations of Data

Inconsistencies exist in the walrus data collected at Cape Peirce from 1981 through 1986. The first walrus activity documented at Cape Peirce during this century occurred in late November 1981 when approximately 2500 walruses were observed on Maggy Beach (Annual Narrative, TNWR 1981). Several aerial surveys were flown in 1982 and 1983 but daily ground counts were not begun until 1984 when a field camp was staffed from June to September. From 1984 through 1986 untrained volunteers rotated through the field camp and censused the walruses, producing inconsistent counts. For example, a photo was enlarged of the peak haulout in 1986. The ground estimate proved to be 35% to 40% higher than the estimate from the photo (11800 ground estimate vs 7100-7500 photo estimate). As a result, the 1984-1986 peak estimates are probably biased.

The primary purpose of the Cape Peirce field camp from 1984 through 1986 was to maintain a presence in order to deter wasteful take of walruses (Hotchkiss, pers. comm.). Walrus counts became more reliable from 1987 through 1991 as personnel at Cape Peirce remained the entire season, focused on obtaining accurate counts, and had better methodological training.

The Round Island walrus numbers are also difficult to analyze. Changes in

personnel on the island and the inability to census the entire island daily result in inconsistent or incomplete haulout data (Hills pers. comm.).

With these limitations in mind, the haulout numbers from Cape Peirce and Round Island have been used to estimate numbers, general patterns in haulout behavior, and population trends over time.

Numbers/Haulout Patterns

Cape Peirce: The number of walruses using the Cape Peirce haulout steadily increased from 1981 through 1985, when a high count of 12,500 walruses was recorded. Numbers declined from 1986 through 1990. The 1990 peak of 1474 was the lowest recorded since the haulout was re-established in 1981. In 1991 the number of walruses hauling out increased over the two previous years, to a peak of 4008.

In 1989 and 1990 walruses primarily hauled out on South Firebaugh Beach and Odobenus Cove, the smaller, more protected beaches below the cliffs. Maggy Beach, a large, sandy, exposed beach where typically many more walruses haul out, was not used until August in 1989 and 1990. In 1991 walruses began hauling out on this beach on 27 June. Used only 27 days in 1989 and 12 days in 1990, Maggy Beach was used 53 days in 1991.

Seasonal peaks at Cape Peirce typically occur later in the year (July-August) than do the peaks at Round Island (May-early July) (Fig. 9 & 10). This may be due in part to the walruses' movement north in the fall to join the females that are moving south ahead of the ice edge (Fay 1982).

Cape Newenham: Information from technicians stationed at the Cape Newenham Air Force Base from 1982 through 1984 provided insight into walrus activity at Cape Newenham during those years. An Alascom technician stated that during the spring and fall months several thousand walruses hauled out on the beaches along the north side of Cape Newenham. Occasionally there were "so many walruses they would stretch from Whitey Cove east all the way to the beach below the runway" (Miller, pers. comm.). Miller had at least ten photographs of these larger haulouts. Apparently when the resupply plane (Twin Otter) came in, the animals remained on the beach, and "didn't seem bothered at all by the plane", even though the plane flew directly over the haulout when landing (Miller, pers. comm.). Almost daily while walruses were hauled out, people from the base would drive 3-wheelers to the haulout beaches, then walk slowly down the beach, scaring the walruses into the water, looking for ivory.

From 1988 through 1990 few walruses were seen at Cape Newenham. Occasionally animals hauled out in Bird Rock Cove. In 1991 walruses hauled out on the north side of Cape Newenham throughout the summer.

Currents, tides, proximity to feeding areas, frequency of disturbances, traditional locations, and population levels may all influence haulout choice. It seems that the Pacific walrus population was at its peak in the late 1970s and early 1980s and during this time new haulouts were being established and old haulouts re-established (Fay et al. 1984). This may in part explain walrus activity in the Cape Peirce-Cape Newenham area during this time.

Haulout Peaks vs Yellow-Fin Sole Fishery

A comparison of monthly peaks from 1985 through 1991 at both Cape Peirce and Round Island show fluctuations in the number of walruses hauling out from year to year. A potential cause of these fluctuations is the presence of the yellow-fin sole fishery in northern Bristol Bay. In 1987 the yellow-fin sole fishery first began fishing in the waters near Round Island. ADFG personnel on Round Island reported hearing loud noises from yellow-fin sole vessels operating near the island in 1987 and again in 1988 when the fishery returned

(Hessing and Brant 1988). At Round Island, the peak number of walruses declined from 1986 to 1987. At Cape Peirce the number of walruses also declined. In 1988 the number of walruses hauling out at Round Island and Cape Peirce was similar to 1987.

In 1989 NPFMC voted to close the waters within 12 miles of Cape Peirce and Round Island to the yellow-fin sole fishery. In 1989 and 1990 the yellow-fin sole fishery did not return to northern Bristol Bay. The number of walruses hauling out at Round Island increased in 1989 and was again high in 1990, while numbers at Cape Peirce declined both years.

In 1991 the yellow-fin sole boats returned to northern Bristol Bay and once again were active in the waters near Round Island. The number of walruses at Round Island decreased; the peak for the season was 4637. ADFG staff on the island again reported hearing noises from the vessels on calm days. Up to 27 vessels were seen at one time from the island in 1991; however, vessel types were not identified (Sheffield, pers. comm.). At Cape Peirce, the haulout peak was 4008, the highest peak since 1988.

In August of 1991 the NPFMC voted to continue the 12 mile closure indefinitely, and to allow a three mile transit zone around Right Hand Point. Despite NPFMC's restrictions, it seems likely that yellow-fin sole vessels are still a potential cause in the change in distribution and number of walruses hauling out in northern Bristol Bay. Low numbers at Round Island have occurred each year the fishery was present. Feeding areas, migration routes and/or travel corridors may be obstructed or negatively impacted by the presence of the yellow-fin sole fleet. As of 6 November nine boats linked to the yellow-fin sole fishery were cited by the Coast Guard for violating the 12-mile closure around Round Island (Dubois, pers. comm).

Carcasses

In both 1990 and 1991 walrus carcass concentration areas were predominantly on sand/gravel beaches. In 1990 eight concentration areas were identified, most with a southeast exposure. The highest concentration of carcasses occurred along the southeastern side of Hagemeister Island, with a mean of 12 carcasses. A maximum of 54 carcasses were observed during the 3-4 August survey.

In 1991 six concentration areas were identified; four of these six areas were also identified in 1990. Exposure of these six concentration areas varied from east to south to west, and the highest concentration of carcasses occurred along the southwestern side of Cape Constantine, with a mean of 13.5. This Cape Constantine concentration area was not identified as a concentration area in 1990. A maximum of 49 carcasses were observed during the 23-28 August survey.

Currents, tides, and winds probably play a significant role in the movement of carcasses in the water and in the location of their deposition. During high tides and storms carcasses can be washed higher on sand/gravel beaches than on rocky beaches and are likely to remain there longer.

SEALS

Limitations of Data

In 1975 seals in Nanvak Bay were studied intensively (Johnson 1976). From 1976 to 1983 occasional aerial surveys were flown over Nanvak Bay, but not until 1984 were ground counts resumed. In order to accurately census the mid-bay bars it is necessary to cross Nanvak channel and view the haulout from a high point on North Spit. From 1984 through 1988 the seal population was

censused only from the Cape Peirce side and not daily. In 1989 counts were made daily, but not until 1990 were the seals counted using both North Spit and Cape Peirce observation points.

Numbers/Haulout Patterns

In 1975 an estimated 3100 seals were present in the bay in late August. The maximum number of pups observed was 36. Channel bar was used primarily as a birth site in June then used heavily during the molt. In 1991 the peak count for the season was 400 seals including 21 pups. Channel bar was only used five times in August and September. Haulout patterns in 1991 were similar to those observed in 1990, when the peak count was 470, with a high of 19 pups. Channel bar was used 5 times in late September of 1990.

The decline in the number of seals in Nanvak Bay parallels population trends observed in many parts of Alaska. A variety of factors may play a role in the decline, including (Lowry 1990):

1. Changes in distribution
2. Disease or pollution
3. Subsistence harvest
4. Entanglement in nets or other debris
5. Incidental fishery take
6. Direct killing by fishermen
7. Changes in prey abundance and availability
8. Displacement by walruses hauling out at Cape Peirce (Fay, pers.comm.)

Throughout the season both boat and plane traffic, including the Refuge boat and plane, caused seals to leave the haulout.

The Nanvak Bay seal haulout is unique: it is the northern-most pupping area for harbor seals in Bristol Bay and as the season progresses, the number of seals increases until it peaks in late August/early September during molting. These factors coupled with the population decline makes the Nanvak haulout both interesting and important.

SEA LIONS

Peak counts of sea lions at Cape Newenham and Round Island occurred in mid-May. On 16 May, 1295 sea lions hauled out at Cape Newenham; on 15 May, 534 sea lions hauled out at Round Island. Herring was first sighted in northern Bristol Bay on 6 May. The commercial herring fishery had openings on 10 and 11 May, and ADFG's last herring survey was on 8 June when an estimated 14,000 tons of fish were spotted (Skrade, pers. comm.). It is probable that herring abundance and location in northern Bristol Bay influence sea lion numbers and distribution.

RECOMMENDATIONS

1. Develop a comprehensive inter-/intra-agency inventory plan to monitor marine mammals in northern Bristol Bay.

2. Continue monitoring walrus haulouts at Cape Peirce, coordinating methods and timing with ADFG. During peak haulouts at Cape Peirce and Round Island conduct aerial surveys of the Cape Seniavin and Cape Newenham haulouts.

3. In cooperation with NMFS, continue monitoring seals at Nanvak Bay. Determine their movement patterns in Bristol Bay with marked individuals. Analyze the seal scat collected at the Nanvak Bay haulout to determine diet composition. Continue scat collection each year to detect changes in prey species.

4. In cooperation with NMFS, continue monitoring the sea lion population at Cape Newenham. Determine movement patterns in Bristol Bay through marked individuals.

5. Continue monthly coastal survey flights to monitor marine mammal haulouts and carcass locations and numbers. Establish trend count areas where carcasses are most concentrated and survey these areas bimonthly. Significant changes in the number of carcasses in Bristol Bay in summer may indicate a change in the mortality rate. Significant increases in walrus mortality could be quickly realized and action taken to determine the cause of the problem. Trends in the Bristol Bay walrus population may be indicative of trends occurring on a larger scale and could prove valuable for walrus managers.

6. Develop a study plan to analyze the effects of disturbance from aircraft and boat traffic on walruses hauled out at Cape Peirce. Continue efforts to minimize boat and aircraft disturbance related to commercial fishing, public use and refuge activities.

7. Analyze the walrus carcass photographs taken at Cape Peirce to determine approximate stages of decay.

8. Compile and computerize sea lion data from Round Island to determine if number of sea lions hauling out has declined.

ACKNOWLEDGEMENTS

Thanks to the Togiak NWR staff who helped in data collection at Cape Peirce and Cape Newenham: L. Haggblom, J. Moran, P. Glidden, B. Short, and especially C. Wilson who braved the winds and rain daily (May-August) to census the walruses and seals. Nightly updates from P. Hessing and G. Sheffield (ADFG) on walrus activity at Round Island continued to be the highlight of the evening radio check. Many thanks to D. Graber who spent many hours counting walrus photos. T. Martin (Station Mechanic) and M. Miller (Alascom Technician) provided information on walrus and sea lion activity at Cape Newenham. Thanks to K. Wynne (Alaska Sea Grant) and D. and O. Seybert (Peninsula Airways) for providing counts and estimates of the Cape Seniavin haulout. Information and support provided by T. Loughlin and D. Merrick (NMFS) for the seal and sea lion work is greatly appreciated. Thanks to D. Seagars and J. Nichols (USFWS) for supporting the Cape Peirce walrus work, and to L. Van Daele (ADFG) for reviewing this report. S. Hills (AFWRCF) continued to provide support and advice for the walrus work, and reviewed this report. A special thanks to M. Hinkes (USFWS) for flying the coastal surveys and helping to coordinate all the marine mammal work done this year, and for reviewing this report.

REFERENCES CITED

Alaska Dept. of Fish and Game, unpubl. field data, 1987-1988, Dillingham, Alaska.

Fay, Francis H. 1982. Ecology and Biology of the Pacific Walrus, Odobenus rosmarus divergens Illiger. North American Fauna; no. 74. Dept. Int. Washington, D.C. 279pp.

Fay, F.H., B.P. Kelly, P.H. Gehnrich, J.L. Sease, and A.A. Hoover. 1984. Modern Populations, Migrations, Demography, Trophics, and Historical Status of the Pacific Walrus. Final Report R.U. #611. Nat. Oceanic and Atm. Admin. Outer Cont. Shelf Assessment Program. Anch., Ak. 142pp.

Frost, K.J., L.F. Lowry, and J.J. Burns. 1982. Distribution of Marine Mammals in the Coastal Zone of the Bering Sea during Summer and Autumn. U.S. Dep. Commer., NOAA, OCSEAP Final Report 20(1983).

Hessing, P., and J. Brant. 1988. Round Island field report. Unpubl. report, Alaska Dep. Fish and Game, Game Divs. Anchorage, Ak. 37pp.

Hessing, P., and G. Sheffield. 1989. Round Island field report. Unpubl. report, Alaska Dep. Fish and Game, Game Divs. Anchorage, Ak. 12pp.

Hoover, A.A. As found in: Twiss, J.R., R.J. Hofman, and J.W. Lentfer. 1988. Selected Marine Mammals of Alaska. Marine Mammal Commission, Washington, D.C. 275pp.

Jemison 1989. Unpubl. field report, U.S. Fish and Wildl. Ser., Togiak N.W.R., Dillingham, AK. 12pp.

Jemsion, L. 1991. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. Unpub. report, Togiak N.W.R., Dillingham, AK. 33pp.

Johnson, Brian W. 1976. Studies on the northernmost colonies of Pacific Harbor Seals, Phoca vitulina richardsi, in the eastern Bering Sea. Unpubl. manuscr., Alaska Dep. Fish and Game, Fairbanks. 67pp.

Lowry, L.F. 1990. Alaska's Seals and Sea Lions: Where Are They Going? Alaska's Wildlife, Alaska Dep. of Fish and Game. 20(5):37.

O'Neil, A., and L. Haggblom. 1987. Cape Peirce Walrus and Marine Mammal Censusing Report. Unpubl. field report, Togiak N.W.R., Dillingham, AK. 8pp.

Pitcher, K.W. 1990. Major decline in number of harbor seals, Phoca Vitulina Richardsi, on Tugidak Island, Gulf of Alaska. Marine Mammal Sci. 6(2):121-134.

Salter, R.E. 1979. Site Utilization, activity budgets, and disturbance responses of Atlantic Walruses during terrestrial haul-out. Canadian J. of Zoo. 57(6):1169-1180.

Sheffield, Gay. 1988. Unpubl. field report, Alaska Fish and Wildl. Ser., Togiak N.W.R., Dillingham, Alaska. 9p.

Togiak National Wildlife Refuge, Annual Narrative 1981. U.S. Fish and Wildl. Ser., Dillingham, AK. 99576.

Togiak National Wildlife Refuge, unpubl. field data. U.S. Fish and Wildl. Ser., Togiak N.W.R., Dillingham, Alaska.

Van Daele, L. 1991. Walrus Islands State Game Sanctuary Annual Report. Unpub. report, Alaska Dept. of Fish and Game, Dillingham, Ak. 6pp.

PERSONAL COMMUNICATIONS

Dubois, T. U.S. Coast Guard, Anchorage, Alaska. In communication with L. Van Daele, Alaska Dept. of Fish and Game, Dillingham, Alaska.

Fay, Francis H. Institute of Marine Science, University of Alaska, Fairbanks, Alaska.

Hessing, P. Alaska Dept. of Fish and Game, Anchorage, Alaska.

Hills, S. Alaska Fish and Wildlife Research Center Fairbanks, Fairbanks, Alaska.

Hotchkiss, L. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Martin, T. Station Mechanic, Cape Newenham, Alaska.

Merrick, R. National Marine Fisheries Service, Seattle, Washington.

Miller, M. Alascom Technician, Anchorage, Alaska.

Seybert, D. Station Manager/Pilot, Peninsula Airways, Dillingham, Alaska.

Sheffield, G. Alaska Dept. of Fish and Game, Fairbanks, Alaska.

Skrade, J. Alaska Dept. of Fish and Game, Commercial Fisheries, Dillingham, Alaska.

Taylor, K. Alaska Dept. of Fish and Game, Fairbanks, Alaska.

Table 1. Number of walruses hauled out at Cape Newenham, southwest Alaska, May - October 1991.

Date	# of Walruses	Location
5/11	15	BRC
5/27	30	BRC
6/9	80	BRC
6/10	285	Whitey
6/20	450	Whitey
6/20	12	BRC
6/21	450	Whitey
6/22	450	Whitey
7/5	870	BRC
7/6	295	BRC
7/21	660	BRC
7/23	260	BRC
7/25	60	BRC
7/27	50	BRC
7/29	470	BRC
7/30	400	BRC
7/31	145	BRC
8/2	300	BRC
8/4	100	BRC
8/7	135	BRC
8/12	5	Whitey
8/18	75	BRC
10/20	3	BRC

BRC = Bird Rock Cove
Whitey = Whitey Cove

Table 2. Number of walruses hauled out at Cape Seniavin, southwest Alaska, May - November 1991.

Date	# of Walruses
5/7	300
5/15	300
5/23	300
5/25	300
6/21	108
6/24	1169
6/25	1105
9/1	135
10/25	800-1000
11/6	1500-2000
12/12	300

Table 3. Walrus response to aircraft and boats at Cape Peirce, southwest Alaska, 1991.

Date & Loc'n	Vehicle	Alt (Ft)	Lateral Distance (estim)	# of Wal h/o	# Walrus Responding at each Level	Degree of Response
5/23 OC	Boat	N/A	300'	133	L1: 18, L5: 115	Moderate
6/10 SFB	24' Boat	N/A	N/D	156	L3: 94, L5: 62	Moderate
6/27 MB	24' Boat	N/A	N/D	537	L1: 86, L3: 30, L5: 276	High
7/2 SFB	Plane	N/D	N/D	52	L1: 25, L5: 2	Low
7/4 OC	Bow Picker	N/A	N/D	1	L5: 1	Low
7/5 MB	24' Boat	N/A	1/2 mi	318	L1: 75, L3: 33, L5: 125	Moderate
7/5 SFB	24' Boat	N/A	1/4 mi	1443	L1: 30	Low
7/22 MB	24' Boat Plane?	N/A N/D	3/4 mi N/D	707	L1: 350, L3: 340, L5: 11	High
7/23 MB	24' Boat	N/A	1/2 mi	1230	L1: 350, L3: 100	Moderate
7/25 SFB	Plane	N/D	N/D	211	L1: 211	Moderate
8/5 MB	Cessna 185	100	over head	695	L3: 595, L5: 100	High
8/5 SFB	Cessna	75	500'	348	L1: 76, L3: 38, L5: 234	High
8/6 MB	Plane	N/D	N/D	2233	L1: 52, L3: 28, L5: 89	Moderate
8/7 MB	24' Boat	N/A	1/2 mi	1100	L1: 111, L3: 51, L5: 351	High
8/14 MB	Cherokee	N/D	3/4 mi	1381	L1: 59, L3: 35, L5: 110	Moderate

Table continued on next page

Table 3. Continued.

Date & Loc'n	Vehicle	Alt (ft)	Lateral Distance (estim)	# of Wal h/o	# Walrus Responding at each Level	Degree of Response
8/15 MB	Cherokee	600	1/2 mi	917	L1: 364, L3: 40, L5: 46	Moderate
8/16 MB	Cherokee	50-100	3/4 mi	371	L1: 133, L3: 10, L5: 64	Moderate
8/18 MB	2-Super Cubs	300-500	1/2 mi	780	L3: 20, L5: 229	High
8/20 MB	Plane	N/D	N/D	2011	L1: 58	Low
8/20 MB	C-130	1000-1500	1/3 mi	1800	L1: 1350, L3: 150, L5: 10	High
8/21 MB	Cessna 185	50	3/4 mi	2937	L1: 2900	High
8/22 SFB	Lund Skiff	N/A	1/4 mi	92	L1: 82, L5: 10	Moderate
9/8 MB	Plane	>2000	N/D	50	L3: 50	Moderate
9/10 MB	DC-6	>3000	over head	819	L1: 35, L3: 30, L5: 34	Moderate
9/11 MB	Jet	>5000	over head	1735	L1: 200, L3: 75	Moderate
9/21 MB	Grumman Widgeon	50	1/2 mi	2580	L3: 60, L5: 325	High

OC = Odobenus Cove
SFB = South Firebaugh Beach
MB = Maggy Beach
Alt = Altitude
h/o = Hauled out
N/A = Does Not Apply
N/D = No Data
L1 = Level 1 (walruses raise heads)
L3 = Level 3 (walruses move toward water)
L5 = Level 5 (walruses enter water)

Table 4. Number of walrus carcasses observed per area during coastal survey flights from the Igushik River to Chagvan Bay, southwest Alaska, May-August 1991.

AREA[1]	5/16	6/10	7/17	8/23	N	MEAN	STAND DEV.
0	-	-	0	0	2	0.0	0.0
1	-	-	5	5	2	10.0	0.0
2	-	-	12	15	2	13.5	1.5
3	0	0	0	0	4	0.0	0.0
4	0	0	0	0	4	0.0	0.0
5	0	1	0	2	4	0.8	0.8
6	0	0	1	2	4	0.8	0.8
7	0	0	1	2	4	0.8	0.8
8	0	0	0	0	4	0.0	0.0
9	0	0	0	0	4	0.0	0.0
10	0	0	0	0	4	0.0	0.0
11	0	0	0	0	4	0.0	0.0
12	0	0	0	1	4	0.3	0.4
13	1	0	1	3	4	1.3	1.1
14	2	4	2	2	4	2.5	0.9
15	0	0	0	1	4	0.3	0.4
16	0	0	0	0	4	0.0	0.0
17*	0	0	0	0	4	0.0	0.0
18	0	0	0	0	4	0.0	0.0
19	0	1	1	1	4	0.8	0.4
20	0	0	0	0	4	0.0	0.0
21	0	0	0	0	4	0.0	0.0
22	1	1	0	0	4	0.5	0.5
23	0	1	0	1	4	0.5	0.5
24	0	0	0	1	4	0.3	0.4
25	11	10	12	10	4	10.8	0.8
26	0	1	1	0	4	0.5	0.5
27	1	0	2	2	4	1.3	0.8
28	0	1	1	1	4	0.8	0.4
29	1	3	3	1	4	2.0	1.0
30	0	0	0	0	4	0.0	0.0
31	0	0	0	0	4	0.0	0.0
TOTAL	17	23	42	49			

1 = see Figure 4 for areas
* = Cape Peirce section of this area not surveyed. A ground survey on 1 August recorded 29 carcasses on Maggy Beach.

Table 5. Number of northern sea lions observed at Cape Newenham, southwest Alaska, April-October 1991.

Date	Estimate	Slide/Grnd Cnt	Count Type
3 April	70	---	Aerial
16 May	1000	1295*	Aerial
24 May	---	658	Ground
25 May	---	483	Ground
28 May	550	818*	Aerial
10 June	525	791*	Aerial
21 June	---	599	Ground
22 June	---	682	Ground
24 June	---	649	Ground
17 July	450	457*	Aerial
27 July	---	373	Ground
29 July	---	314	Ground
30 July	450	370 *	Aerial
4 August	---	231	Ground
29 August	450	457*	Aerial
30 August	600	412	Aerial
3 September	550	---	Aerial
5 September	500	388*	Aerial
9 October	325	241**	Aerial
24 October	400	---	Aerial

--- = no data
* = slides (haulout photographed during aerial surveys)
** = minimum count (blurry slides)

Table 6. Number of juvenile, adult male, and total number of northern sea lions hauled out per beach area at Cape Newenham, southwest Alaska, June-August 1991.

		6/21	6/22	6/24	7/27	7/29	8/4
SOLSTICE	JV	30	8*	9*	0	0	0
	AM	4	4	4	0	0	0
	TL	97	111	98	0	0	0
	%J	31	*	*	-	-	-
SENTRY PT	JU	36	8*	10*	21	36	12
	AM	2	8	4	1	1	2
	TL	180	226	225	205	151	142
	%J	20	*	*	10	24	8
WHITE ROCK	JU	37	37	20	20	12	6
	AM	3	5	3	2	1	0
	TL	212	209	199	168	139	78
	%J	17	18	10	12	9	8
LANDS END	JU	20	23	5	0	0	0
	AM	3	4	2	0	0	0
	TL	93	84	50	0	0	0
	%J	22	27	10	-	-	-
MEAN %J		23	23	10	11	17	8

JV = Juvenile animals
AM = Adult male
TL = Total number of sea lions hauled out
%J = Percentage of juvenile animals
* = Incomplete census

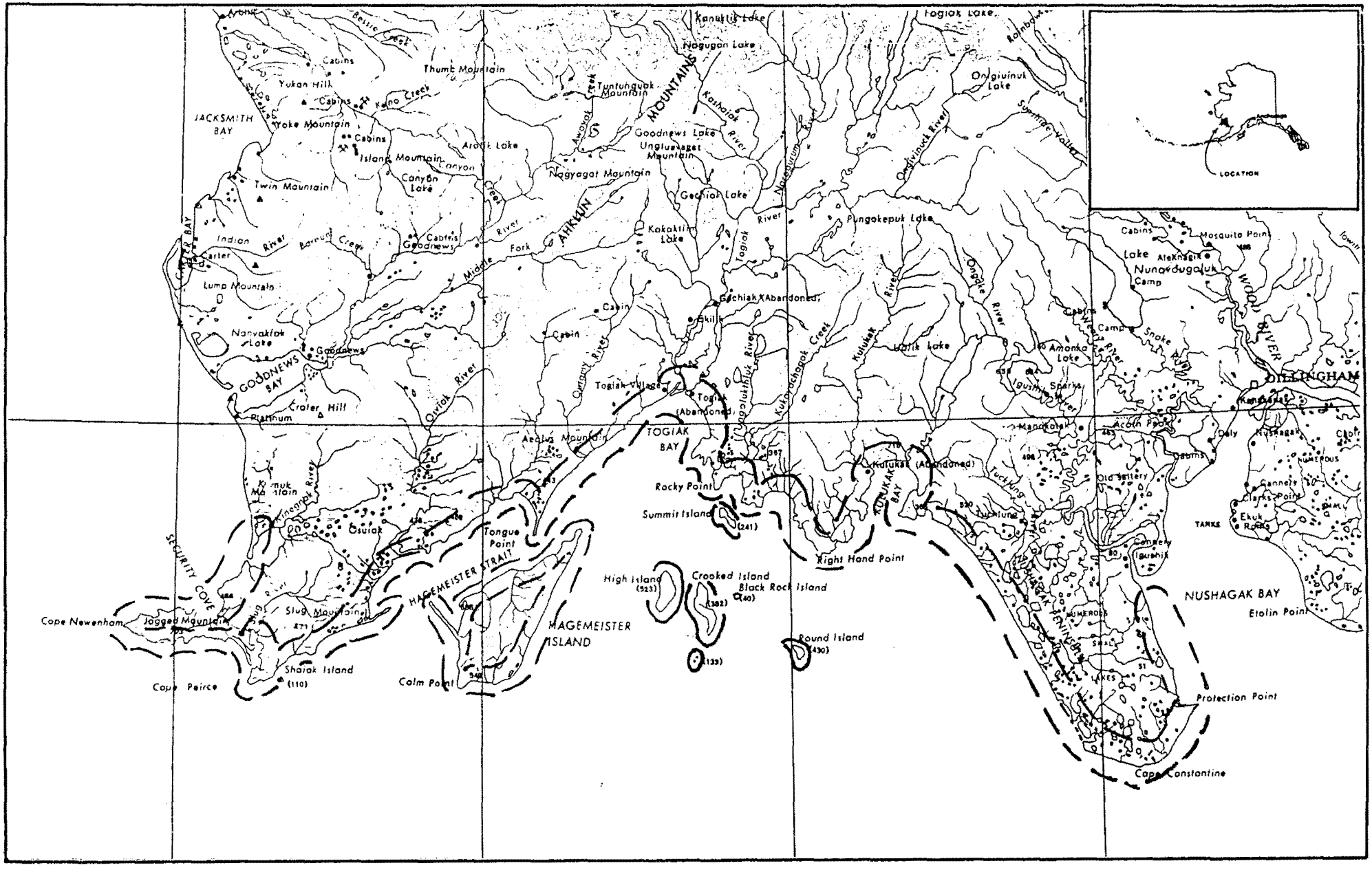


Figure 1. Location of marine mammal study area, southwest Alaska 1991.

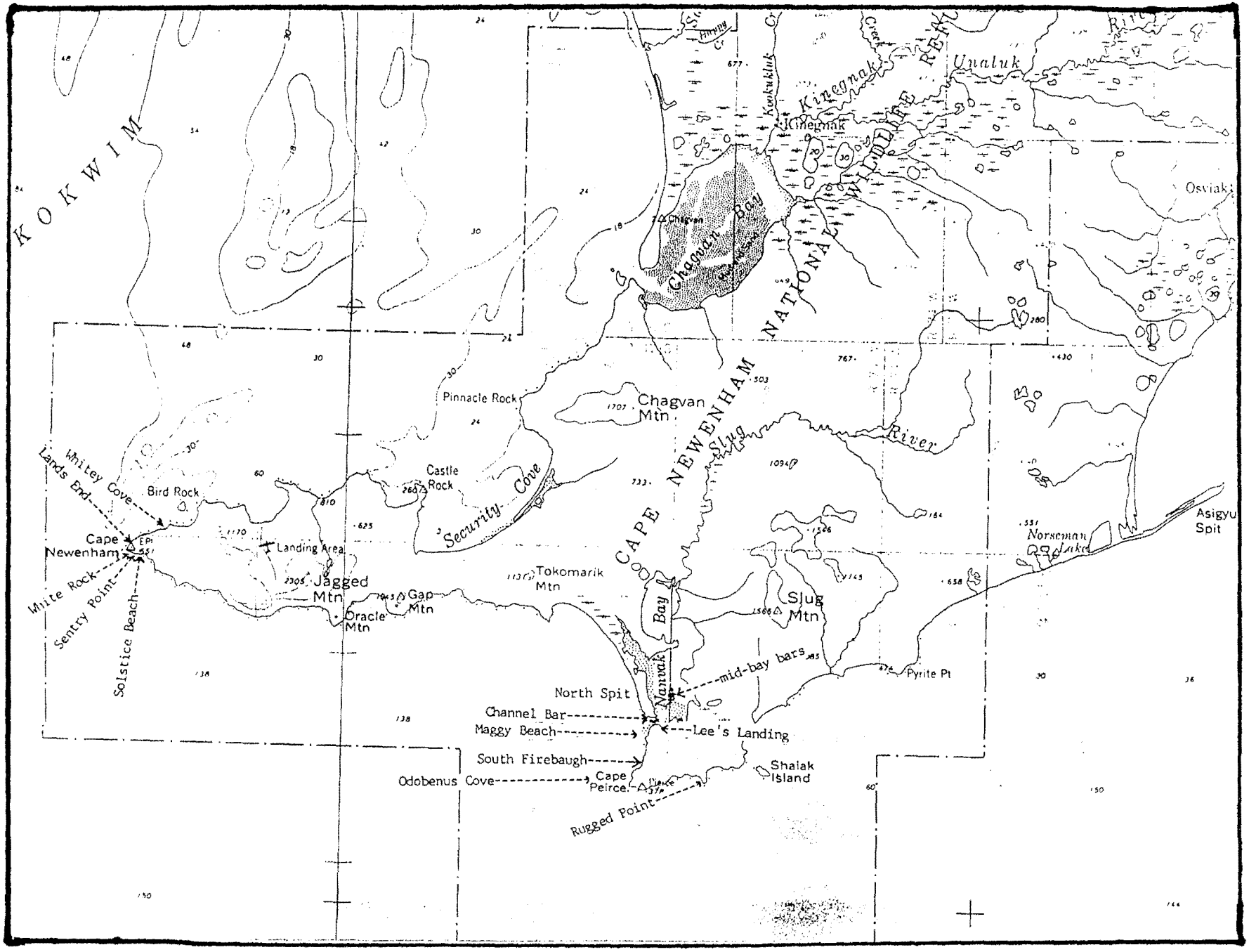


Figure 2. Cape Peirce-Cape Newenham, southwest Alaska.

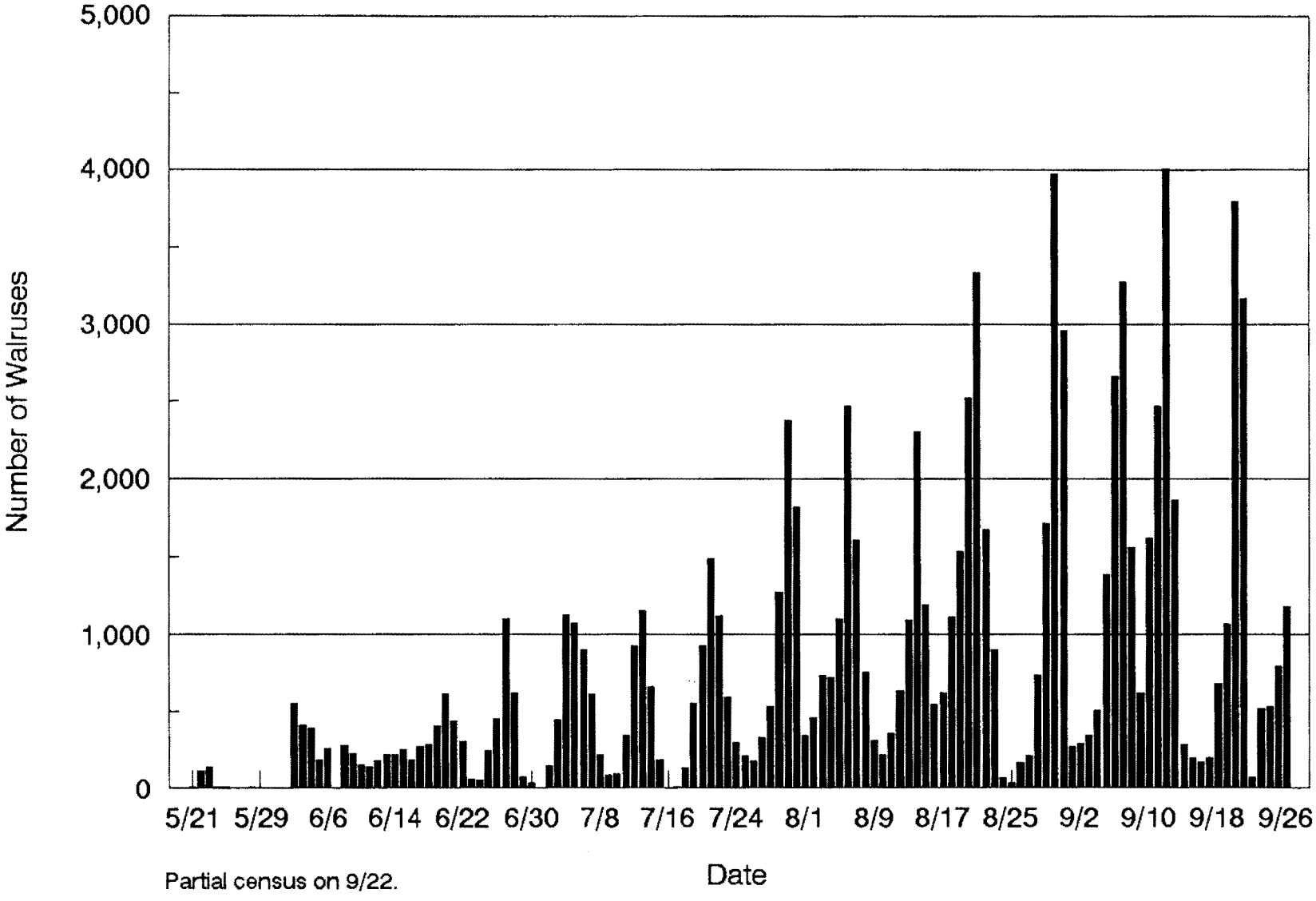


Figure 3. Number of walruses hauled out at Cape Peirce, southwest Alaska, May-September, 1991.

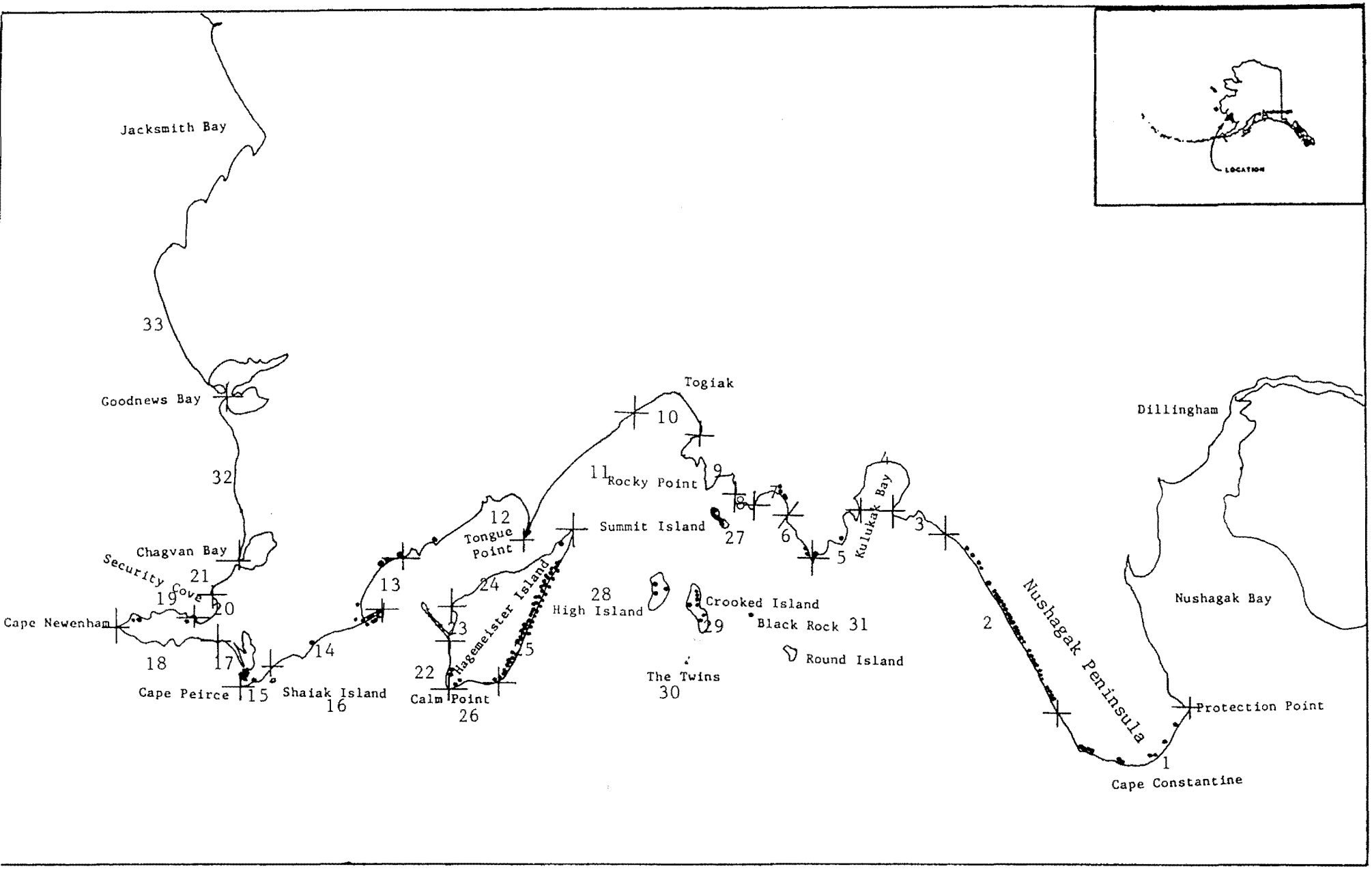
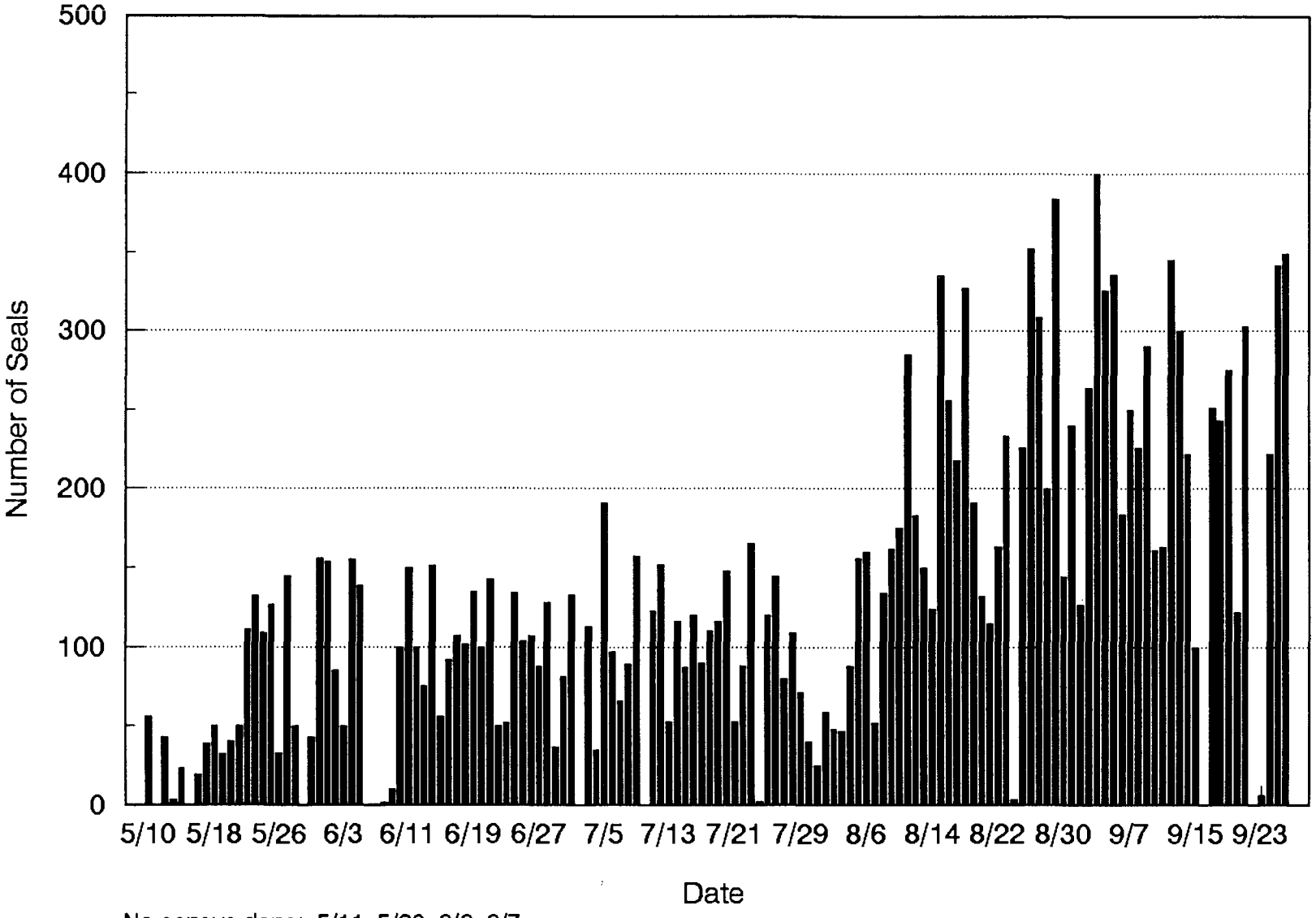
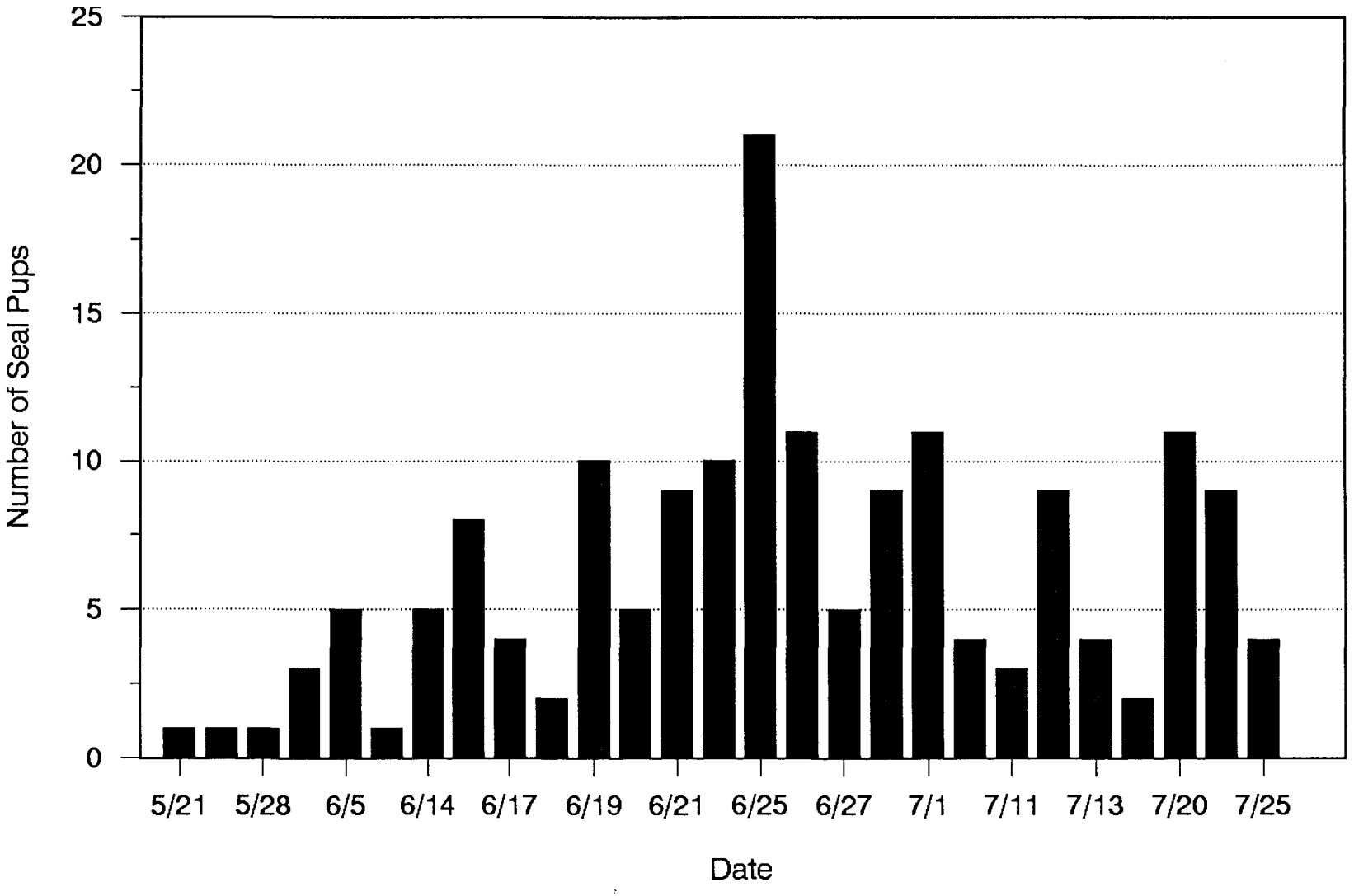


Figure 4. Survey areas and walrus carcass locations observed during aerial and ground surveys of northern Bristol Bay coast, southwest Alaska, May-August 1991.



No census done: 5/11, 5/29, 6/6, 6/7.

Figure 5. Number of seals hauled out in Nanvak Bay, southwest Alaska, May-September, 1991.



Only North Spit pup counts included in this graph.

Figure 6. Number of seal pups in Nanvak Bay, southwest Alaska, May-July, 1991.

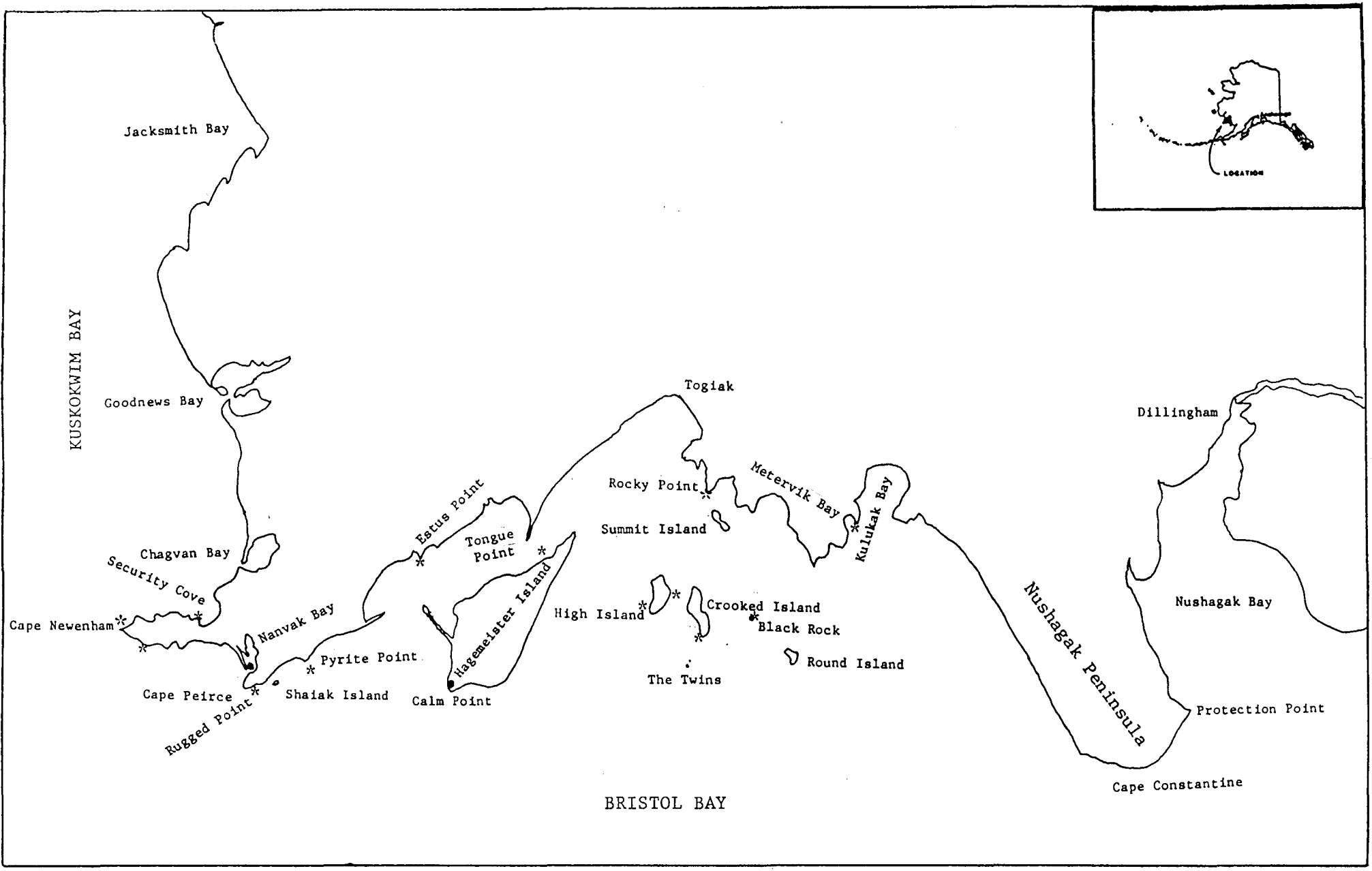


Figure 7. Haulout locations of seals in northern Bristol Bay, southwest Alaska 1991.

* = small concentrations (100 seals)

• = large concentrations (100 seals)

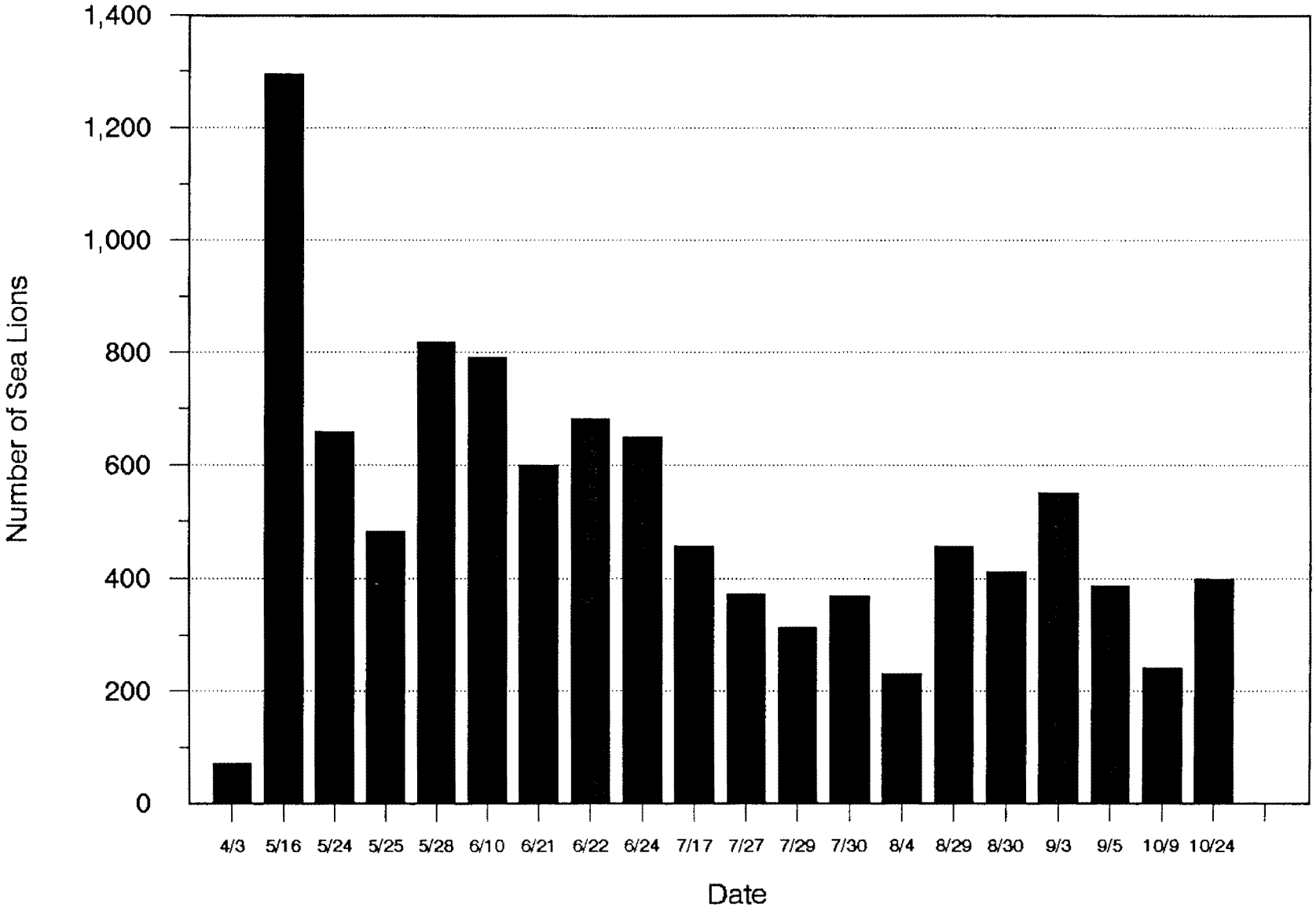


Figure 8. Number of sea lions hauled out at Cape Newenham, southwest Alaska, 1991.

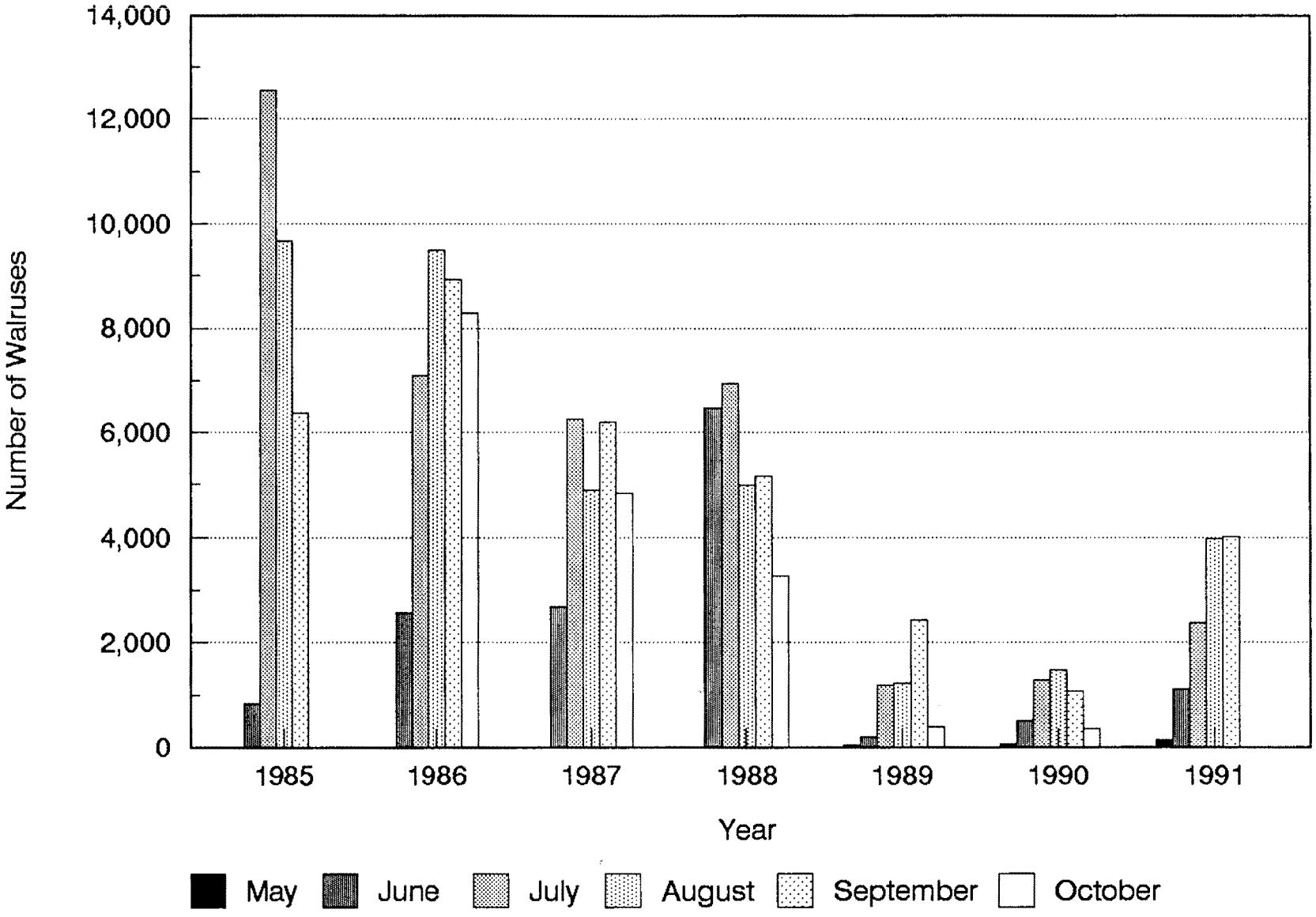


Figure 9. Monthly walrus haulout peaks at Cape Peirce, southwest Alaska, 1985-1991.

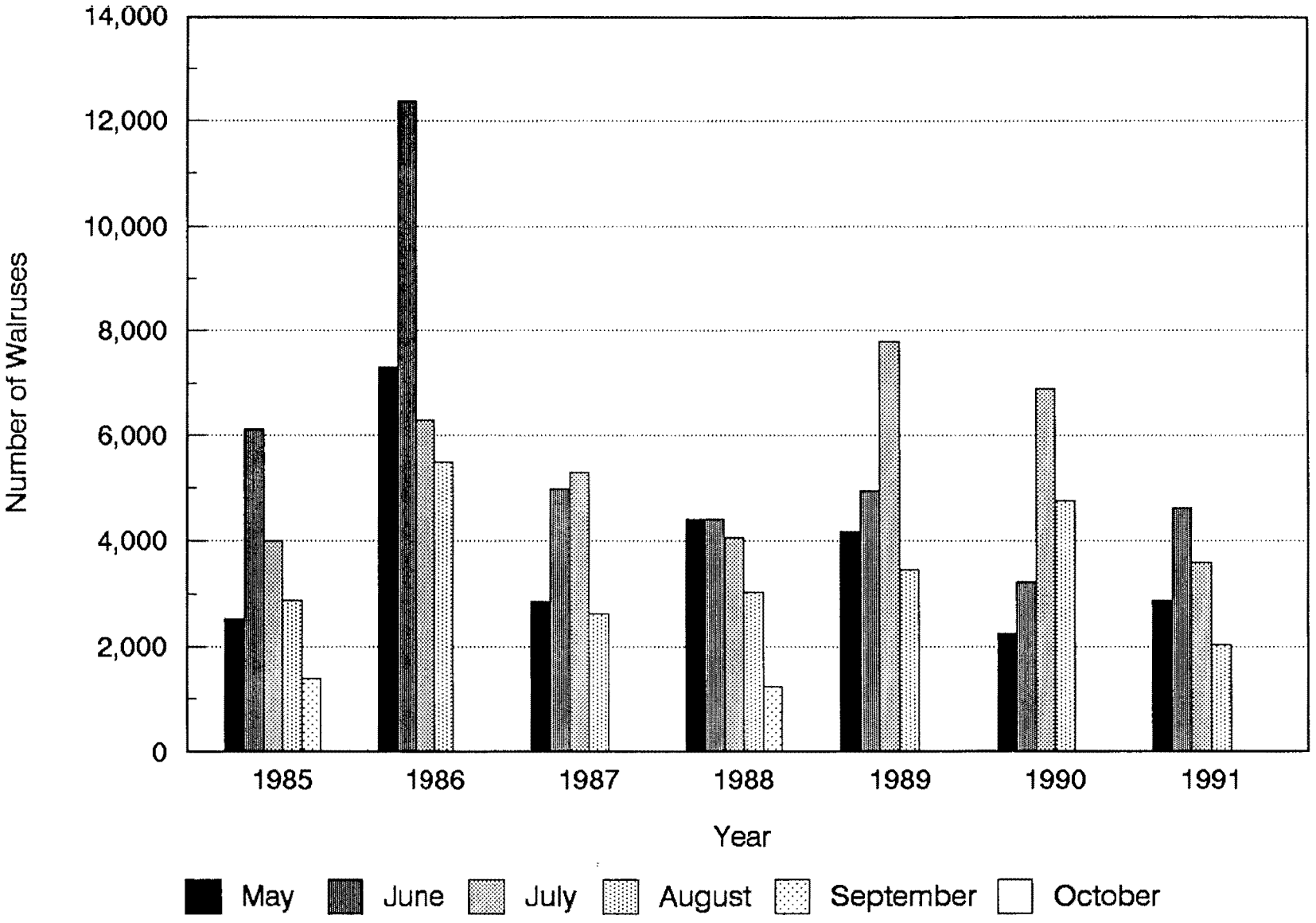


Figure 10. Monthly walrus haulout peaks at Round Island, southwest Alaska, 1985-1991.

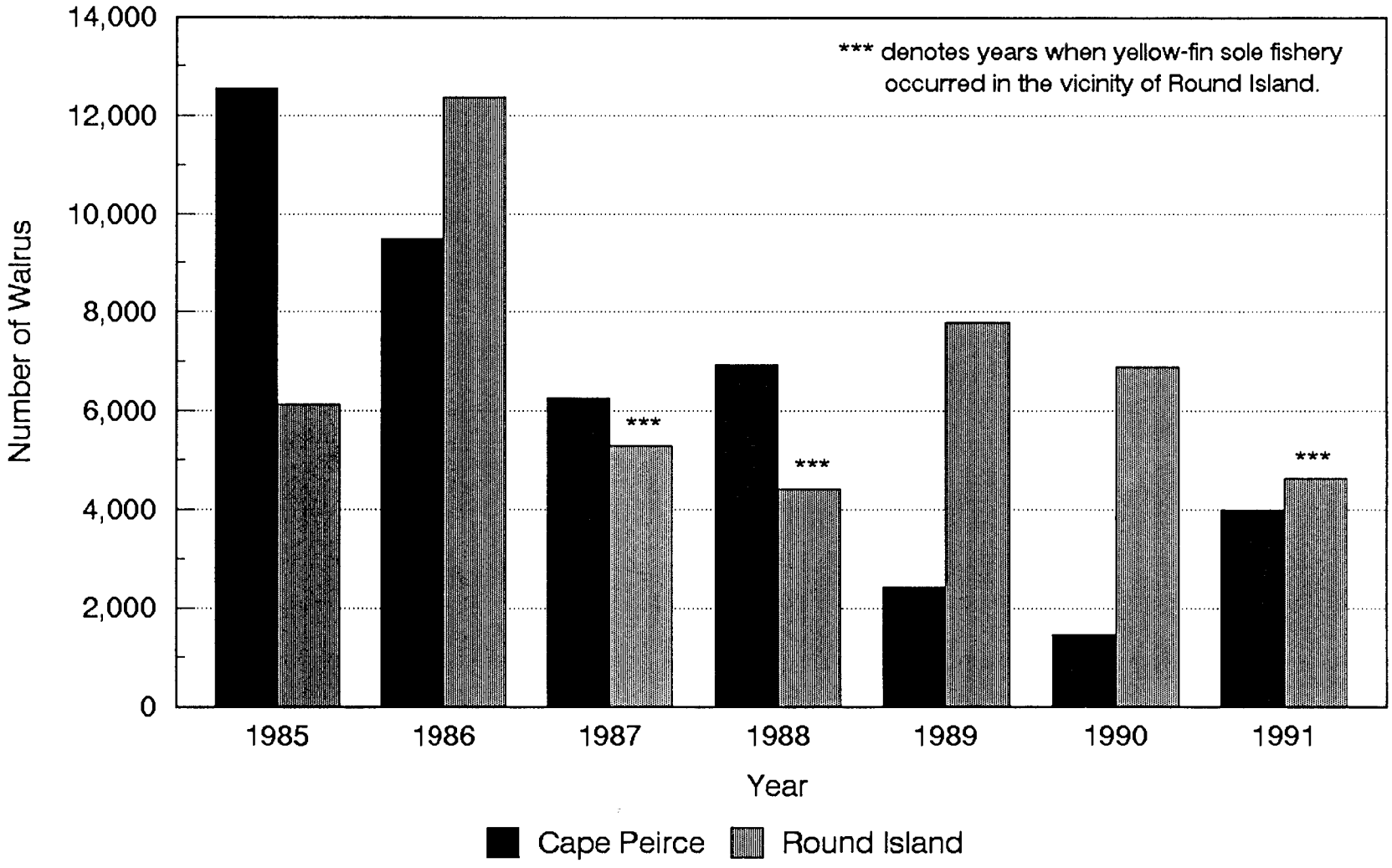


Figure 11. Comparison of walrus haulout peaks at Cape Peirce and Round Island, 1985-1991.

APPENDIX 1. Walrus Haulout Census Data, Cape Peirce, Southwest Alaska, April - September, 1991.

MO	DA	BC	CLD CVR	WND SPD	WND DIR	PC	BAROM CHG	MA	MI	TD	TIME	LOC'N	CP WTR	CP LND	CP TOT
4	25	1	2	13	3	0				4	1424	SFB	2	93	95
4	26	0	2	5	3	1		41	32	2	1030	SFB			0
4	27	1	1	15	4	0			31	2	1324	SFB	0	1	1
4	28	1	1	10	3	0		47	32	1	1600	OC	4	0	4
4	29	0	2	1	9	1		46	35	1	1545	ALL	0	0	0
4	30														0
5	1														0
5	2	1	1	17	2	0		43	34	3	1530	ALL	0	0	0
5	3	1	1	17	3	0		46	35	1	2000	ALL	0	0	0
5	4														0
5	5	2	2	20	3	1		40	34	2	1100	ALL	0	0	0
5	6	2	2	7	3	1		40	37	2	1230	OC	1	0	1
5	7	2	1	3	3	0		52	36	3	1700	ALL	0	0	0
5	8														0
5	9	1	2	13	2	1		40	34	3	1700	ALL	0	0	0
5	10	2	2	13	7	1		42	32	3	1900	ALL	0	0	0
5	11														0
5	12	1	2	3	6	1		52	32	3	1300	ALL	0	0	0
5	13	1	1	10	7	0		52	30	3	1605	OC	1	2	3
5	14	2	1	17	7	0		46	33	3	1649	SFB	3	0	3
5	15	3	1	35	8	0		40	34	3	1700	ALL	0	0	0
5	16	2	1	25	9	0		46	35	3	1730	ALL	0	0	0
5	17	1	2	15	3	1		43	33	3	1800	ALL	0	0	0
5	18	2	1	40	8	0		43	31	3	180	OC	0	2	2
5	19	2	1	35	8	0		42	36	3	1700	ALL	0	0	0
5	20	1	1	7	8	0		41	36	3	1930	ALL	0	0	0
5	21	1	0	7	7	0		55	35	4	1207	SFB,OC	1	5	6
5	22	1	1	3	6	0		50	27	3	2000	OC	27	88	115
5	23	1	0	3	9	0		50	29	2	2000	SFB,OC	0	139	139
5	24	1	1	16	3	0		54	32	3	1300	ALL	6	0	216
5	25	1	2	10	3	1		44	39	3	1200	ALL	2	6	8
5	26	2	2	30	4	1		44	38	3	1300	ALL	1	0	1
5	27	2	2	17	4	1		45	37	4	1215	SFB	1	2	3
5	28	2	1	17	8	0		50	36	3	1515	OC	0	2	2
5	29	3	2	40	8	1		40	36	4	1040	ALL	0	0	0
5	30	3	2	40	8	1		40	38	4	1130	ALL	0	0	0
5	31	3	2	35	7	1		40	36	4	1345	OC	1	0	1
6	1		1	25	8	0		40	33	3	1100	SFB	5	0	5
6	2	1	1	27	2	0		50	35	3	1330	SFB,OC	16	538	554
6	3	1	2	27	3	1		46	40	3	1815	SFB,OC	0	414	414
6	4	0	2	10	3	1		50	42	4	1045	SFB,OC	25	370	395
6	5	1	1	10	3	0		55	35	3	1515	SFB,OC	3	184	187
6	6	1	1	5	7	0		53	41	4	1015	SFB,OC	4	259	263
6	7														0
6	8	0	0	7	7	0				3	1900	SFB,OC	3	277	280
6	9	0	1	10	7	0		63	38	3	1240	SFB,OC	5	223	228
6	10	1	1	13	6	0		66	45	3	1345	SFB	16	141	157
6	11	2	0	10	8	0		59	45	3	1220	SFB	14	130	144
6	12	1	1	7	6	0			38	3	1400	SFB	4	175	179
6	13	2	1	15	8	0		62	45	3	1607	SFB	6	216	222
6	14	2	2	13	7	0		55	42	3	1449	SFB	1	218	219
6	15	2	2	7	6	0		54	40	3	1140	SFB	239	17	256
6	16	3	2	45	6	1		50	39	4	1225	SFB	25	160	185
6	17	2	2	13	4	1		48	40	4	1300	SFB	6	266	272
6	18	1	1	15	4	0		56	40	4	1350	SFB	7	279	286
6	19	1	1	20	4	0		53	45	4	1300	SFB	23	382	405
6	20	1	0	25	4	0		52	45	3	1445	SFB	15	601	616
6	21	1	1	17	4	0		53	42	3	1434	SFB	6	432	438

APPENDIX 1. Continued.

MO	DA	BC	CLD CVR	WND SPD	WND DIR	PC	BAROM CHG	MA	MI	TD	TIME	LOC'N	CP WTR	CP LND	CP TOT
6	22	1	2	22	4	0		53	42	3	1334	SFB	3	305	308
6	23	0	2	30	3	0		54	45	1	1700	SFB	1	58	59
6	24	1	2	37	4	1		53	46	3	1330	SFB	18	36	54
6	25	0	2	10	4	1		51	46	1	1025	SFB	8	239	247
6	26	0	2	5	4	0		54	45	4	1415	SFB	4	448	452
6	27	0	2	10	8	0		61	44	3	1700	SFB,MB	5	1097	1102
6	28	2	2	13	8	0		62	46	3	1415	SFB,MB	3	615	618
6	29	3	1	27	4	0		55	48	3	1500	SFB,MB	6	67	73
6	30	3	2	30	4	0		58	49	4	1345	SFB,MB	0	35	35
7	1	1	2	25	8	0		60	50	1	1826	SFB	4	0	4
7	2	3	1	15	8	0		65	50	1	2130	SFB	5	144	149
7	3	2	0	10	8	0		71	50	3	1530	SFB	7	438	445
7	4	1	1	17	8	0		65	52	3	1830	SFB,OC	34	1091	1125
7	5	1	0	10	7	0		70	52	3	1430	SFB,M,O	83	990	1073
7	6	1	2	20	3	0		63	46	3	1500	SFB,M,O	26	875	901
7	7	0	2	7	5	0		64	46	3	1500	SFB,MB	20	591	611
7	8	0	1	13	1	0		66	46	4	155	SFB,OC	6	212	218
7	9	2	1	25	8	0		62	49	3	1141	SFB	2	83	85
7	10	2	0	17	8	0		70	52	4	1128	SFB	6	92	98
7	11	1	0	15	8	0		74	52	3	1537	SFB	5	344	349
7	12	1	2	17	3	0		60	46	3	1345	SFB,OC	9	920	929
7	13	1	2	17	7	0		63	50	4	1245	SFB,M,O	17	1137	1154
7	14	2	2	7	9	0		68	48	4	1320	SFB,M,O	7	653	660
7	15	0	2	25	4	1		56	50	4	1145	SFB,MB	7	183	190
7	16	3	2	35	6	1		54	47	4	1210	SFB	5	0	5
7	17	2	2	20	6	0		61	48	3	1204	SFB,LL	6	1	7
7	18	2	2	15	6	1		52	51	2	1305	SFB	0	135	135
7	19	2	2	15	6	1		56	51	3	1300	SFB	8	549	557
7	20	2	2	13	6	1		63	48	3	1330	SFB,MB	56	868	924
7	21	1	1	10	6	0		57	46	3	1215	SFB,MB	15	1467	1482
7	22	0	0	15	6	0		66	43	1	1300	SFB,MB	43	1073	1116
7	23	0	1	15	4	0		68	44	3	1400	SFB,MB	49	547	596
7	24	0	1	5	9	0			54	4	1345	SFB,MB	22	277	299
7	25	0	2	5	9	1				4	1210	SFB	4	211	215
7	26	2	2	15	7	0				4	1233	SFB	3	175	178
7	27	2	2	15	7	0		60	50	3	1451	SFB	5	332	337
7	28	2	2	23	7	1		55	48	3	1245	SFB,MB	10	526	536
7	29	1	1	7	7	0		66	50	3	1415	SFB,MB	15	1258	1273
7	30	1	1	7	8	0		66	48	4	1100	SFB,MB	45	2329	2374
7	31	2	2	15	7			62	46	3	1100	SFB,MB	3	1813	1816
8	1	1	1	10	7	0		66	46	4	1200	SFB,MB	6	339	345
8	2	1	0	7	8	0		62	36	1	1812	SFB	8	450	458
8	3	2	2	17	7	1		60	46	1	1750	SFB	6	730	736
8	4	1	2	5	9	0			49	3	1215	SFB,MB	28	691	719
8	5	1	0	5	8	0		70	51	1	1530	SFB,MB	17	1080	1097
8	6	1	2	5	9	0		68	50	1	1400	SFB,MB	16	2451	2467
8	7	0	2	5	9	0				3	1330	SFB,MB	116	1488	1604
8	8	1	2	13	4	1				3	1258	SFB,MB	57	696	753
8	9	0	2	17	4	0				4	1215	SFB	6	310	316
8	10	0	2	15	4	0				4	1215	SFB	9	210	219
8	11	1	2	20	3	1				4	1300	SFB	20	344	364
8	12	1	2	17	4	0				4	1200	SFB	36	600	636
8	13	1	2	7	4	0		63	51	4	1300	SFB,OC	88	1007	1095
8	14	1	2	35	4	1		54	44	4	1400	SFB,M,O	18	2288	2306
8	15	1	2	23	4	1		58	50	4	1230	SFB,MB	49	1146	1195
8	16	1	1	15	4	0			52	4	1230	SFB,MB	109	436	545
8	17	1	1	5	9	0		65	44	3	1300	SFB,MB	32	588	620
8	18	1	1	17	4	0		60	45	3	1300	SFB,MB	21	1090	1111
8	19	0	2	5	9	0		52	49	3	1200	SFB,MB	60	1470	1530

APPENDIX 1. Continued.

MO	DA	BC	CLD CVR	WND SPD	WND DIR	PC	BAROM CHG	MA	MI	TD	TIME	LOC'N	CP WTR	CP LND	CP TOT
8	20	1	1	5	9	0		50		3	1300	SFB,MB	43	2482	2525
8	21	1	1	15	7	0				3	1815	SFB,MB	16	3321	3337
8	22	1	1	10	8	0		58	52	3	1300	SFB,MB	26	1647	1673
8	23	1	2	10	4	0		56	42	4	1100	SFB,MB	34	864	898
8	24	1	2	17	4	1		56	53	4	1215	SFB	6	59	65
8	25	2	2	15	7	1		65	50	4	1151	SFB	15	18	33
8	26	2	2	27	8	1		57	45	3	1231	SFB	7	158	165
8	27	2	1	15	8	1		56	50	4	1141	SFB	4	213	217
8	28	1	0	17	1	0		58	52	4	1000	SFB,MB	68	668	736
8	29	2	2	13	8	1		57	48	3	1120	SFB,MB	45	1664	1709
8	30	2	0	13	8	0		64	50	2	1130	SFB,MB	72	3898	3970
8	31	1	0	17	4	0		56	44	2	1215	SFB,MB	90	2870	2960
9	1	1	2	35	3	0		54	47	3	1120	SFB	14	259	273
9	2	1	1	25	3	0		59	51	3	1117	SFB	2	292	294
9	3	1	2	13	3	0		58	49	3	1400	SFB	5	344	349
9	4	1	2	5	4	0		54	48	3	1055	SFB	5	499	504
9	5	2	2	15	7	1		60	50	3	1030	SFB,MB	32	1353	1385
9	6	1	1	3	9	0		60	50	3	1030	SFB,MB	56	2608	2664
9	7	0	3	23	3	0		55	50	4	1000	SFB,MB	59	3215	3274
9	8	0	3	10	3	1		55	48	4	1030	SFB,MB	36	1525	1561
9	9	0	3	5	3	1		55	49	3	1100	SFB,MB	330	293	623
9	10	1	3	5	4	0		59	45	4	1100	SFB,MB	25	1591	1616
9	11	0	2	5	6	1		56	48	4	1100	SFB,MB	22	2451	2473
9	12	0	2	5	1	0		56	47	3	2030	SFB,MB	69	3939	4008
9	13	2	2	35	3	1		52	48	2	900	SFB,MB	179	1685	1864
9	14	0	2	15	3	1		53	51	2	1530	SFB,MB	0	285	285
9	15	1	1	25	3	0		54	49	3	1450	SFB	30	173	203
9	16	1	2	35	4	1		51	47	2	1425	SFB	6	169	175
9	17	1	2	20	6	1		52	48	3	1115	SFB,MB	4	195	199
9	18	2	2	25	6	1		54	48	2	1245	SFB,MB	22	661	683
9	19	2	2	25	7	1		54	48	1	1140	SFB,MB	204	860	1064
9	20	1	1	15	7	0		55	44	1	1500	SFB,MB	35	3759	3794
9	21	1	1	20	4	0		53	45	3	1000	SFB,MB	55	3114	3169
9	22	2	2	60	3	1		50	46	2	930	MB*	75		75
9	23	0	2	10	3	1		49	49	4	930	SFB	21	498	519
9	24	1	2	25	4	1		49	49	3	1320	SFB	7	530	537
9	25	3	2	15	5	1			47	3	1115	SFB	12	778	790
9	26	2	2	5	7	1				3	1030	SFB,MB	17	1163	1180

APPENDIX 2. Seal Haulout Census Data, Nanvak Bay, Southwest Alaska, April - September, 1991.

MO	DA	CLD CVR	WND SPD	WND DIR	PC	MAX	MIN	TD	TIME	LOC'N	NO. WTR	NO. LND	NO. PUP	TOT	CNT LOC'N
4	23	1	5	3	0			1	725	MBB	1	0		1	
4	24	1	5	3	0			2	1930	MBB	7	0		7	
4	25	2	10	3	0			1	1430	MBB	2	22		24	
4	26													0	
4	27	1	10	4	0	41	32	1	1504	MBB	1	31		32	
4	28	1	0		1	47	32	1	2039	MBB	5	27		32	
4	29	2	5	1	0	40	35	4	740	MBB	2	41		43	
4	30	1	7	3	0	54	34	2	1115	MBB		0		0	
5	1														
5	2	1	17	3	0	43	34	3	2025	MBB,PARL	1	0		1	
5	3	1	23	3	0	46	35	3	1715	MBB	0	54		54	
5	4														
5	5	2	13	3	1	39	34	3	1850	MBB	2	48		50	
5	6	2	3		1	42	37	3	2102	MBB	4	34		38	
5	7	1	3	4	0	52	36	3	1730	MBB	3	0		3	
5	8														
5	9	2	7	3	0	40	34	3	1930	MBB	12	12		24	
5	10	1	3	9	1			2	1400	MBB	18	18		56	
5	11														
5	12	1	5	6	0	52	32	3	1740	MBB	22	21		43	
5	13	1	10	8	0	52	30	1	1800	MBB	3	0		3	WPD
5	14	1	10	8	0	46	33	1	2000	MBB	5	18		23	WPD
5	15	1	15	8	0	40	35	1	1730	MBB	0	0		0	WPD
5	16	1	7	8	0	46	35	1	2127	MBB	0	19		19	WPD
5	17	2	13	3	1	43	33	3	1539	MBB	4	35		39	WPD
5	18	1	10	8	0	43	31	3	1930	MBB	0	50		50	WPD
5	19	1	22	7	0	42	36	1	2006	MBB	2	30		32	WPD
5	20	1	7	8	0	41	36	1	2130	MBB	0	40		40	WPD
5	21	0	3	9	0	48	36	1	2200	MBB	0	50		50	KYK
5	22	1	3	6	0	50	27	1	2315	MBB	3	108	1	111	
5	23	0	5	3	0	50	29	1	1430	MBB	32	100		132	
5	24	1	20	3	0	54	32	2	1545	MBB	1	108		109	
5	25	0	10	4	0	44	39	3	1825	MBB	0	127		127	
5	26	2	25	3	1	44	38	3	2000	MBB	13	20		33	
5	27	2	10	4	1	45	37	3	1800	MBB	2	143	1	145	
5	28	1	25	8	0	50	38	2	2220	MBB	6	43	1	50	
5	29									PARL					
5	30	2	25	8	1		38	1	1920	MBB	3	40		43	WPD
5	31	1	35	8	1	40	36	3	2100	MBB,PARL	4	151		156	WPD
6	1	1	7	3	0	40	35	3	2030	MBB	5	149		154	NSD
6	2	1	30	3	0	50	35	1	2127	MBB	0	85		85	WPD
6	3	2	30	3	1	46	40	1	2000	MBB	0	50		50	WPD
6	4	1	13	3	0	50	42	1	2100	MBB	0	155	3	155	NSD
6	5	0	15	7	0	55	35	1	2015	MBB	8	131	5	139	NSD
6	6														
6	7														
6	8	0	15	8	0			2	2000	MBB	1	0		1	WPD
6	9	0	10	7	0	63	38	1	1715	MBB	10	0		10	LL
6	10	0	13	6	0	66	45	1	2100	MBB	0	100		100	LL
6	11	0	13	7	0	59	45	3	1630	MBB	0	150		150	AER
6	12	0	20	1	0		38	1	2053	MBB	0	100	1	100	WPD
6	13	1	15	8	0	62	45	1	1600	MBB	0	75		75	CLF
6	14	2	15	7	0	55	42	1	2000	MBB	5	146	5	151	NSD
6	15	2	7	6	1	54	40	3	1935	MBB,PARL	1	55		56	LL
6	16	2	15	7	1	50	39	1	2000	MBB	5	87	8	92	NSD
6	17	1	10	4	0	48	40	3	2127	MBB	3	104	4	107	NSD
6	18	1	17	4	1	56	40	4	2050	MBB,OC	3	99	2	102	
6	19	0	17	4	0	53	45	1	2125	MBB	7	128	10	135	NSD

APPENDIX 2. Continued.

MO	DA	CLD CVR	WND SPD	WND DIR	PC	MAX	MIN	TD	TIME	LOC'N	NO. WTR	NO. LND	NO. PUP	TOT	CNT LOC'N
6	20	1	17	4	0	52	45	2	2304	MBB	0	100	5	100	NSD
6	21	1	5	4	0	53	42	3	2115	MBB	0	134	9	143	NSD
6	22	2	25	4	1	53	42		2104	MBB	23	27	3	50	LL
6	23	2	25	3	0	54	45	3	1907	MBB	6	46	8	52	WPD
6	24	2	25	4	0	53	46	3	2229	MBB,PARL	3	131	10	134	NSD
6	25	2	10	4	1	51	46	3	1915	MBB	15	89	21	104	NSD
6	26	2	2	4	1	54	45	1	2200	MBB	6	101	11	107	NSD
6	27	1	2	9	0	61	44	1	2214	MBB	19	69	5	88	NSD
6	28	1	10	1	0	62	46	1	2304	MBB	0	128	9	128	NSD
6	29	2	17	1	0	55	48	1	2252	MBB	4	33	6	37	LL
6	30	1	30	1	0	58	49	1	2252	MBB	10	71	4	81	WPD
7	1	1	7	8	0	60	50	1	2050	MBB	9	124	11	133	NSD
7	2	0	10	8	0	65	50	2	2200	MBB	0	0		0	LL
7	3	0	7	8	0	71	50	3	2251	MBB	1	112	4	113	NSD
7	4	1	17	8	0	65	52	3	2100	MBB	8	27	2	35	LL
7	5	0	5	7	0	70	52	2	1903	MBB	31	160	3	191	LL,WPD
7	6	1	5	9	0	63	46	3	1837	MBB	7	90	6	97	WPD
7	7	2	5	8	0	64	46	1	2037	MBB	9	57	3	66	WPD
7	8	1	13	1	0	66	46	1	2000	MBB	0	89	5	89	LL
7	9	1	25	8	0	62	49	1	1850	MBB	2	155	5	157	LL
7	10	0	7	8	0	70	52	1	2255	MBB	0	0		0	LL
7	11	0	5	9	0	74	52	1	2315	MBB	2	121	3	123	NSD
7	12	2	5	9	0	60	46	1	1955	MBB	19	133	8	152	NSD
7	13	2	17	8	0	63	50	3	2035	MBB	0	49	4	53	NSD
7	14	2	5	8	0	68	48	3	1820	MBB	0	116		116	NSD
7	15	2	25	4	1	56	50	2	1900	MBB	0	87		87	NSD
7	16	2	25	6	1	54	47	1	1920	MBB	4	116	1	120	WPD,LL
7	17	2	15	6	1	55	48	3	1730	MBB	40	50		90	AER
7	18	2	15	6	1	52	51	1	2030	MBB	15	95	2	110	
7	19	2	25	6	1	56	51	1	1645	MBB	4	112	5	116	WPD
7	20	2	7	7	0	63	48	1	1906	MBB	3	145	11	148	NSD
7	21	1	15	7	0	57	46	1	1545	MBB	4	49		53	WPD
7	22	0	2	6	0	66	42	1	1800	MBB	3	85		88	WPD
7	23	2	7	9	0	68	44	1	2110	MBB	2	163	9	165	NSD
7	24	1	5	4	0		54	1	2030	MBB	2	0		2	LL
7	25	2	13	8	0			1	1749	MBB	3	117	4	120	NSD
7	26	2	15	7				1	2049	MBB	6	139		145	NSD
7	27	2	20	7	0	60	50	3	1925	MBB	3	77		80	WPD
7	28	2	15	7	1	55	48	4	1920	MBB	5	104		109	NSD
7	29	2	5	7	0	66	50	4	2030	MBB	3	68		71	NSD
7	30										0	40		40	
7	31										0	25		25	
8	1	1	5	7	0	66	46	1	2020	MBB	1	58		59	NSD
8	2	0	7	8	0	62	36	1	1800	MBB	0	48		48	LL
8	3	2	10	7	0	60	46	1	1905	MBB	12	35		47	LL
8	4	1	7	8	0		49	1	1803	MBB	0	86	3	88	NSD
8	5	0	2	1	0	70	51	1	2000	MBB	0	156	8	156	NSD
8	6	2	10	8	0	68	50	1	1852	MBB	0	160	7	160	WPD
8	7	2	7	4	1	58		1	2145	MBB	0	52	2	52	LL
8	8	2	20	4	1	54	48	1	2045	MBB	8	126	1	134	LL
8	9	2	20	3	1	56	50	1	1917	MBB	12	150		162	WPD
8	10	1	20	4	0	58	52	3	2043	MBB	5	170	1	175	NSD/KYK
8	11	2	5	9	0	60	50	1	1945	MBB	36	249		285	WPD
8	12	1	20	3	0	58	50	1	1901	MBB	1	183		183	WPD
8	13	1	5	9	0	63	51	1	1900	MBB	16	134	2	150	NSD
8	14	2	37	4	1	54	44	1	1745	MBB	18	106		124	WPD
8	15	1	20	4	0	58	50	1	1700	MBB	25	310		335	NSD
8	16	2	20	3	1	56	52	1	1835	MBB	11	245		256	WPD
8	17	0	7	6	0		44	1	1854	MBB,CHAN	7	211	2	218	NSD,KYK

APPENDIX 2. Continued.

MO	DA	CLD CVR	WND SPD	WND DIR	PC	MAX	MIN	TD	TIME	LOC'N	NO. WTR	NO. LND	NO. PUP	TOT	CNT LOC'N
8	18	2	13	4	0	60	45	1	1948	MBB	5	321	6	327	NSD,ZOD
8	19	2	10	8	0	52	49	1	1821	MBB	27	164	3	191	NSD,KYK
8	20	1	7	8	0	59	50	1	1905	MMB	8	124	4	132	NSD,KYK
8	21	1	17	7	0	57	51	1	1936	CHAN	0	115		115	LL
8	22	0	15	8	0	58	52	1	1931	NSB,MBB	2	161		163	LL
8	23	2	17	4	0	56	42	1	1949	MBB	6	402		233	LL,WPD
8	24	2	17	7	1	56	42	1	1955	WATER	3	0		3	LL
8	25	1	15	7	1	65	53	2	1626	NSB	12	214		226	WPD
8	26	2	25	8	1	57	50	1	1908	NSB	3	349		352	LL
8	27	1	15	8	1	56	45	2	1408	NSB	5	304		309	LL
8	28	1	37	8	0	58	50	1	1600	CHAN	0	200		200	WPD,ARCH
8	29	2	17	8	1	57	48	3	1600	CHAN,NSB	0	384		384	WPD
8	30	0	13	8	0	64	50	2	1840	MBB	5	140		145	WPD,CLF
8	31	1	17	4	0	56	44	1	1623	MBB	0	240		240	WPD
9	1	2	27	3	1	54	47	3	1558	MBB	0	127		127	WPD
9	2	1	23	3	0	59	51	3	1430	MBB	0	264		264	WPD
9	3	2	17	3	0	58	49	3	1600	MBB	0	400		400	WPD
9	4	2	5	4	1	54	48	1	1610	MBB	0	326		326	NSD
9	5	2	15		0	60	50	3	1700	NSB	0	336		336	WPD
9	6	2	15	3	0	60	50	1	2000	MBB	0	284		184	WPD
9	7	2	30	3	1	55	50	3	1230	NSB,MBB	0	250		250	CLF
9	8	2	10	4	1	55	48	1	1658	NSB,MBB	34	192		226	LL
9	9	2	10	3	0	55	49	1	1600	MBB	0	290		290	WPD
9	10	2	10	5	0	59	45	1	1603	MBB	13	148		161	NSD
9	11	0	10	8	0	56	48	1	1559	NSB,CHAN	7	156		163	WPD
9	12	1	10	4	0	56	47	1	1521	MBB	5	340		345	BD
9	13	2	35	3	1	52	48	1	1530	MBB	0	300		300	CLF
9	14	2	15	3	1	53	51	1	1734	MBB	63	159		222	WPD
9	15	2	20	5	1	51	47	1	1540	MBB	0	100		100	CLF,WPD
9	16	2	37	4	1	51	47	4	1400		0	0		0	LL,CLF
9	17	2	20	6	1	52	48	1	1443	MBB	16	235		251	NSD
9	18	2	25	6	1	54	48	1	1732	NSB	5	238		243	WPD
9	19	2	25	7	0	54	48	1	1300	NSB	6	269		275	LL
9	20	1	15	7	1	55	44	1	928	NSB	12	110		122	WPD
9	21	1	30	4	0	53	45	1	1425	NSB,MBB	8	295		303	WPD
9	22	2	55	3	1	50	46	1	1500	MBB	0	0		0	WPD
9	23	2	10	3	1	49	49	2	1520	MBB	6	0		6	WPD
9	24	2	20	4	1	49	49	3	1410	MBB	2	220		222	DUNES
9	25	2	15	6	1		47	1	1355	NSB,MBB	2	340		342	WPD
9	26	1	5	7	0			1	1430	MBB	11	338		349	BD

APPENDIX 3. Other marine mammal sightings, northern Bristol Bay, southwest Alaska, April-October 1991.

Harbor Porpoises (Phocoena phocoena):

8/30: 2 harbor porpoises swimming between Pyrite Point and Shaiak Island.

9/3: 2 harbor porpoises (1 adult, 1 small, possibly young?) swimming off the coast between Gap and Oracle Mountain.

Seals

5/1-5/12: 1-2 seals seen daily in Chagvan Bay.

6/10: 2 seal carcasses on Hagemeister Spit.

Whales

4/25-6/15: Gray whales (Eschrichtius robustus) were often seen travelling north along the coast of the Cape Peirce peninsula. As many as 22 whales were seen in one day (3 May) from the Cape Peirce cliffs.

5/16: 1 Killer whale (Orcinus orca) in water swimming mid-way between Summit Island and Rocky Point.

5/16: 1 whale carcass on Picnic Beach on the Nushagak Peninsula, pile of bones.

5/16: 1 gray whale swimming between Rugged Point and Cape Peirce Point.

7/17: 1 gray? whale swimming just off the east coast of the Twins.

7/20: 1 whale carcass (probably gray) 1/2 mile north of Nichols Spit on the Nushagak Peninsula; 3 whale carcasses (probably gray) on Picnic Beach, 4-5 miles northwest of Kikertalik Lake on the Nushagak Peninsula, one a pile of bones.

8/23: 1 whale carcass (probably gray) 1/2 mile north of Nichols Spit on the Nushagak Peninsula. Flesh peeling back, ribs showing; 1 whale carcass 7 miles southeast of Kikertalik Lake on the Nushagak Peninsula. Some of flesh gone, about half of the bones showing; 5 whale carcasses (all probably gray) on Picnic Beach on the Nushagak Peninsula: 1 20', red-gray in color, 1 20'-25', red-gray in color, 2 separate piles of whale bones, and 1 whale red-gray in color. All appeared to have been dead several months, at least.