

ABUNDANCE AND DISTRIBUTION OF MARINE MAMMALS IN
NORTHERN BRISTOL BAY AND SOUTHERN KUSKOKWIM BAY

--A Status Report of the 1994 Marine Mammal Monitoring
Effort at Togiak National Wildlife Refuge

BY

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January 1995

KEY WORDS:

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

A COOPERATIVE EFFORT BETWEEN

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SUMMARY

In 1994, the marine mammal program at Togiak National Wildlife Refuge (TNWR) focused on monitoring the abundance and distribution of walruses and seals in northern Bristol Bay, with opportunistic observations occurring in southern Kuskokwim Bay. Ground counts of walruses at Cape Peirce and Round Island produced peak numbers of 3,845 and 5,949, respectively. The peak count at Cape Peirce is higher than the average of the past five years, though much lower than the peak of 7,530 in 1993. The greatest number counted on any one day in northern Bristol Bay was 5,968 on 4 June. Other high total counts of the northern Bristol Bay area occurred on 13 and 23 July with 4,424 and 4,663 walruses, respectively, counted at both Cape Peirce and Round Island. These may not represent complete censuses of the area's haulouts, as no monitoring at Cape Newenham and Cape Seniavin took place this year.

An unusual occurrence took place at Cape Peirce during 20-24 September when over 200 walruses hauled out atop cliffs near a larger haulout on a sandy beach. At least 42 walruses died as a result of falling from high cliffs and dunes as they attempted to find their way back to the beach. Many more probably met a similar fate after camp was closed, as an aerial survey on 5 December revealed 119 fresh, bloated carcasses in the Cape Peirce vicinity.

Nanvak Bay near Cape Peirce continues to be the largest seal haulout in northern Bristol Bay. A peak count of 540 seals was recorded there on 25 August. This is slightly higher than average peaks for the last six years, when regular daily censusing took place. This year's peak is 139 less than 1993's peak and much lower than the peak count of 3,100 in 1975. This decline parallels harbor seal population trends observed in other parts of Alaska; the causes of the decline are unknown and must be further investigated. Harbor seal pups were observed in Nanvak Bay; a high count of 15 pups was recorded on 1 July.

INTRODUCTION

Togiak National Wildlife Refuge's 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 some of 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 Dept. 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 North Pacific Fisheries Management Council's (NPFMC) decision to restrict the activities of the yellow-fin sole fishery. 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 TNWR 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 since the mid 1970s (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 by USFWS staff, with funding from NMFS, began in 1990 and continued through 1993. In 1991 concentrated efforts determined that Cape Newenham is a 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. Sea lions were not monitored at Cape Newenham in 1994, due to funding constraints.

During 1994, TNWR, Marine Mammals Management (MMM), and ADFG have worked jointly to determine abundance and distribution of walruses in northern Bristol Bay. A continued cooperative effort will help ensure responsible management of this species.

OBJECTIVES

1. Determine number of walruses, number and average length of haulout peaks, and long-term population trends at Cape Peirce.
2. Monitor and document walrus behavioral response to aircraft, boats and increased visitor use at Cape Peirce.
3. Determine changes in the number, location and state of decay of walrus carcasses at Cape Peirce.
4. Collect teeth from walrus carcasses for aging by MMM.
5. Estimate number and ages of walruses 10 years of age and under at the South Firebaugh haulout throughout the season.
6. 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.

STUDY AREA

The study area covers approximately 43 km of coastline in southwest Alaska, from Rugged Point east of Cape Peirce in northern Bristol Bay to Air Force Cove on the north side of Cape Newenham (Fig. 1). It also includes Round Island in the Walrus Islands State Game Sanctuary (ADFG). The Cape Peirce-Cape Newenham area is located approximately 193 km west-southwest of Dillingham within the Togiak National Wildlife Refuge. Steep, jagged cliffs above rock and sand beaches characterize the coastline in this area. Nanvak Bay is located approximately 3 km north of Cape Peirce Point (Fig. 2).

Opportunistic observations were made at Chagvan Bay by a USFWS crew stationed at a waterfowl camp 8 April-13 May (Moran, unpub. report 1994), along the coast and islands of Kuskokwim and Bristol bays by a USFWS crew aboard the *Rex M* surveying for seabirds 9-28 June (Hagblom, unpub. report 1994), and at Carter Spit and Jacksmith Bay on Bureau of Land Management (BLM) land by a BLM crew surveying for shorebirds 6 July-7 August (Seppi, unpub. report 1994).

METHODS

WALRUSES

Haulout

Cape Peirce: Beaches where marine mammals haul out at Cape Peirce were checked daily and the following information was recorded: date, time, weather (wind direction and speed, cloud cover, visibility, precipitation, temperature), tide, beach conditions, number of animals hauled out, number of animals in the water, and unusual scars or features on walruses. Additionally, the number of animals in age classes 2-3, 4-5, 6-7, 8-9, and 10 years (estimated based on body size and tusk length) were counted at the South Firebaugh haulout. Maggy Beach was not surveyed for age classes, as haulout configurations there make it difficult to clearly view individual 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. Larger haulouts were usually photographed with either a 35mm Nikon camera, 50mm wide angle lens or a 35mm Pentax camera with a 70-200 zoom lens. Color slide and black-and-white print films were used. Photographs will be counted for comparison with ground counts. Haulouts were visually scanned each day for transmittered animals.

Radio contact was made with personnel on Round Island several nights each week to compare walrus activity at the two haulouts.

Cape Newenham: No staff was stationed at Cape Newenham this year to census walruses, due to funding constraints. Employees of the Long-Range Radar (LRR) site reported one estimate of numbers on 21 May, and the crew of *Rex M* surveyed the Cape Newenham peninsula for walruses 9-13 June. Two aerial surveys of Cape Newenham were flown in conjunction with other flights on 6 and 7 July.

Round Island: The walrus haulout on Round Island was monitored by ADFG and MMM Wildlife Technicians from 12 May through 15 August.

Behavioral Response to Human Activities-Opportunistic Observations

In the past at Cape Peirce, walruses have moved off the beach when boats or planes travel near hauled out animals (O'Neil & Haggblom 1987, Sheffield 1988, Jemison 1989, 1991 and 1992). 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 orient and/or 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

Because of high visitor use at Cape Peirce this year, staff was able to plan ahead in monitoring haulouts during much of the aircraft activity. Incidences of marine mammal disturbances were reported to TNWR headquarters, where appropriate follow-up action was taken.

AERIAL SURVEYS

Opportunistic sightings of marine mammals were collected during an aerial seabird survey along the coast from the Nushagak Peninsula to Hagemeister Island on 24 May. Cape Newenham was surveyed from the air on 6 July. Both surveys were flown in TNWR's Cessna 185 on floats, at an altitude of 300-500 feet and an airspeed of 110 knots. Cape Newenham and Cape Peirce walrus haulouts were censused on 7 July during an ADFG aerial survey of Bristol Bay for orcas and belukhas, in an Aerocommander at an altitude of 1,000 feet (Frost, pers. comm.). A survey for carcasses was flown on 05 December along the coast between Togiak Bay and Cape Newenham in a Cessna 185 on wheels, at an altitude of 600 feet and an airspeed of 120 knots. Marine mammal surveys of the entire northern Bristol Bay coast were not flown this season, due to funding constraints.

CARCASSES

The location and condition of carcasses at Cape Peirce were recorded when they first appeared or if they were moved by tides and storms. The two front lower jaw teeth were collected from carcasses to be sent to MMM for aging.

Opportunistic observations of carcasses along the coast of Kuskokwim and Bristol bays were made by the USFWS crew of *Rex M* and the BLM crew at Carter Spit.

SEALS

Haulout/Nanvak Bay

Seals hauled out on the mid-bay bars (Fig. 2) in Nanvak Bay were primarily censused from observation points established in 1990 on North Spit. Crossing Nanvak channel to North Spit was done in a Klepper kayak. A secondary observation point 0.5 km 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. Occasionally, counts were made from the bluff behind the cabin or from the cliffs if the haulout configuration made counts difficult from the secondary observation point. 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.

Anthropogenic disturbances to seals were documented and reported to TNWR headquarters.

NORTHERN SEA LIONS

Numbers

Northern sea lions were observed hauled out at the tip of Cape Newenham on 6 July during an aerial survey and on 16 July by the *Rex M* crew as the ship motored by offshore. No staff was stationed at Cape Newenham this year to census sea lions, due to funding constraints. Opportunistic counts were made at other locations.

RESULTS

WALRUSES

Numbers/Haulout Patterns

Cape Peirce: Walrus haulout beaches were censused daily at Cape Peirce from 25 May through 29 September (Appendix 1). Walruses were first observed hauled out on 25 May. Numbers remained below 100 (except for 2 June) until 9 June, when they began steadily increasing to a peak on 1 September of 3,845.

Seventeen peaks in the number of walruses hauled out occurred this season (Fig. 3). Length of haulout periods (the number of days from one low count to the next) ranged from 3 to 10 days, with a mean length of 6.9 days. Number of days between peaks ranged from 2 to 12 days, with a mean of 6.4 days.

Walruses estimated to be ≤ 10 years old were counted at the South Firebaugh haulout (Fig. 4). Aging was not done on 13 days due to poor visibility (fog) or time constraints. Between 1 June and 28 September, the percent of the total haulout consisting of younger walruses averaged 2.62%.

No VHF or satellite-linked radio transmitters were observed this year at Cape Peirce.

Round Island: Walruses hauled out on Round Island were censused from 12 May to 15 August (Appendix 1). The peak count was 5949 on 4 June (ADFG unpub. data, 1994).

Cape Newenham: On 21 May, "hundreds" of walruses were reported hauled out at Whitey Cove (Fig. 2) by employees of the LRR site (Peltier & Polakoff, pers. comm.). No walruses were present on beaches 9-13 June, when the *Rex M* crew surveyed the area. Thirty walruses were observed hauled out at Bird Rock Cove on 6 July during an aerial survey. On the following day, 40 walruses were counted at Whitey Cove during an aerial survey (Frost, pers. comm.).

Cape Seniavin: An opportunistic estimate of approximately 2,000 walruses at the Cape Seniavin haulout on the Alaska Peninsula (Fig. 1) was made by an anonymous local pilot during herring season in early-mid May (R. Grant, pers. comm.).

Disturbances

Cape Peirce: Twenty-four disturbances (occurring on 18 days) to walruses were observed at Cape Peirce in 1994; 19 were caused by planes, two by boats, one by hunters and one by a visitor (Appendix 2). One disturbance occurred when a walrus hauled out atop and set off a small live-trap staff had placed well outside the haulout area the previous day.

Forty-two percent of the disturbances provoked a high degree of response from walruses, 27% provoked a moderate degree, and 31% provoked a low degree.

Cape Newenham: One disturbance to walruses was observed on 21 May at Whitey Cove by employees of the LRR site (Appendix 2). Two boats entered the cove, provoking a high degree of response as hundreds of walruses went into the water from the haulout. Passengers drove the boats in among the walruses in the water (Peltier & Polakoff, pers. comm.).

Behavioral Observations

On the morning of 20 September, following a storm with winds of at least 50 mph out of the east, the staff at Cape Peirce, discovered 50-75 walruses hauled out on the top edge of west-facing, 30-38 meter-high cliffs. These cliffs overlook Parlier Beach and Bristol Bay (Fig. 5). Walruses have not been known to travel such terrestrial distances or to such elevations at Cape Peirce since the area has been monitored by USFWS (1984-1994).

Walrus reached the cliff top via a tundra and grass covered incline extending up from large sand dunes surrounding Maggy Beach. Frequently this summer, walrus had hauled out higher than usual on the dunes.

The cliff-top walrus group alternately rested and wandered back and forth along the edges of the cliffs, over a distance of approximately 0.5 km. Soapstone Hill prevented walrus from moving further south. By early afternoon, most walrus had made their way back down to the main group of 830 animals on Maggy Beach; only two remained on the cliffs.

That afternoon staff discovered 15 fresh walrus carcasses below the shorter (15-23 m), north-facing cliffs overlooking Maggy Beach. Carcasses were hard to distinguish, as live walrus were hauled out atop and surrounding them. Since staff did not monitor the cliffs all day (they were unaware earlier that any walrus had died), they knew only that the deaths occurred sometime since the previous nightfall. Ten of the carcasses were together in a pile, along with large broken rocks, covered in rubble, directly at the base of the cliffs. Other carcasses were washed up along the tide line. Staff noticed wide trails through the wet grass above the cliffs and pile of carcasses, and deduced the walrus had died by falling from the cliffs. Some walrus hauled out on the beach below may have been killed or injured by walrus falling on top of them. Staff later discovered one fresh carcass at the bottom of the west-facing cliffs on Parlier Beach.

At daybreak on 21 September no walrus remained on the cliffs. A herd of 1,230 walrus were hauled out on Maggy Beach, and did not climb higher during daylight hours.

On 22 September, staff found 241 walrus hauled out in the morning atop the west-facing cliffs, and four new carcasses on Maggy Beach. Throughout the day staff monitored the animals. The walrus wandered along the cliff edge and some attempted to return to Maggy Beach by going down the north-facing, grassy incline/cliffs. Staff witnessed, videotaped and photographed several walrus rolling, slipping, sliding and falling off these cliffs to the rocky beach below, where 440 walrus were hauled out. Some died and some survived, at least long enough to reach the water. Staff couldn't determine how many individuals died because the animals fell into the hauled-out herd. A large part of the cliff-top group found safe ways back to the beach. By nightfall, approximately 140 walrus remained on the west cliffs, all at one spot not far from the drop-offs over Maggy Beach.

At daybreak of 23 September, staff observed at least five walrus falling from the north-facing cliffs. Staff monitored the walrus all day again, photographing and videotaping as several animals fell and many made it down safely. There was a total of 9 new carcasses on Maggy Beach and 8 new ones on Parlier Beach by nightfall of 23 September. In the early evening, about 45 walrus remained atop the cliffs, together in a group at the base of Soapstone Hill. At this time, since staff judged walrus to be in a position where they would not be disturbed, staff planted "flags" (plastic white garbage bags attached to wooden stakes) at cliff-side spots to deter walrus from returning to the cliff edges where they'd been falling. The rustle of plastic materials such as rain gear has been observed to frighten walrus at both Cape Peirce and Round Island. Polly Hessing, of Marine Mammals Management, had offered this suggestion, to be used at the staff's discretion. No more walrus moved from the cliffs before dark.

On the morning of 24 September, staff found no walrus atop the cliffs, and a few new trails through the grass and tundra which were direct and safe routes back to Maggy Beach. From their tracks, it appeared the walrus had avoided the flags and kept away from the dangerous areas. Five more carcasses were found on Parlier Beach below the spot where walrus were last seen hauled out atop the cliffs the night before (at the base of Soapstone Hill).

The total known carcass count from 20-24 September was 42. Mortalities might have been higher. Carcasses could have been hidden from view on Parlier Beach or washed off by high tide. Injured walrus may have died later after swimming away from Maggy Beach. Native hunters reported seeing three fresh walrus carcasses along other beaches at Cape Peirce a few days later.

Judging by tusk length and body size, it was estimated that there was one 3-year old, three 5-6-year olds, one 6-8-year old, and four 10-15 year olds among the mortalities. Most of the others seemed to be 15-20 years old. Lower jaw teeth were collected from many of the carcasses for aging.

No more walrus hauls took place atop the cliffs while the Cape Peirce camp remained open through 29 September. Since then, a group of native hunters reported seeing three walrus atop the cliffs, and four fall from the cliffs one day during the week of 09-15 October. The hunters also found several fresh carcasses on Maggy Beach.

Aerial surveys on 22 November and 5 December revealed 119 frozen carcasses, most in a fresh, bloated stage, along Maggy Beach and the southern half of Nanvak Bay. More carcasses may have been hidden by ice and snow. This is an unusually high number, and it is presumed most of these walrus fell from the cliffs. At least half of the carcasses appeared since 29 September, when camp closed.

Subsistence Harvests

One successful hunt took place at Cape Peirce, on 12 September. A younger male walrus, probably between six and eight years old, was killed on Maggy Beach with one shot to its head. The hunters harvested almost all of the blubber and muscle accessible to them, along with three flippers, the head with tusks, and the kidneys, liver, and heart. Staff videotaped and photographed the harvest, with the hunters' cooperation. A high level of disturbance resulted from the hunting activities as more than half of the 1,819 walrus hauls went into the water (Appendix 2).

Another group of hunters arrived at Cape Peirce on 26 September, but decided not to hunt. Under 20 walrus were hauled out on Maggy Beach, the usual hunting spot, and the water was too rough off South Firebaugh to approach by boat. The hunters collected ivory from some of the cliff-fallen walrus.

Carcasses

Mapping of carcasses for the entire northern Bristol Bay coast via aerial surveys was not done this season due to funding constraints. Cape Peirce was the focus of carcass surveys this year. Opportunistic counts were made at other locations.

As of 27 May, 36 carcasses were counted during a ground survey at Cape Peirce that covered the south half of North Spit, the south shore of Nanvak Bay, and the beaches from Maggy Beach to Rugged Point (Fig. 2). All of these were at least several months old, and some were a few years old. Two carcasses that had been tagged in the summer of 1993 were still present, with tags partially intact. During ground surveys in July and August of the north half of North Spit and Nanvak Bay, 9 additional older carcasses were discovered.

Throughout the season, carcasses were counted and tracked, and prior to 20 September, 15 fresh carcasses had appeared in these areas. The first appeared 23 June, with the majority occurring mid August to early September. High mortalities caused by walrus falling from cliffs 20-24 September resulted in 42-43 new carcasses. One more old carcass, with barnacles attached to its tusk, washed up by the time camp closed on 29 September, bringing the season total of carcasses new to Cape Peirce to 58-59. Lower jaw teeth were removed from all accessible carcasses, and sent to MMM for aging.

One-hundred and nineteen carcasses, almost all frozen in a fresh, bloated condition were counted on Maggy Beach and the south shores of Nanvak Bay during aerial surveys on 22 November and 5 December. At least roughly half of these had appeared since 29 September.

Hagemeister Island has been observed in the past few years to have one of the highest concentrations of carcasses (Jemison 1992, 1993). The only counts this year were taken opportunistically by the *Rex M* crew; an adult male carcass on Hagemeister Spit 22 June, and an adult carcass on a southeast beach of Hagemeister Island 26 June (Hagblom, unpub. report 1994).

Opportunistic counts by the BLM crew between 06 July-07 August on Carter Spit (Kuskokwim Bay) included a total of 13 walrus in varying degrees of decay (Seppi, unpub. report 1994).

Other Observations

Orcas (*Orcinus orca*) interacted with a group of walrus in South Firebaugh Cove at approximately 14:30 on 02 July. Just prior to the appearance of the whales, 7-9 walrus were observed in an unusual formation of a tightly packed circle, with individuals facing each other, nuzzling and playing. Two orcas of medium size swam swiftly into the cove from the north, directly up to the group of walrus. The walrus turned away a little and then turned toward the whales. The orcas nosed into some of the walrus and swam off, continuing south. Shortly afterward, an orca female and her calf swam by the cove, leaping and porpoising frequently out of the water. The walrus appeared to behave normally after the orcas left.

Among the usual array of walrus wounds such as cuts, bloody facial punctures, and large patches of torn-off flesh, some were especially noteworthy. Two walrus were seen with large (45-60 cm, approximate length) tumors or abscesses. Two had swollen, ulcerated right eyes - one was partly prolapsed. An older walrus sustained a possible broken jaw - he was unable to close his mouth, and his jaw and lower lip were hanging and swollen. His left tusk was jaggedly broken off to a stub. One animal appeared to have a broken front right flipper, as he never put weight on the flipper and moved very slowly in hauling out, resting every few steps.

Seven walrus with distinctive markings or tusks were identified and catalogued with sketches, descriptions, and photographs in an attempt to track individuals. Two of the animals were resighted once.

SEALS

Nanvak Bay

Haulout patterns: Seals hauling out in Nanvak Bay were censused daily from 26 May through 29 September (Appendix 3). Seals hauled out only on the mid-bay bars until 9 August, when they also began using the tip of North Spit (Fig. 2). Seals regularly hauled out on North Spit in August and September, coinciding with their molting season. The mid-bay bars were used to a lesser extent during this period. Seals were observed to be hauled out continuously during all observable daylight hours on North Spit for two extended periods on 9-16 August and 18-20 August. Frequently during the season, a group of 10-25 seals that appeared to be of a distinctive pelage (very light background with dark spots all over) hauled out at a location separate from the other seals.

Numbers: The number of seals in Nanvak Bay increased throughout the season and began to fall by late September (Fig. 6). In northern Bristol Bay, molting probably peaks in late August and early September (Johnson 1976); peak seal numbers typically occur during the height of the molt. The peak haulout count for the molting period, as well as the high count for the year, occurred on 25 August with a total of 540 seals in Nanvak Bay. Both harbor and spotted seals haul out in Nanvak Bay, however the percentage of each was not determined.

Pupping: The first pup of the season was seen swimming and nursing on 31 May. The number of pups increased throughout June and early July until a high count of 15 pups was recorded on 1 July (Fig. 7). The peak haulout during the pupping period was 338 on 22 June.

Two stranded pups were found on 17 and 25 June. The first was stranded at the high tide line on the west shore of Nanvak Bay, and appeared to be a starving, emaciated and weak. The second pup was resting on Maggy Beach where the surf was rough, and scrambled into the water when approached.

Northern Bristol Bay and Southern Kuskokwim Bay Haulout Locations

Though no aerial surveys were flown of the entire northern Bristol Bay coast this year, opportunistic aerial and ground counts occurred.

One to two seals were observed daily in Chagvan Bay during a waterfowl camp from 28 April-13 May. Five seals were

spotted in the bay from the air on 13 May (Moran, unpub. report 1994). Three seals were seen hauled out at the base of Oracle Mountain (Cape Newenham, Fig. 2) on 30 May (Anders, Peltier & Polakoff, pers. comm.). At the base of the south-facing cliffs at Cape Peirce, between 3-10 seals with pups were usually seen hauled out during opportunistic sightings from June through August. One to two harbor seals were spotted six times by the BLM crew between 08 July-02 August near Carter and Cripple Creek spits (Seppi, unpub. report 1994).

Disturbances

Nanvak Bay: Though no method has been standardized for assessing the degree of anthropogenic disturbances to seals at Cape Peirce, disturbances have been monitored for several years in Nanvak Bay. In 1994, 18 seal disturbances were documented. Twelve of these were caused by planes, four by boats and two by seal hunters in boats. During 14 of the disturbances, all or nearly all seals hauled out went into the water. In four of the disturbances, less than half of the group hauled out went into the water.

Cape Newenham: One disturbance to seals was observed by employees of the LRR site (Anders, Peltier & Polakoff, pers. comm.) on 30 May. Three seals hauled out on the rocks at the base of Oracle Mountain were scared into the water by a skiff ferrying three people back and forth on nearby beaches.

Subsistence Harvests

Two seal-hunting incidences were observed at Cape Peirce this summer. Hunters fired several rounds from their boat while in Nanvak Bay during the evening of 11 September and the following morning. Three seals were killed and retrieved. A hunt was attempted on 26 September in Nanvak Bay. Hunters in two skiffs shot three rounds at seals, but none were taken. These hunters had taken two seals in the waters of Togiak Bay and Tongue Point, en route to Cape Peirce.

Carcasses

The *Rex M* crew saw a harbor seal carcass on 9 June floating in the lower Kuskokwim River near Eek Island, and one on 23 June on Hagemester Spit (Hagblom, unpub. report 1994). Between 06 July-07 August on Carter Spit, the BLM crew found a total of 7 harbor seal carcasses in varying degrees of decay (Seppi, unpub. report 1994).

NORTHERN SEA LIONS

Cape Newenham

Numbers: The northern sea lion haulout at the tip of Cape Newenham was surveyed twice this summer. Sea lions were observed hauled out on 16 June by *Rex M*, though the boat was travelling too far offshore for an accurate count (Hagblom, unpub. report 1994). About 300 sea lions were seen on the tip during an aerial survey on 6 July.

The *Rex M* crew saw several sea lions in the Cape Newenham vicinity. One repeatedly surfaced near the boat as it motored from Chagvan Bay to Security Cove 10 June. Two sea lions were seen on the west side of Security Cove 11 June. One sea lion was near Bird Rock, and two to three were seen around *Rex M* as it was anchored in Air Force Cove 12 June.

No sex and age composition, marked animal, disturbance, or subsistence harvest data were collected at Cape Newenham, since no ground crew was staffed at the site this summer.

Cape Peirce

Sea lions were seen 14 times, in groups of 1-3, in the water below the west cliffs of Cape Peirce between 05 June-10 August. On one occasion (11 June), a female or young male swam near the walrus haulout on South Firebaugh for several minutes, repeatedly peering out of the water at the walrus onshore and swimming towards the ones in the

water. On 16 July, a female or young male with a circular wound on its left shoulder stood in the surf near the walrus haulout at South Firebaugh, intermittently roaring at the walruses and swimming away. The sea lion came ashore, acting antagonistically. It rested next to the walruses for several minutes at a time, periodically getting up and roaring. It provoked a couple of bluff-fights with walruses, then laid down for 15 more minutes before swimming off (Moore & Moran, pers. comm.).

Round Island

The peak sea lion count was 542 on 16 May. Numbers steadily declined thereafter through mid August (ADFG unpub. data 1994). Round Island's field camp closed 15 August.

Other observations

During an aerial survey on 24 May, 15-20 sea lions were seen in Togiak Bay pursuing herring.

Small groups of sea lions were seen almost daily from 02 May-13 May in Chagvan Bay. At high tide on 11 May, 30 sea lions were very active, roaring and leaping, in the mouth of the bay for several hours. On 12 May, sea lions fed constantly on herring that had entered the bay.

Between 06 July-07 August on Carter Spit, the BLM crew found a total of 2 sea lion carcasses in varying degrees of decay (Seppi, unpub. report 1994).

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 inconsistent counts resulted from untrained volunteers rotating through the field camp to census the walruses. For example, a photo was enlarged of a peak haulout in 1986. The ground estimate proved to be 35% to 49% higher than the estimate from the photo (11,800 ground estimate vs. 7,100-7,500 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 to deter wasteful taking of walruses (Hotchkiss, pers. comm.). Walrus counts have become more reliable since 1987 as personnel at Cape Peirce remained the entire season, focused on obtaining accurate counts, and had better methodological training.

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. Census data for 1984 at Cape Peirce was collected sporadically, and is not used in this report.

Numbers/Haulout Patterns

The peak walrus count at Cape Peirce of 3845 on 1 September was far less than the peak of 7530 in 1993, and slightly higher than the average of the previous four years (Fig. 8). Last year's numbers were exceptionally high throughout the

season (Wilson & Jemison 1994); this year's numbers follow the normal trend since 1989, and are very similar to 1991 in their seasonal pattern and magnitude (Fig. 9).

Numbers generally declined from 1986-1990, and have been rising but variable in the past four years (Fig. 8). Prior to the steady decline begun in 1986, the number of walrus using the Cape Peirce haulout had been increasing from 1981 through 1985, when a high count of 12,500 walrus was recorded. The 1993 peak count of 7,530 represents the highest peak during all years of consistent daily censusing (1987-1993).

Seventeen peaks punctuated by steep declines (>500 walrus) in the number of walrus hauled out at Cape Peirce occurred during the census period in 1994 (Fig. 3). Seventeen peaks also occurred in 1993, but they were defined by steeper declines ($>1,000$ walrus), which may have been due to the greater magnitude of the haulouts that year. These strong fluctuations in numbers of walrus onshore may be synchronous with resting and feeding cycles, based on telemetry studies at Round Island. Such fluctuations may also be related to severity of storms and to anthropogenic disturbances.

During storms with strong onshore winds and heavy surf, hauling grounds are usually abandoned (Nikulin 1947 in O'Neil & Haggblom 1987). Preliminary analysis comparing wind speed to declines and increases in walrus numbers in 1993 (Wilson & Jemison 1994) and 1994 seem to suggest some relationships.

In 1994, all of the 17 haulout peaks corresponded with the occurrence of low wind speeds (≤ 20 mph, $\bar{x}=12$ mph) on the same or previous day. There were four days or periods of low wind speeds unaccompanied by peak haulouts. Two of these occurred in early June, when only low numbers of walrus were at Cape Peirce; one (22 July) coincided with several disturbances which drove walrus from their haulouts prior to censusing; and the last (31 August) showed a decline of < 500 animals.

Conversely, 13 of the 18 low counts in 1994 coincided with high wind speeds (≥ 25 mph, $\bar{x}=34$). All but one of the episodes of high wind speed at Cape Peirce were accompanied by steep declines in numbers of walrus hauled out on the same or following day.

Not all sharp declines in walrus hauled out coincide with high wind speeds. Five steep declines occurred following days with anthropogenic disturbances; three of these were on high wind speed days. Four disturbance days happened while walrus numbers were already very low, and numbers continued to be low. Eight disturbance days appeared to have no long-term (2-3 days) effects on the haulouts, as walrus numbers either remained stable or increased in the following days. The long-term effects of the last disturbance of the season was undetermined, since staff closed camp that day.

Walrus in 1994 seemed to follow the general trend in haulout patterns at Cape Peirce for low-count years (Fig. 9). In most low-count years (1989-1991), numbers are relatively low in June and peak in August-September. Nineteen ninety-two was a unique low-count year, with its peak haulout occurring in early June, which may have been related to the unusually high numbers of walrus using Cape Newenham (Jemison 1993).

Seasonal peaks at Cape Peirce typically occur later in the year (July-September) than do peaks at Round Island (May-early July) (Fig. 10). This may be due in part to males migrating north in the fall to join females at the edge of the ice pack (Fay 1982). This year, the peaks followed the typical pattern, with Round Island's peak of 5,968 on 4 June and Cape Peirce's peak of 3,845 on 1 September.

In 1994 as in 1993, Maggy Beach was used earlier and more frequently by walrus than it had been in the previous 4 years. Walrus began using this beach in mid-June in 1993, though not consistently until early July. In 1994, they were present on Maggy Beach on 30 May. In 1992 and 1991, walrus began using this beach in late June, and in 1990 and 1989, they did not use it until August. Walrus were present on Maggy Beach 77 days (60% of the 129 days censused) in 1994, compared to 93 days in 1993, 34 in 1992, 53 in 1991, 12 in 1990 and 27 in 1989. Maggy Beach is a large, sandy exposed beach where typically the most walrus haul out. In 1992, 1990 and 1989, when overall walrus numbers were lowest at Cape Peirce, use of Maggy Beach was low. Walrus primarily hauled out on South Firebaugh Beach and Odobenus Cove, the smaller, more protected beaches below the cliffs. From field observations, it seems that when

these smaller beaches "fill up," walrus begin hauling out on Maggy Beach.

Between 1 June and 28 September, the percent of the total haulout on South Firebaugh and Odobenus beaches consisting of walrus ≤ 10 years old ranged from 0-15.4% and averaged 2.62% (Fig. 4). The unusually high percent of 15.4% occurring 7 June is based on a small sample size ($n=13$), and may not be representative. Though not varying greatly, the biweekly average generally rose steadily from 1.8% in mid-June to 3.72% in late September, reflecting an apparent trend of younger walrus making up a larger proportion of the haulout later in the season. Due to the haulout configuration, younger walrus are not counted at Maggy Beach, though this is the major haulout for walrus later in the season. The percentage of the herd on Maggy Beach consisting of younger walrus appears to increase markedly in late summer, based on casual observations.

The beaches at Cape Newenham have been used sporadically by walrus during the last 10 years. In the three years of more regular censusing (1991-1993), peaks ranged from 870 to 4000 (Fig. 8). Between 1988 and 1990, few walrus were seen at Cape Newenham (Jemison 1992). From 1978 to 1984, when observations were very irregular, numbers ranging from a few individuals to several thousand animals were reported hauled out during the spring and fall months (Jemison 1992, TNWR Annual Narrative 1986).

Total Haulout Count: The greatest number of walrus known to have hauled out on any one day in northern Bristol Bay was the combined count at Round Island and Cape Peirce on 4 June of 5,968, which coincides with Round Island's peak count of the season, and includes 19 walrus from Cape Peirce (Fig. 11). This does not represent a complete census of the area's haulouts, as Cape Newenham and Cape Seniavin were not monitored this season. Other high counts occurred on 13 and 23 July with 4,424 and 4,663 walrus, respectively, counted at both Cape Peirce and Round Island. Aerial surveys of Cape Newenham haulouts estimated 30 walrus on 6 July and 40 walrus on 7 July. This brought the total count for the three northern Bristol Bay haulouts combined to 1,471 and 2,510, respectively, on these two dates. During 1991-1993 it appeared that walrus were less likely to congregate at any one haulout area than in previous years. In 1994, walrus appeared to congregate primarily at Round Island up until late June, and primarily at Cape Peirce beginning mid July, with more similar numbers at both haulouts in the interim. It is probable that some of the same animals use all three northern Bristol Bay haulouts, and possibly Cape Seniavin, intermittently. Movement of walrus between Cape Peirce and Round Island has been confirmed through telemetry studies (Hills 1987 & 1990, Sheffield 1988). Surveys of all four haulouts, at least during peaks at Cape Peirce and Round Island, are essential to better determine the extent of the walrus population in Bristol Bay and southern Kuskokwim Bay.

Yellow-Fin Sole Fishery

A comparison of annual haulout peaks from 1985 through 1994 at both Cape Peirce and Round Island show fluctuations in the number of walrus hauling out from year to year (Fig. 8). A potential cause of these fluctuations is the presence of the yellow-fin sole fishery in northern Bristol Bay. During 1987 and 1988, when the yellow-fin sole fishery was highly active within 3 miles of Round Island, haulout numbers were low at Round Island and high at Cape Peirce. In 1989 and 1990 when there was no yellow-fin sole fishery in northern Bristol Bay, peak numbers at Round Island were higher than peak numbers at Cape Peirce. Few walrus were seen at Cape Newenham these years (Miller, pers. comm.). During 1991 through 1994, when the fishery was restricted, haulout numbers were variable at Cape Peirce, Round Island and Cape Newenham.

In 1989 the NPFMC voted to close waters within 12 miles of Cape Peirce and Round Island to the yellow-fin sole fishery. 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. Further investigation is needed to evaluate the possible effects of the yellow-fin sole fishery on the distribution and number of walrus hauling out in northern Bristol Bay. Feeding areas, migration routes, and/or travel corridors may be affected by the yellow-fin sole fleet. Cape Peirce and Cape Newenham may be used as alternate haulout sites.

Compliance with the regulations has been good in the past three years. In 1994 and 1993 no yellow-fin sole vessels were cited for violating the 12-mile restricted zone around Round Island (Nussbaumer, Hoover, pers. comm.). In 1992 there was little activity by yellow-fin sole vessels inside the 12-mile zone (Hessing and Van Daele 1992). This contrasts

with 1991 when nine boats linked to the yellow-fin sole fishery were cited by the Coast Guard for violating the 12-mile closure (Dubois, pers. comm.)

Disturbances

Cape Peirce: Twenty-four disturbances of walrus occurred at Cape Peirce this year (Appendix 2), a fewer than the 30 recorded in 1993, and far more than the five in 1992. Fewer disturbances probably occurred in 1994 compared to 1993 because walrus were hauled out on Maggy Beach fewer days, especially during the peak visitor season, when there was greater air traffic. Possible reasons for the larger number of disturbances in 1994 than in 1992 include walrus haulout locations (more days on Maggy Beach in 1994), the increased number of public use visits to the area, and the disregard by pilots (not associated with public use) of altitude and lateral distance recommendations for flying in the wildlife sensitive area.

The majority (80%) of the disturbances were caused by aircraft. Besides the 19 flights that disturbed walrus, there were 54 other aircraft sighted in the Cape Peirce vicinity that caused no apparent disturbances. However, 45 of these 54 aircraft flew by when no walrus were hauled out on beaches within hearing range (based on human observation) or were public use flights which used Sangor Lake, an area approximately 3 km away from the nearest haulout on Maggy Beach (Fig. 2). Total number of aircraft flights documented in the Cape Peirce vicinity in 1994 (78) is double the number documented in 1993 (39). This may be due, in part, to increased public use and to better documentation by experienced staff members.

Two (8.3%) of the disturbances were caused by boats. Each of these boats was within 100 m of the shore and visible from the west-facing cliffs above the walrus haulouts. Twenty-three other boats were sighted from these cliffs throughout the season; 7 were within 3.2 km of the shore and were either small boats or travelled by when no walrus were present on beaches, and 13 were 4.8-24 km offshore. These did not cause any observable disturbances to walrus hauled out. Two purse-seiners and a skiff were present nearshore fishing for capelin, along with a Supercub spotting overhead, in the early morning of 30 May; no walrus were present on beaches when the census was conducted later that day, so it is unknown whether the vehicles' presence affected walrus haulouts.

Cape Newenham: One disturbance was observed this season at Cape Newenham (Appendix 2). Others may have occurred, but there was no staff stationed to regularly monitor haulouts. Air traffic arrives and departs at least weekly at an airstrip, located near walrus haulout beaches, on the Cape Newenham long-range radar site. The effects of this traffic on the walrus haulouts are undetermined.

Behavioral Observations

The phenomenon of walrus climbing up to cliffs and falling, often to their death, as they did 20-24 September, is unusual and has never before been documented at Cape Peirce, nor perhaps elsewhere. P. Abraham of Togiak knew of two occurrences of walrus climbing up high. One happened on Nelson Island before the epidemic of the mid 1800's, and the other took place on Estes Point probably in 1976, after a big storm with high winds. No walrus were known to have fallen from these high points (P. Abraham, pers. comm.). T. Tucker, a pilot who flew a Grumman Widgeon in the early 1970s to resupply staff at Round Island, reported he had seen walrus hauled out atop 6-8 m high bluffs or rocks on the island. These animals jumped into the water upon the Widgeon's takeoffs (Tucker, pers. comm.). Mass mortalities were discovered in a frozen state on Punuk and Little Diomed islands by Fay in early spring. He attributed these to possible crushing by sea ice, due to the presence of gross internal injuries and the lack of external injuries (Fay 1982). Perhaps these walrus could have died from falls similar to those witnessed at Cape Peirce.

It seems likely that a storm with high winds was instrumental in prompting walrus to climb up to the cliffs at Cape Peirce on 20-24 September. Winds of at least 50 mph were clocked during the day of 20 September, and were probably higher during the previous night, judging from damage to structures. This was the biggest storm of the season and came from the east, blowing offshore, approaching the walrus haulout from the land rather than from the ocean. Most big storms during the summer blow onshore, from the west or northwest. Offshore winds affect sea state and wave formation differently from onshore winds. The direction of this severe storm and the sea state may have presented the

walrus with an unusual condition that caused them to react by trying to retreat from the winds and perhaps avoid the sea. Once they were on the cliffs, they appeared confused as to what direction to take next, and were unable to find the same return route.

Carcasses

Disregarding the cliff-fallen walrus, far fewer new carcasses occurred in 1994 than in 1993. This is probably directly related to the much lower numbers of live walrus in 1994. In general, most new carcasses appear later in the season at Cape Peirce, as walrus numbers increase, and more animals use Maggy Beach.

In 1994 the majority (80%) of 16 new carcasses (not including carcasses of cliff-fallen walrus) at Cape Peirce were found on Maggy Beach, a northwest-facing, sand/gravel beach where most of the walrus hauled out this summer. Cause of death of these animals was unknown, except for one which staff saw harvested by native hunters. Most appeared to have died on site while hauled out. An especially high concentration of six fresh carcasses appeared on Maggy Beach on 1 September. These died near the center of a large haulout during sunny weather, and were first noticed the day after an aircraft disturbance. The carcasses turned black and bloated quickly, oozing blood.

A high proportion (67%) of older carcasses already present at Cape Peirce when camp opened were also found on Maggy Beach.

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. Walrus carcasses observed from 1990 through 1994 were found predominantly on sand/gravel beaches.

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 and identify pups 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 observed using both the North Spit and Cape Peirce observation points.

Numbers/Haulout Patterns

In 1975 an estimated 3,100 seals were present in Nanvak Bay in late August (Johnson 1976). No counts over 700 animals have been recorded since. In 1994 the peak count for the season was 540 seals on 25 August. The maximum number of pups observed in 1975 was 36; in 1994, it was 15. Though the peak count of the season was lower, more seals seemed to be consistently hauled out during 1994, especially in June and July (Fig. 6) than in 1993 (Wilson & Jemison 1994). The peak count during pupping was 338 in 1994 compared to 183 in 1993. Nineteen ninety-four follows the haulout pattern for all years; numbers are low from early June to mid July during pupping, rise steadily to peak in August-mid September during molting, and then begin to decline (Fig. 6).

If the peak seal count for each year of reliable censusing (1989-1994) is an accurate reflection of that year's population trend, seal numbers have slightly increased at Nanvak Bay since 1989. If all years of censusing are considered, peak numbers have doubled since the lows near 200 in 1987-88, but are still not as high as the peaks of 1984 and 1986 (Fig. 12).

The peak pup count in 1994 was 15 (Fig. 7). It is unknown how many of these were born in the bay. However, two small pups accompanying mothers with fresh placenta were seen on the mid-bay bars 15 and 16 June. Though the peak total

seal counts in 1994 and 1993 were higher than the previous three years of reliable observations, the peak pup counts were the lowest. A peak of 15 pups was counted 1993 as well as 1994. During the years 1990-1992 peak pup counts were 19, 21, and 24, respectively.

Observations of seal pups in 1994 and 1993 suggest that most or all newborn pups in Nanvak Bay during June-July are harbor seals rather than spotted seals. Based on the taxonomy of Nowat (1991) and other sources, harbor seal pups are usually born with adult-like pelages and are able to swim immediately; all new pups observed in Nanvak Bay in 1993-94 fit this description. Spotted seal pups, by contrast, have long white lanugo that's molted after about one month, and are unable to swim at birth.

In 1975 Channel Bar (Fig. 2) was used primarily as a birth site in June and then occupied frequently during the molt. From 1990-1993, the use of Channel Bar as a pupping site seems to have declined or ceased. Channel Bar was not used during the pupping season (June through mid July) in 1990, 1991 and 1993, and was used only twice during this period in 1992. In 1994, Channel Bar had disappeared as the channel between Nanvak Bay and the Bering Sea changed its course, redistributing sand. The nearby tip of North Spit was occupied 36 times from 9 August-27 September, but not at all during pupping. Though not analyzed, the data from 1994 (Appendix 3) and 1993 during the latter part of summer suggests seals may have hauled out more often on North Spit/Channel Bar during westerly and northerly winds, and on the mid-bay bars during easterly and southerly winds (Moran, pers. comm.).

The decline in the number of seals in Nanvak Bay since the mid 1970s parallels population trends observed in many parts of Alaska. A variety of factors may play a role in the decline, such as changes in distribution, disease or pollution, subsistence harvest, entanglement in nets or other debris, incidental and direct take by fishermen, and changes in prey abundance and availability (Lowry 1990). Anthropogenic disturbances may affect numbers, too. Throughout the season, boat and plane traffic caused seals to leave their haulouts in Nanvak Bay at least 16 times.

The Nanvak Bay seal haulout is unique because it is the northern-most pupping area for harbor seals in Bristol Bay. Coupled with the population decline, this makes the Nanvak haulout both interesting and important.

SEA LIONS

Numbers/Haulout Patterns

Cape Newenham and Round Island are the major sea lion haulouts in northern Bristol Bay (Jemison 1991). NMFS funded regular monitoring of the sea lion haulout at Cape Newenham in 1991 and 1992; data was collected opportunistically in 1993, and only once during an aerial survey in 1994. ADFG has censused sea lions at Round Island since the late 1970s, where the peak count recorded in 1994 of 542 was higher than the peak of 369 in 1993. The northern sea lion was listed as a threatened species in 1990; numbers have declined throughout their range in Alaska from the late 1950s to the mid 1980s (Hoover 1988). This is a critical time to monitor major sea lion haulout sites.

Legal action on the unlawful wasteful take of eight sea lions at Chagvan Bay on 5 May 1993 (Wilson & Jemison 1994) continued. As of mid December 1994, the National Oceanic and Atmospheric Association's general council had adjudicated the case and set a penalty for the two hunters, which had not yet been paid (Rapport, Robertson, pers. comm.).

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. Begin regular monitoring of the Cape Newenham haulout. During peak haulouts at Cape Peirce, Round Island, and Cape Newenham, conduct aerial surveys of the Cape Seniavin haulout.

3. In cooperation with NMFS, continue monitoring seals at Nanvak Bay. Determine their movement patterns in Bristol Bay with marked individuals. Attempt to more closely monitor numbers and behavioral differences of harbor and spotted seals. Continue to accurately identify pups of each species. 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, monitor the sea lion population at Cape Newenham.
5. Develop a study plan together with MMM and ADFG to analyze the effects of disturbance from aircraft and boat traffic on walrus hauled out at Cape Peirce. This should include comparisons between normal and disturbed behavior. Continue efforts to minimize boat and aircraft disturbance related to commercial fishing, public use and refuge activities.
6. Document severity of walrus disturbances in terms of percent of haulout disturbed, rather than pure numbers alone.
7. In cooperation with NMFS, develop a standardized method for documenting and assessing disturbances to seals hauled out in Nanvak Bay.
8. Observe walrus activity at the Maggy Beach haulout over 24-hour periods, either directly or through videotaping, to detect diurnal patterns in movement on and off the beach.
9. In cooperation with National Biological Survey (NBS), develop a method to tag and follow individual walrus, in order to better assess length of stays at and movement of animals between northern Bristol Bay haulouts.
10. Count photos of walrus haulouts at Cape Peirce from 1994 and previous years, and compare to ground counts.
11. Analyze the walrus carcass data and photographs taken at Cape Peirce to determine approximate stages of decay and possible factors affecting deposition of carcasses. Investigate methods of determining cause of death in carcasses.
12. Compile and computerize sea lion data from Round Island to determine if number of sea lions hauling out has declined.

ACKNOWLEDGEMENTS

Thanks to the TNWR staff who helped in data collection at Cape Peirce: H. Moore, T. Mooney, D. Albert; and especially J. "Boss" Moran, who once again spent endless hours censusing walrus and seals and video tapping disturbances and strange phenomena, and A. Aderman for his great patience and dentistry. Thanks to L. Haggblom (USFWS) for her conscientious and timely follow-ups on marine mammal disturbances reported to the TNWR office, and for her observations aboard the *Rex M*; to P. Hessing (MMM) for her advice on cliff-climbing walrus, which probably saved some walrus lives; to B. Seppi (BLM) for data from Kuskokwim Bay; to L. Van Daele (ADFG) for Round Island information and his advice and comments; to B. Anders, J. Peltier and A. Polakoff (Cape Newenham LRR site) for observations at Cape Newenham; and to B. Ballachy, G. Garner, and L. Holland (NBS) for their suggestions for future walrus research at Cape Peirce. An especial thanks to M. Hinkes for his untiring support, humor and help in coordinating all the marine mammal work done this year, and for reviewing this report. Also, to L. "S." Jemison, to whom much of the marine mammal work at TNWR owes its origin, and who is much missed by the pinnipeds of Cape Peirce. This report is dedicated to the memory of B. Fay, whom I, regrettably, never had the honor of meeting, but whose work continues to inspire myself and many others involved with walrus.

REFERENCES CITED

- Alaska Dept. of Fish and Game, unpubl. field data, 1987-1988 & 1994, Dillingham, AK.
- 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.
- 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).
- Haggbloom, L. 1994. Trip Report - Research Vessel *Rex M*, June 1994. Unpub. report, Togiak N.W.R., Dillingham, AK.
- Hessing, P., and G. Sheffield. 1989. Walrus Islands State Game Sanctuary Annual Report. Unpub. report, Alaska Dept. of Fish and Game, Dillingham, AK.
- Hessing, P., and L. Van Daele. 1992. Walrus Islands State Game Sanctuary Annual Report. Unpub. report, Alaska Dept. of Fish and Game, Dillingham, AK. 6pp.
- Hills, S. 1987. Unpub. field report, Alaska Fish and Wildlife Research Center, Fairbanks, AK.
- Hills, S. 1990. Unpub. field report, Alaska Fish and Wildlife Research Center, Fairbanks, AK.
- 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, L. 1989. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. A Status Report of the 1989 Marine Mammal Monitoring Effort at Togiak N.W.R. Unpub. report, Togiak N.W.R., Dillingham, AK.
- Jemison, L. 1991. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. A Status Report of the 1990 Marine Mammal Monitoring Effort at Togiak N.W.R. Unpub. report, Togiak N.W.R., Dillingham, AK. 29pp.
- Jemison, L. 1992. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. A Status Report of the 1991 Marine Mammal Monitoring Effort at Togiak N.W.R. Unpub. report, Togiak N.W.R., Dillingham, AK. 33pp.
- Jemison, L. 1993. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. A Status Report of the 1992 Marine Mammal Monitoring Effort at Togiak N.W.R. Unpub. report, Togiak N.W.R., Dillingham, AK. 25pp.
- Johnson, Brian W. 1976. Studies on the northernmost colonies of Pacific Harbor Seals, *Phoca vitulina richardsi*, in the eastern Bering Sea. Unpubl. manuscript, 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.
- Moran, J. 1994. Unpub. field report, Togiak N.W.R., Dillingham, AK.
- Nowat, R.M. 1991. Walker's Mammals of the World, v.2, 5th ed. John Hopkins Univ. Press, Baltimore and London, 1991. 1885pp.
- O'Neill, A., and L. Haggbloom. 1987. Cape Peirce Walrus and Marine Mammal Censusing Report. Unpub. report,

Togiak N.W.R., Dillingham, AK. 7pp.

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 haulout. *Canadian J. of Zoo.* 57(6):1169-1180.

Seppi, B. 1994. Unpub. field report, Bureau of Land Management, Anchorage, AK.

Sheffield, G. 1988. Unpub. field report, Alaska Fish and Wildf. Ser., Togiak N.W.R., Dillingham, AK. 9pp.

Togiak National Wildlife Refuge, Annual Narratives 1981 and 1986. U.S. Fish and Wildl. Ser., Dillingham, AK.

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

Wilson, C., and Jemison, L. 1994. Abundance and Distribution of Marine Mammals in Northern Bristol Bay. A Status Report of the 1993 Marine Mammal Monitoring Effort at Togiak N.W.R. Unpub. report, Togiak N.W.R., Dillingham, AK. 27pp.

PERSONAL COMMUNICATIONS

Abraham, P. Togiak, AK.

Anders, B., J. Peltier, and A. Polakoff. Government-contracted employees at Cape Newenham Long Range Radar site, Cape Newenham, AK. In communication with L. Haggblom, Togiak N.W.R., Dillingham, AK.

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

Frost, K. Alaska Dept. of Fish and Game, Fairbanks, AK. In communication with L. Haggblom, Togiak N.W.R., Dillingham, AK.

Grant, R. Tikchik Airventures, Dillingham, AK.

Hills, S. Alaska Fish and Wildlife Research Center Fairbanks, Fairbanks, AK. In communication with L. Jemison, Togiak N.W.R., Dillingham, AK.

Hoover, D. U.S. Coast Guard, Anchorage, AK. In communication with L. Jemison, Togiak N.W.R., Dillingham, AK.

Hotchkiss, L. U.S. Fish and Wildlife Service, Anchorage, AK. In communication with L. Jemison, Togiak N.W.R., Dillingham, AK.

Miller, M. Alascom Technician, Anchorage, AK. In communication with L. Jemison, Togiak N.W.R., Dillingham, AK.

Moore, H. and J. Moran. Togiak N.W.R., Dillingham, AK.

Moran, J. Togiak N.W.R., Dillingham, AK.

Nussbaumer, Lt. J.G., U.S. Coast Guard, Division of Law Enforcement, Juneau, AK.

Peltier, J. and A. Polakoff. Government-contracted employees at Cape Newenham Long Range Radar site, Cape Newenham, AK. In communication with L. Haggblom, Togiak N.W.R., Dillingham, AK.

Rapport, D. National Marine Fisheries Service, Anchorage, AK.

Robertson, L. National Oceanographic and Atmospheric Administration, Juneau, AK.

Tucker, T. Tucker Aviation, Dillingham, AK.

Taylor, K. Alaska Dept. of Fish and Game, Fairbanks, AK. In communication with L. Jemison, Togiak N.W.R., Dillingham, AK.

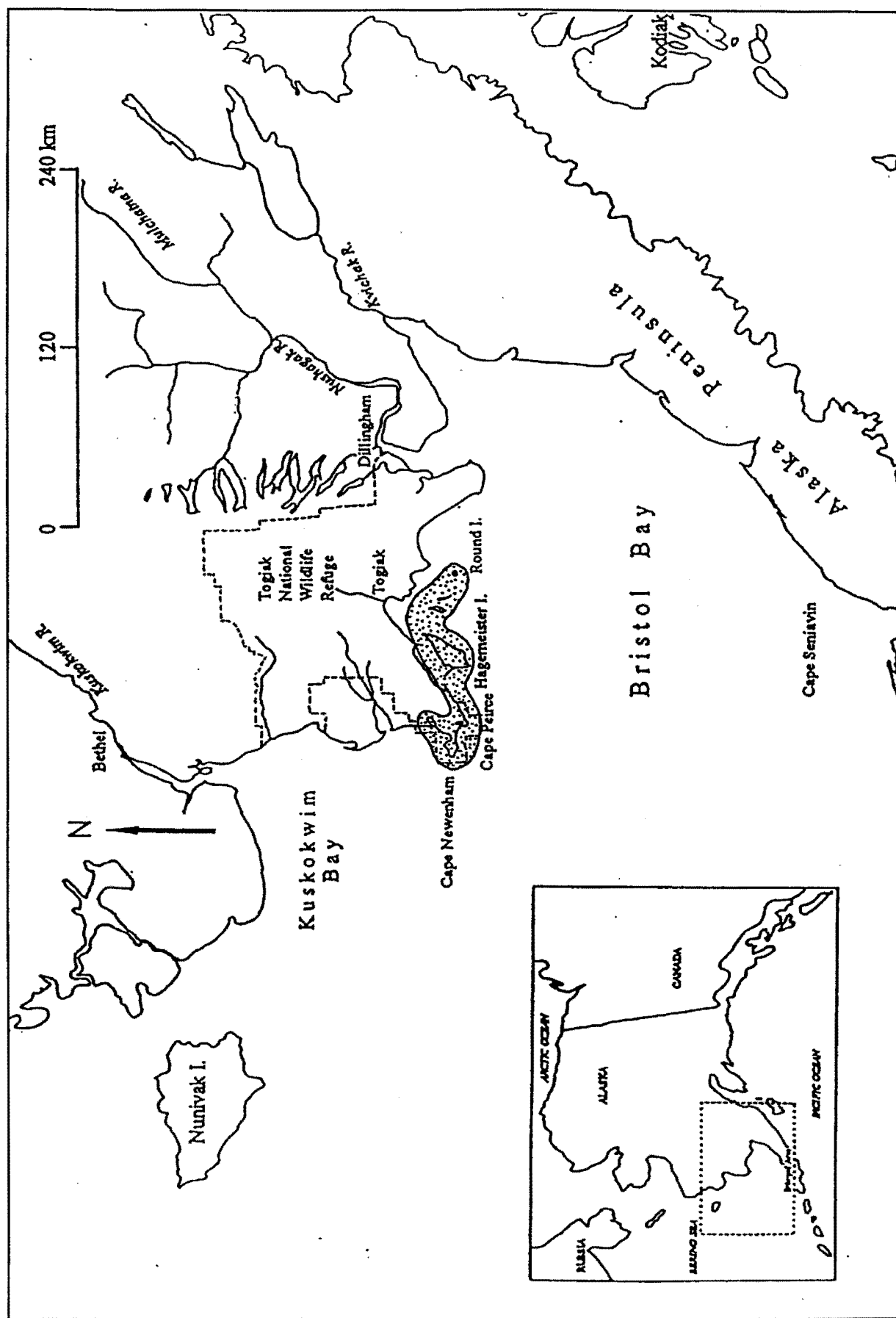


Figure 1. Location of the marine mammal study area, southwest Alaska, 1994.

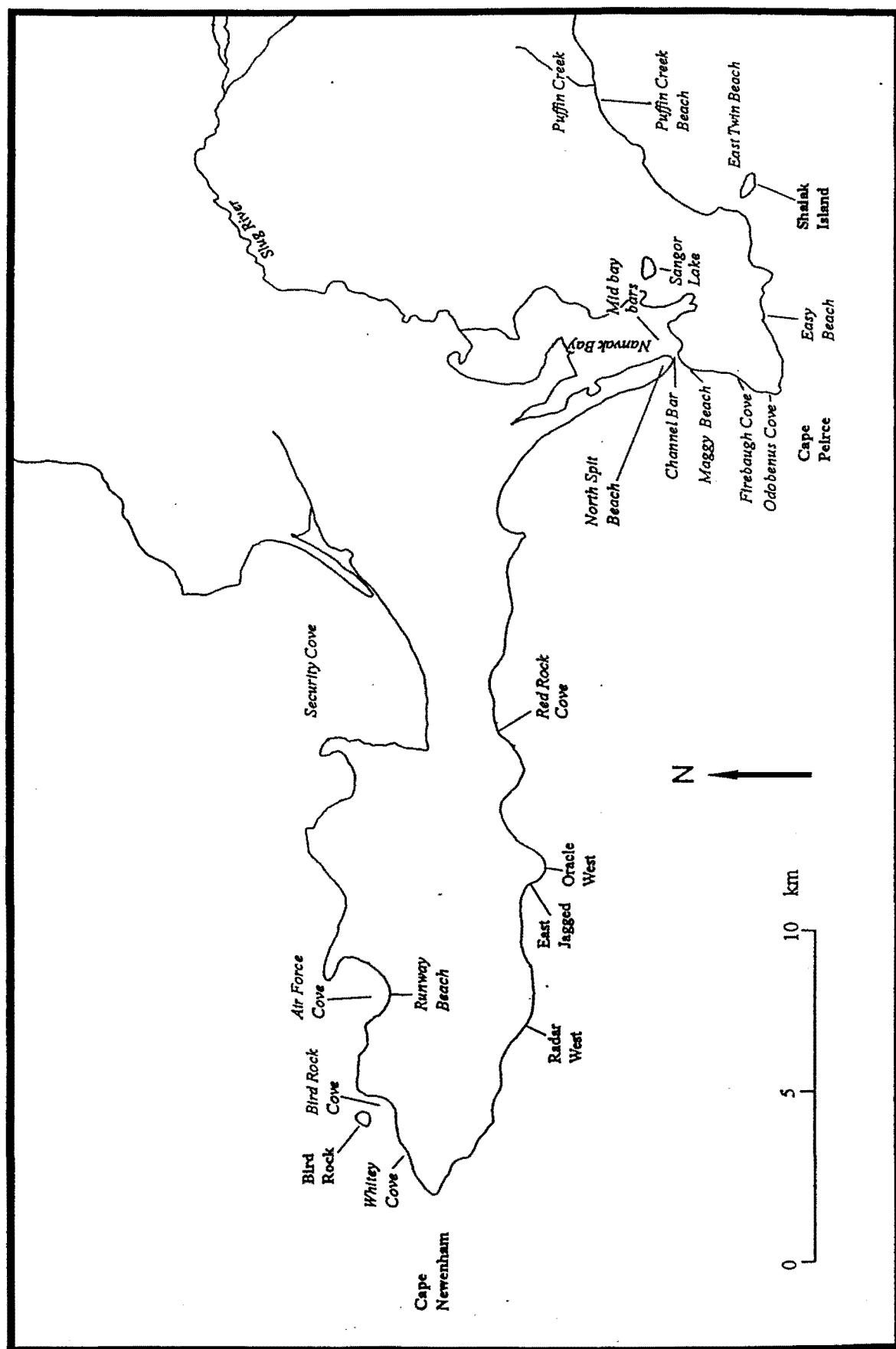


Figure 2. Cape Peirce and Cape Newenham, Togiak National Wildlife Refuge, southwest Alaska.

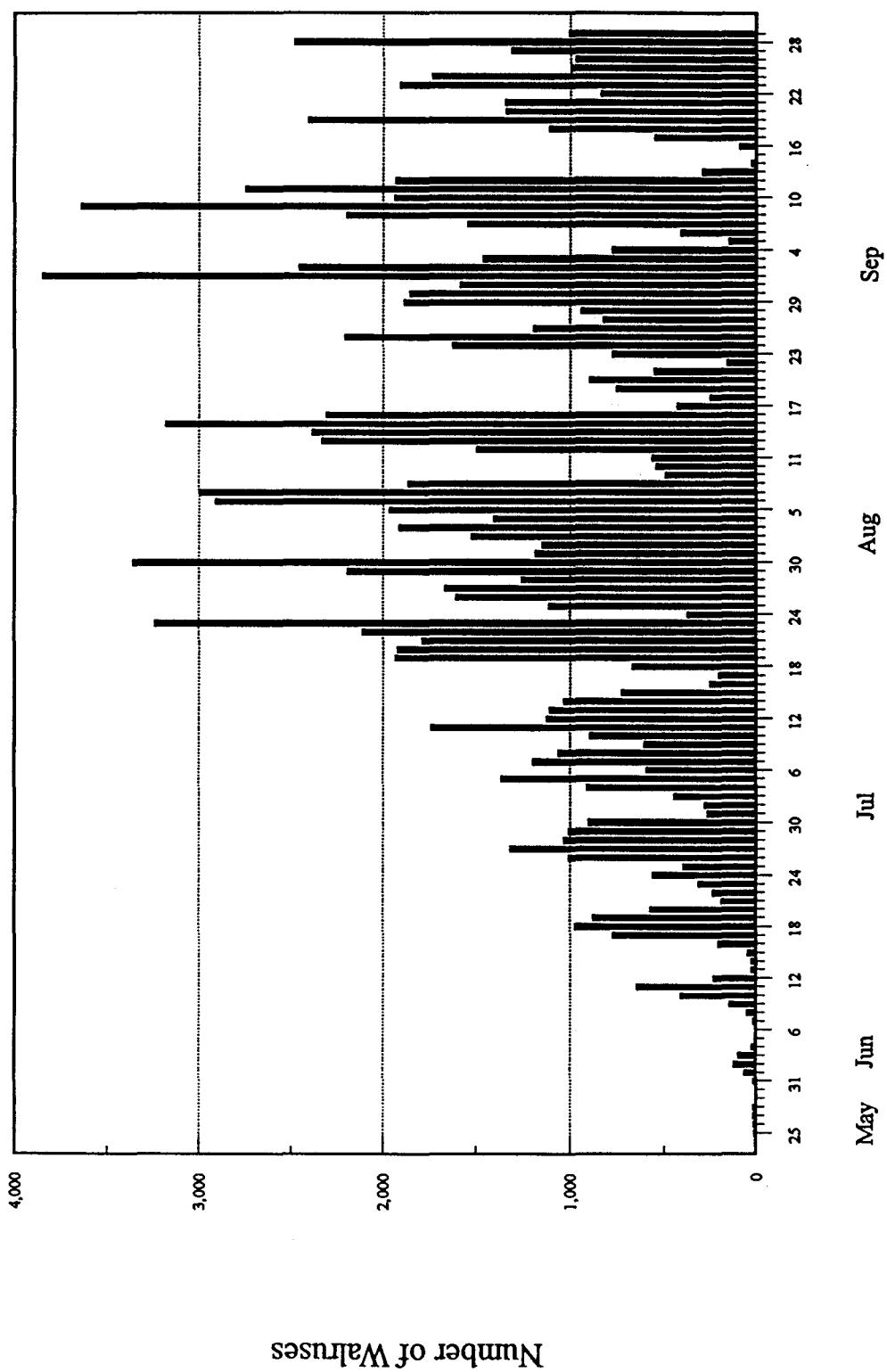


Figure 3. Number of walrus hauled out at Cape Peirce, southwest Alaska, 25 May - 29 Sept, 1994.

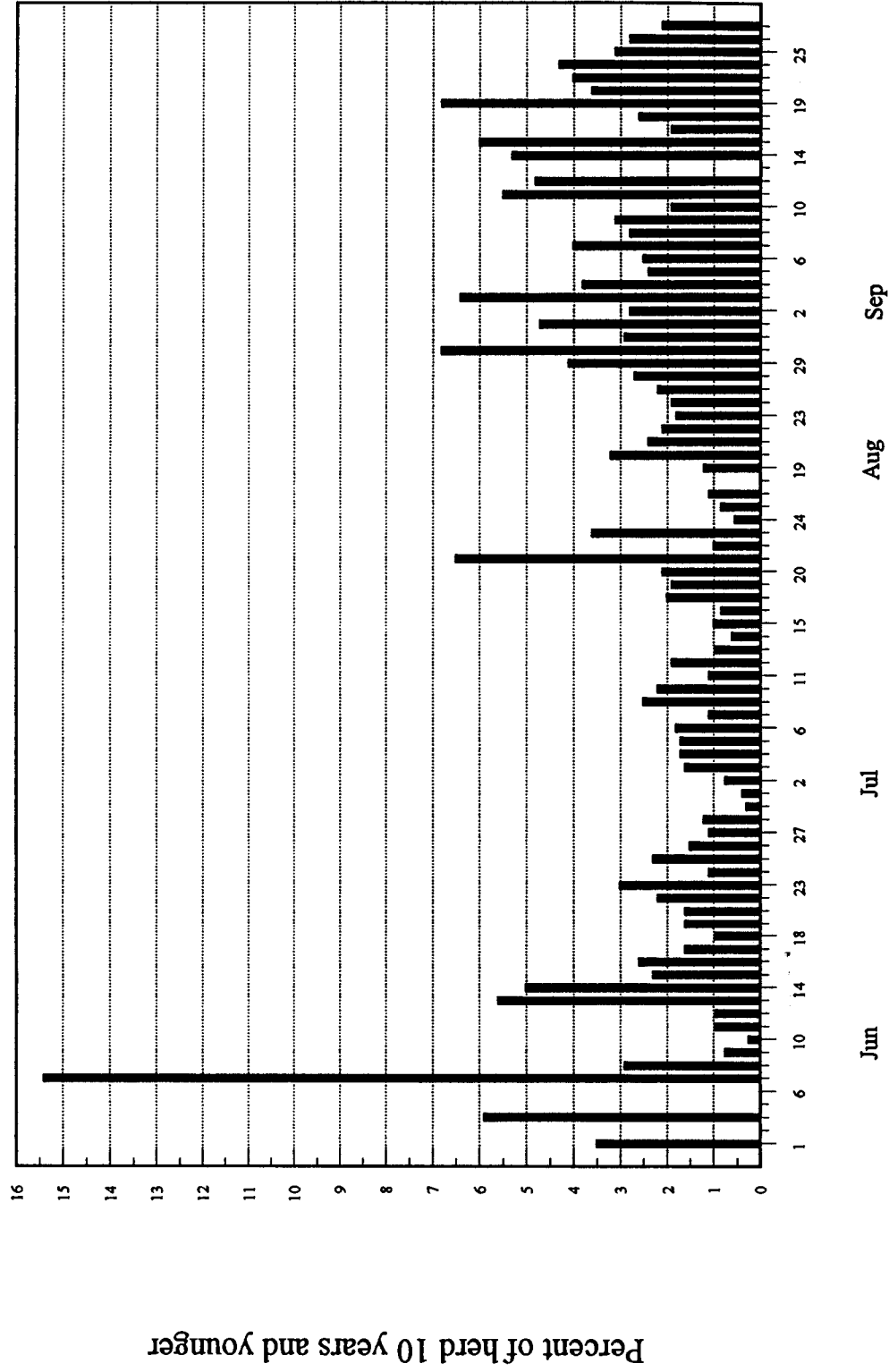
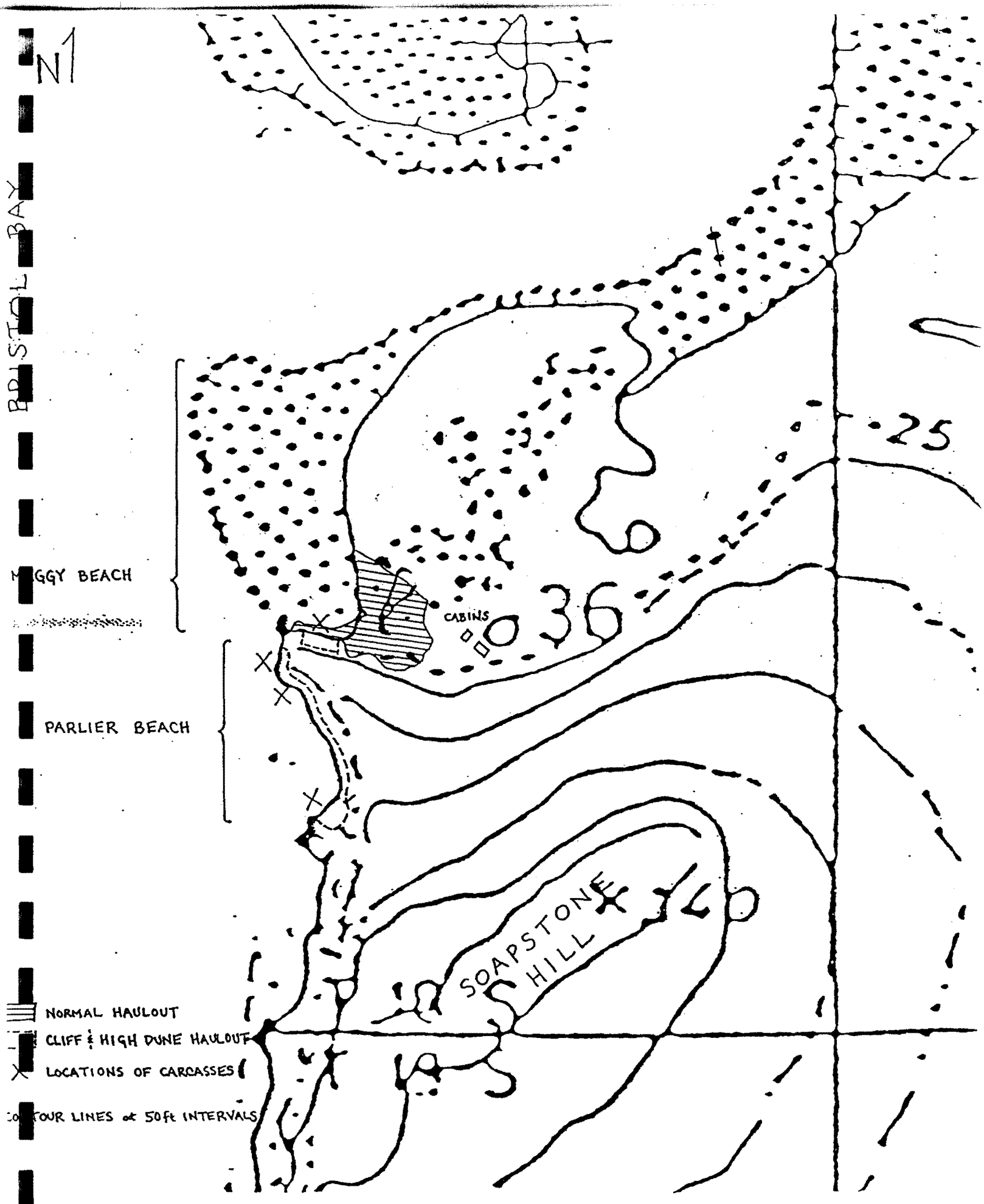


Figure 4. Percent of walrus herd age 10 years and younger hauled out on South Firebaugh Beach at Cape Peirce, southwest Alaska, Jun-Sep 1994.



CAPE PEIRCE, TOGIAC NWR, ALASKA

Figure 5. Sites of walrus haulouts atop cliffs and locations of resultant walrus mortalities. Maggy Beach, 20-24 Sept. 1994.

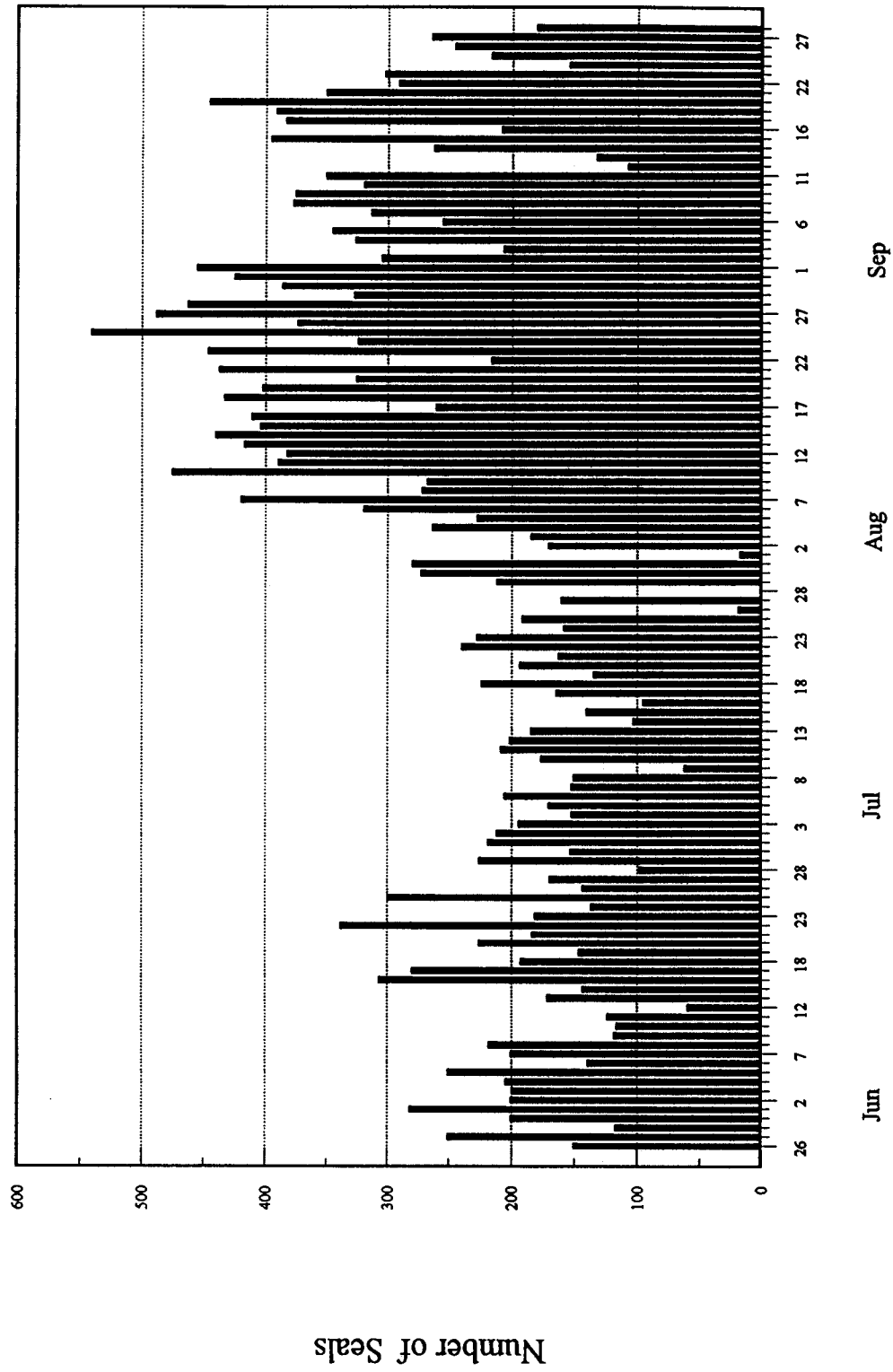


Figure 6. Number of seals hauled out at Nanvak Bay, southwest Alaska, 26 May - 29 Sept , 1994.

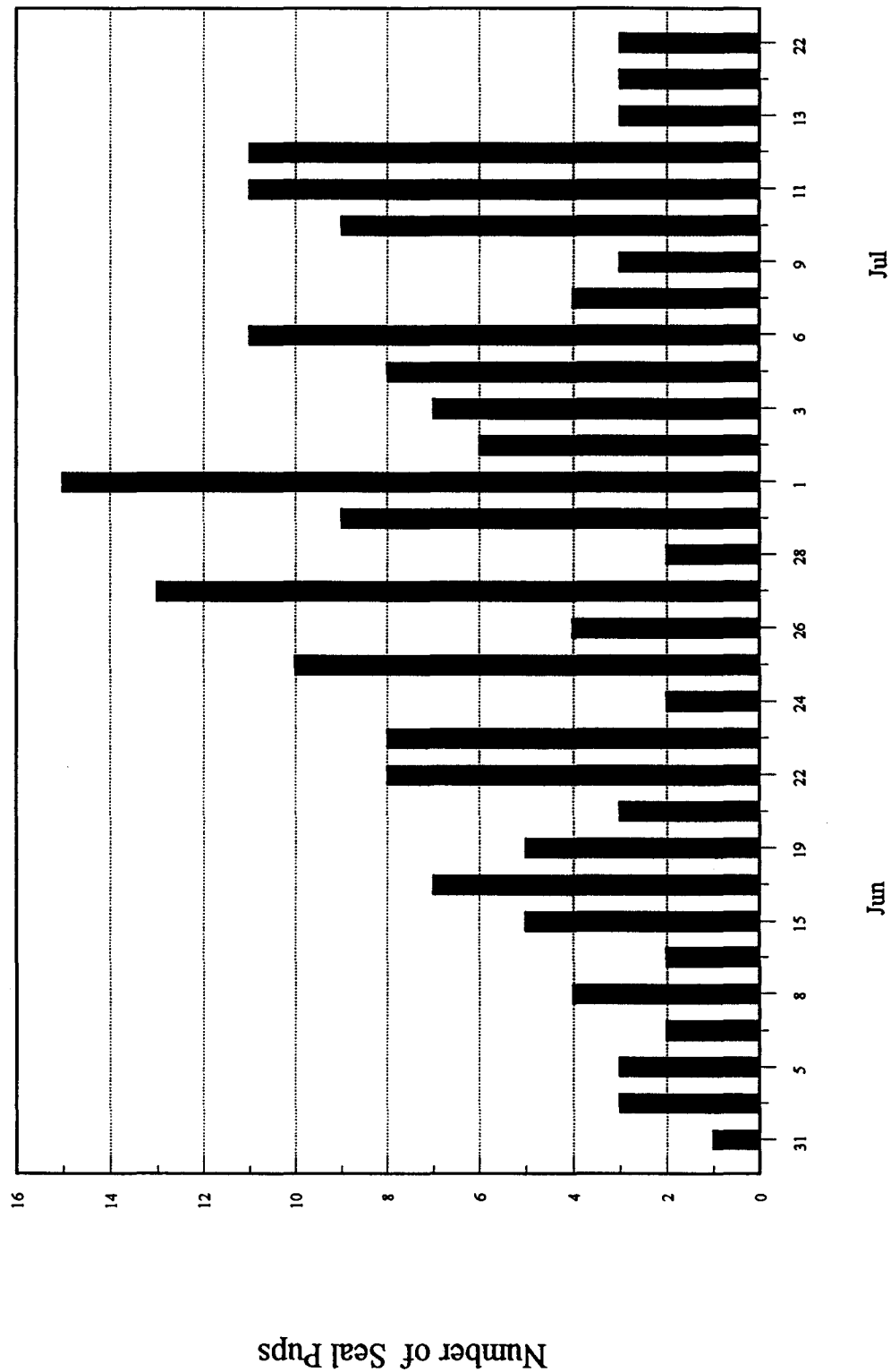


Figure 7. Number of seal pups in Nanvak Bay, southwest Alaska, May-Jul, 1994.

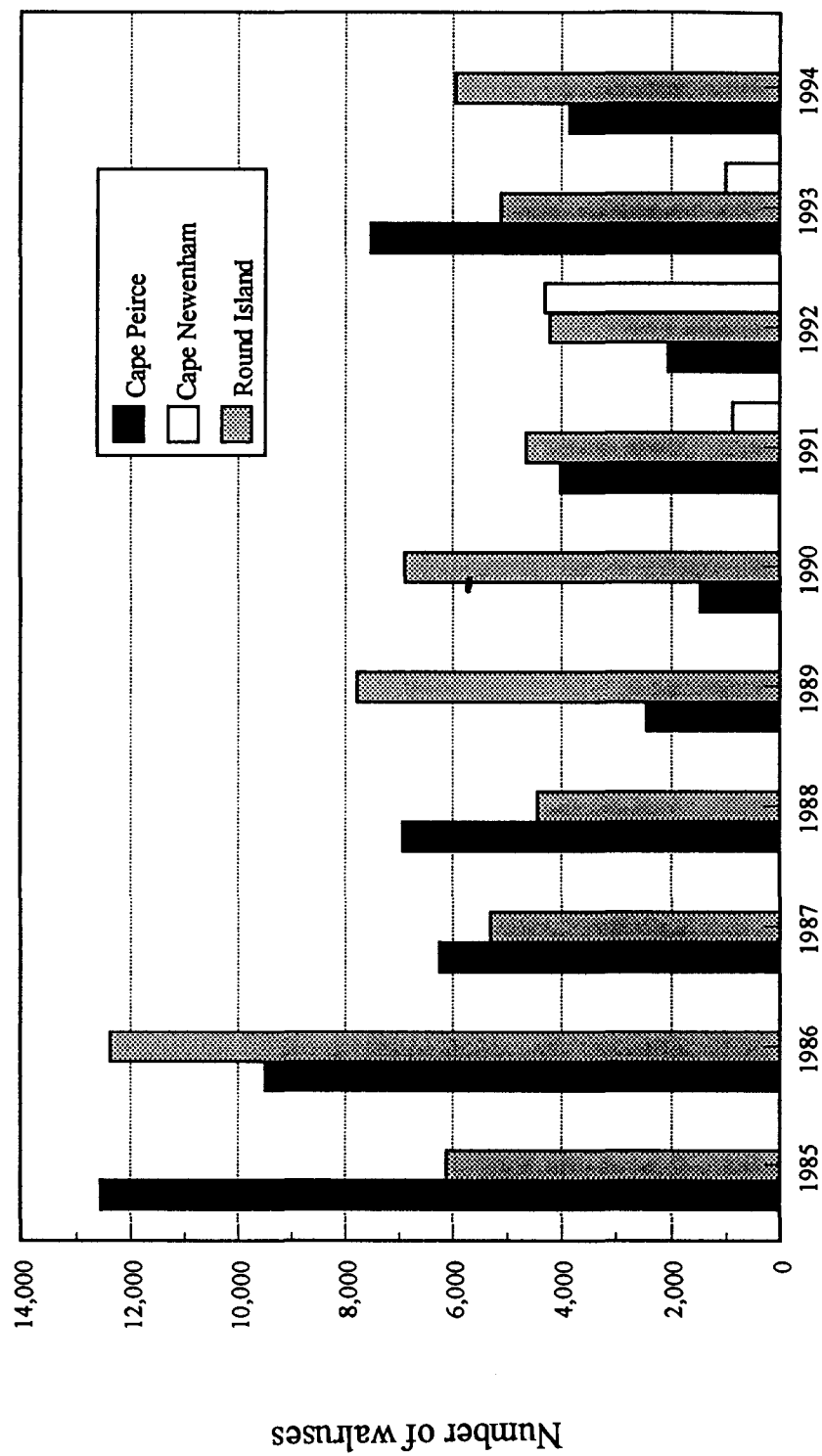


Figure 8. Comparison of walrus haulout peaks at Cape Peirce, Cape Newenham, and Round Island, southwest Alaska, 1985-1994 (Cape Newenham surveyed 1991-1993 only).

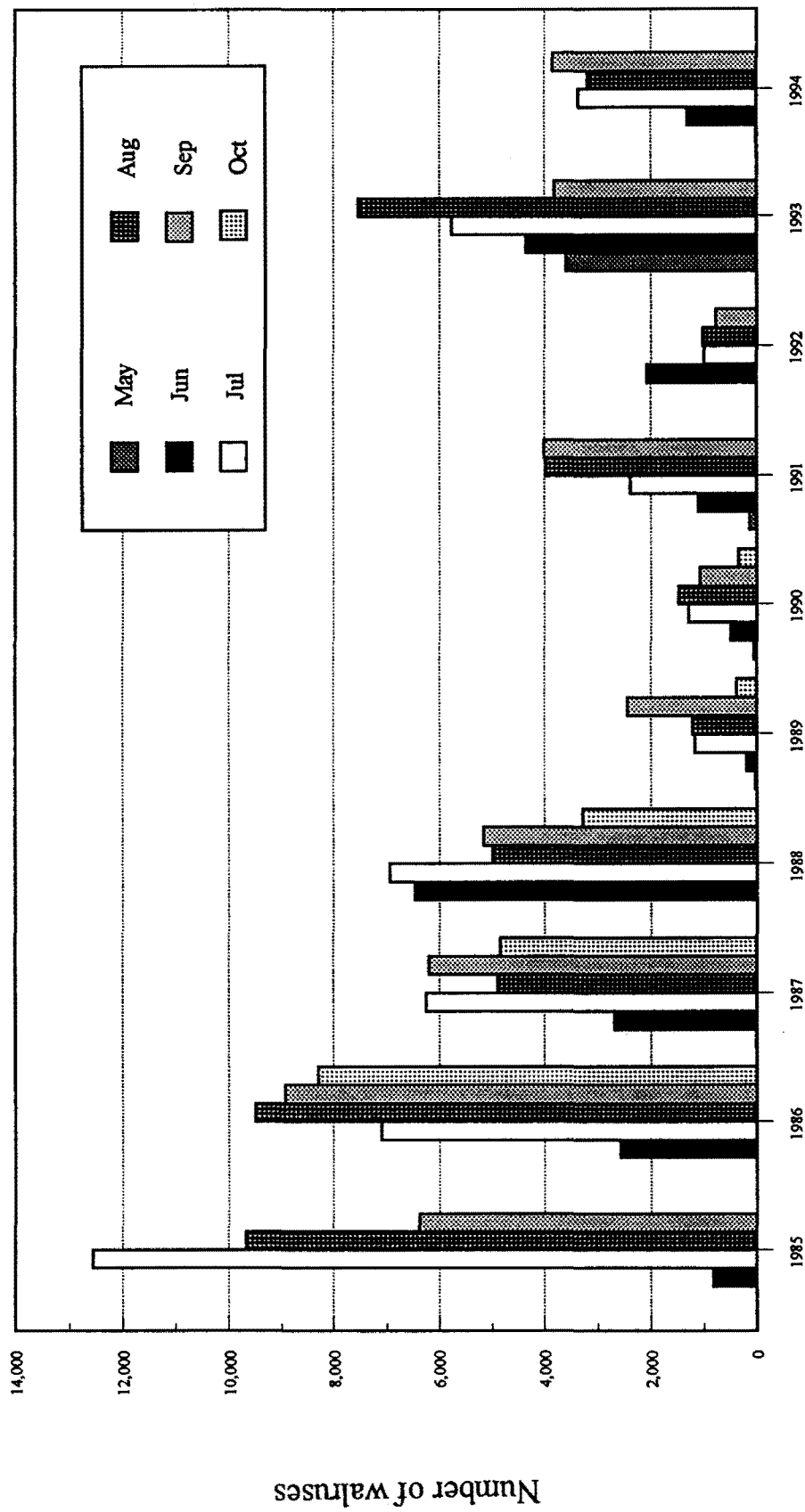


Fig. 9 Monthly walrus haulout peaks at Cape Peirce, southwest Alaska, 1985-1994.

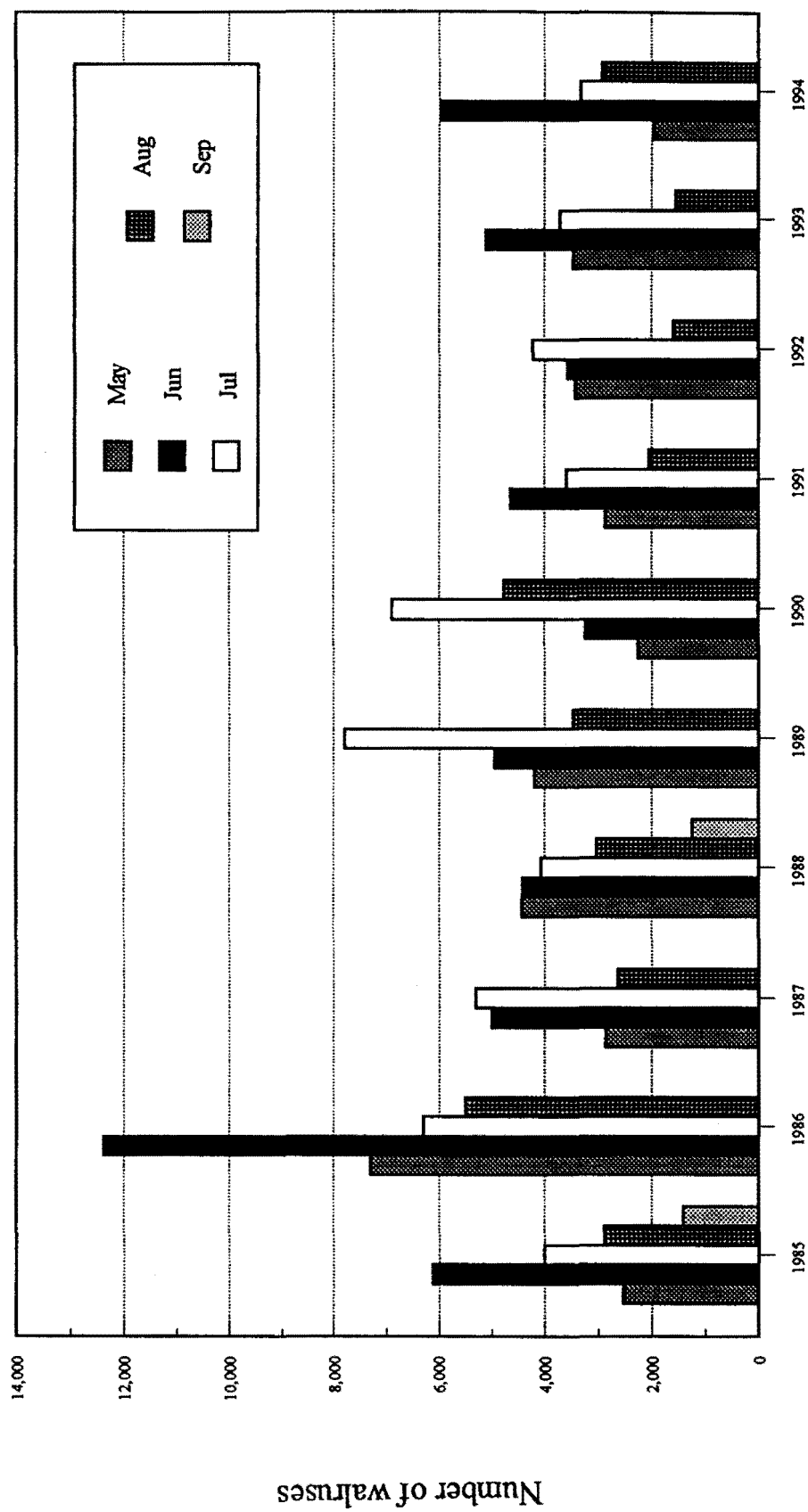


Fig. 10. Monthly walrus haulout peaks at Round Island, southwest Alaska, 1985-1994.

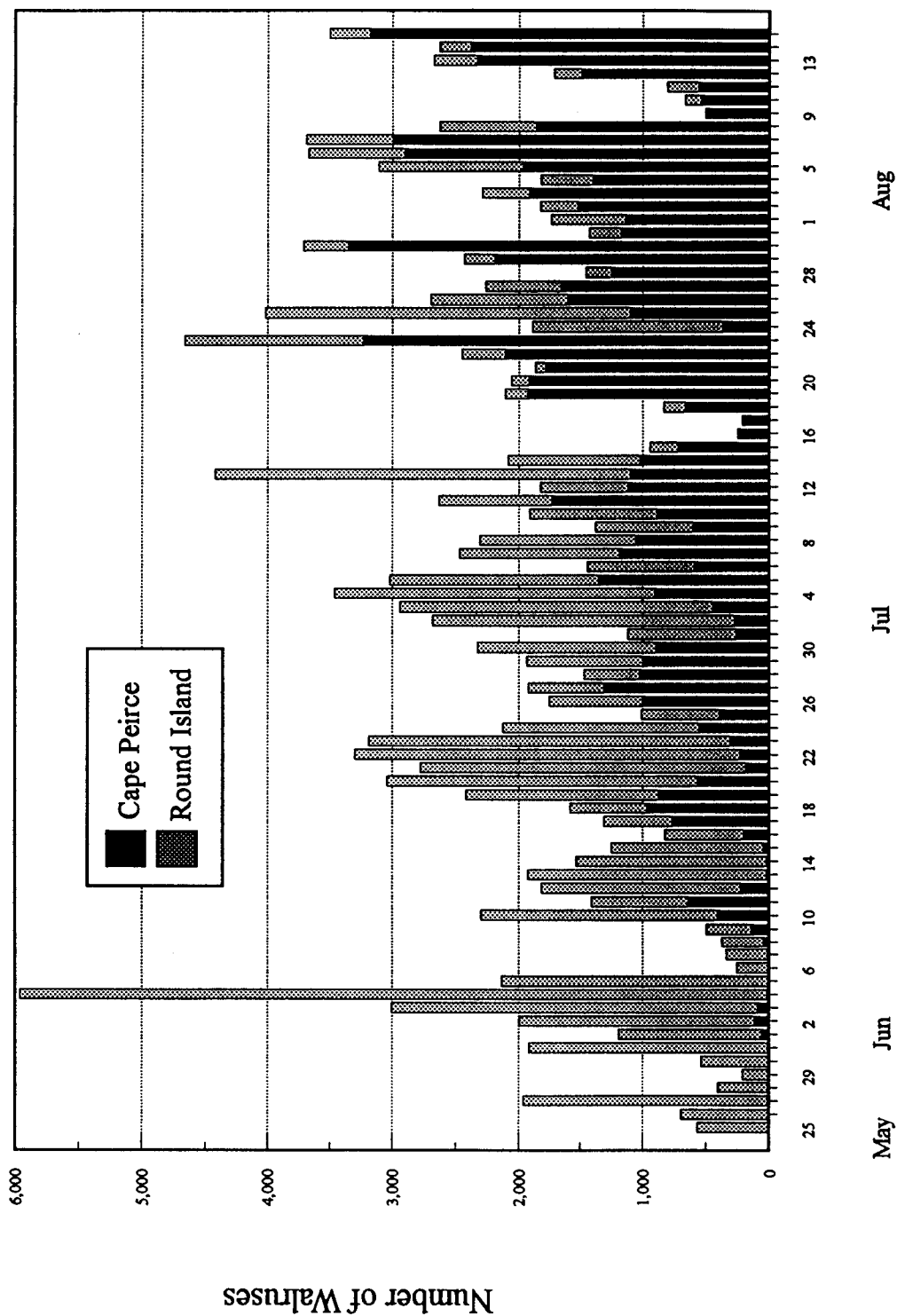


Figure 11. Total walrus haulout counts from Cape Peirce and Round Island, southwest Alaska, 1994.

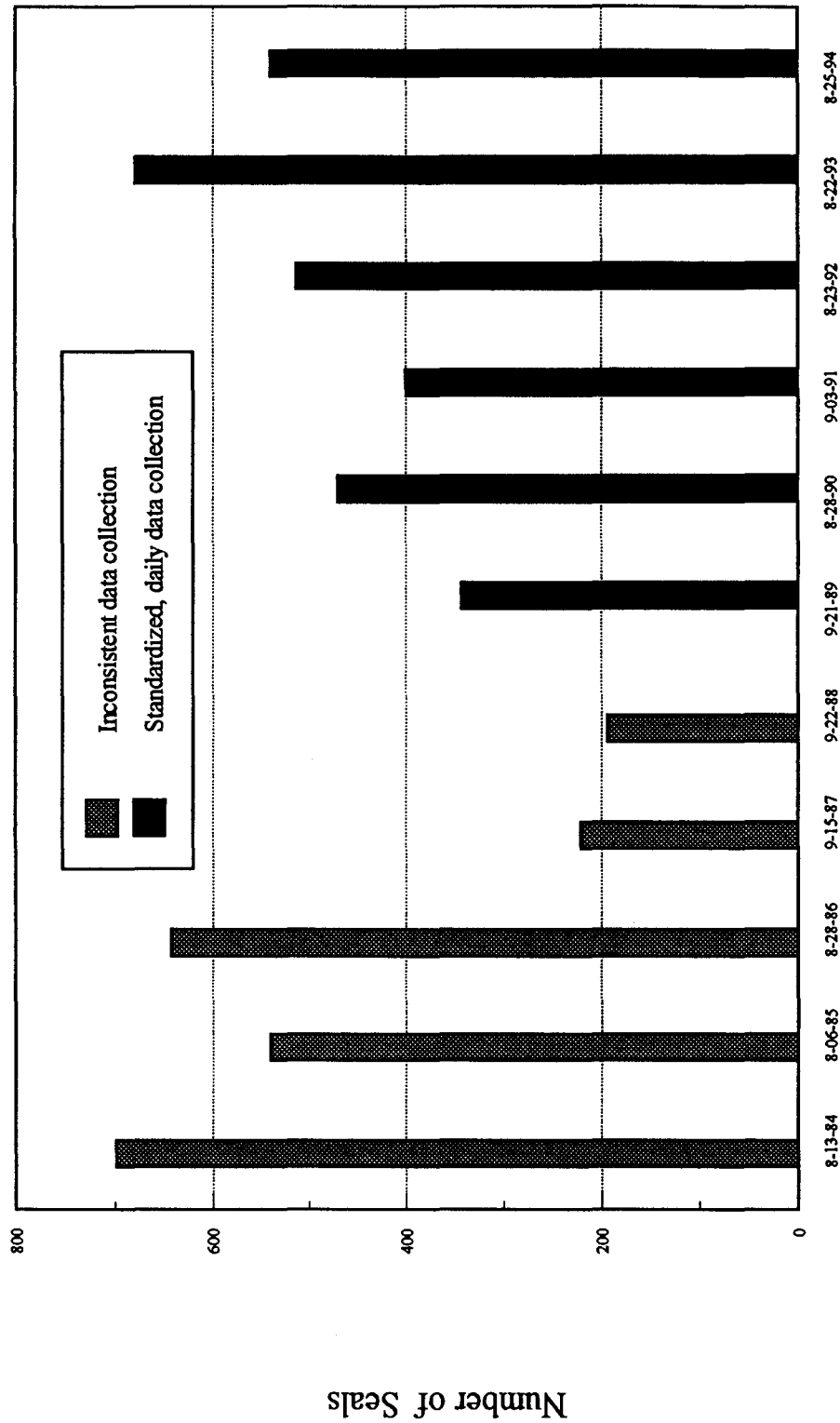


Figure 12. Annual seal haulout peaks at Nanvak Bay, southwest Alaska, 1984-1994 (counts before 1989 may be unreliable).

APPENDIX 1. Walrus haulout data, Cape Peirce and Round Island, southwest Alaska, May-September, 1994.

														R.I. DATA					
MO	DA	BC	CLD CVR	WND SPD	WND DIR	PC	BAROM	MA	MI	TD	TIME	LOC'N	CP	CP	CP	R.I. Count	RI	CP + RI	
													WTR	LND	TOT	LOC'N	TOT	TOT	
5	25	N/D	N/D	N/D	N/D	1	N/D	N/D	N/D	N/D	N/D		SB	N/D	7	7	E. Main	561	568
5	26	1	2	20	2	1	N/D	44	38	1	19:49		SB	2	8	10	E. Main	686	696
5	27	1	1	20	2	0	N/D	51	40	3	15:00		SB	0	12	12	Tot Isl	1950	1962
5	28	2	1	20	7	1	N/D	55	40	3	14:39		P,SB,OC	4	10	14	E. Main	392	406
5	29	2	1	30	7	0	29.00	42	36	3	17:39		OC	0	2	2	E. Main	207	209
5	30	1	1	7	2	0	28.9	42	27	3	14:14		all	0	0	0	E. Main	538	538
5	31	1	2	5	7	0	28.95	53	33	4	12:30		SB,OC	6	7	13	Tot Isl	1905	1918
6	1	2	2	10	7	0	29.00	55	34	3	15:21		SB	1	57	58	E. Main	1134	1192
6	2	1	2	10	8	0	28.95	56	35	3	19:12		SB	0	119	119	E. Main	1875	1994
6	3	2	2	15	8	0	N/D	56	35	3	15:00		SB	0	92	92	E. Main	2915	3007
6	4	0	1	5	6	0	29.05	56	36	2	12:37		SB	2	17	19	E. Main	5949	5968
6	5	1	1	35	4	0	28.85	54	39	3	17:38		SB	0	5	5	E. Main	2132	2137
6	6	0	1	35	4	0	28.75	53	44	3	16:03		all	0	0	0	E. Main	255	255
6	7	0	2	20	4	0	28.83	55	42	1	16:56		SB	0	13	13	E. Main	325	338
6	8	1	2	16	4	0	28.97	56	45	3	15:39		SB,OC	12	35	47	E. Main	329	376
6	9	1	1	20	4	0	29.12	62	42	4	13:58		SB,OC	7	136	143	E. Main	353	496
6	10	0	2	5	3	0	29.1	68	46	4	10:46		SB	9	400	409	Tot Isl	1890	2299
6	11	0	1	3	9	0	29.01	66	46	4	12:58		NB,SB	10	633	643	E. Main	770	1413
6	12	1	0	10	8	0	28.93	68	43	3	13:15		SB	18	212	230	E. Main	1587	1817
6	13	2	1	30	8	0	28.9	66	45	4	13:02		SB	4	18	22	E. Main	1907	1929
6	14	3	2	20	8	0	29.1	54	45	4	11:44		SB	1	20	21	E. Main	1514	1535
6	15	2	2	25	8	0	29.24	50	41	3	15:27		SB	1	44	45	E. Main	1208	1253
6	16	2	0	20	8	0	29.34	59	40	3	12:40		MB,SB,OC	12	194	206	E. Main	618	824
6	17	2	2	15	7	0	29.39	53	40	3	17:28		SB	6	765	771	E. Main	540	1311
6	18	1	2	10	7	0	29.26	58	38	2	11:09		MB,SB	25	943	968	E. Main	619	1587
6	19	2	2	15	6	1	29.16	N/D	39	3	14:15		SB	0	872	872	E. Main	1548	2420
6	20	1	2	5	7	1	N/D	61	43	1	16:59		SB	5	564	569	Tot Isl	2472	3041
6	21	2	2	25	6	0	28.73	54	N/D	3	13:52		SB	2	183	185	E. Main	2594	2779
6	22	0	2	13	6	1	N/D	54	43	3	13:39		SB	4	228	232	E. Main	3069	3301
6	23	1	2	10	4	1	29.14	50	44	3	14:55		SB	7	303	310	Tot Isl	2876	3186
6	24	2	2	30	7	1	29.03	56	44	3	17:29		SB	7	548	555	E. Main	1574	2129
6	25	1	2	10	7	0	29.14	56	42	1	18:06		SB	1	393	394	E. Main	616	1010
6	26	0	1	4	7	0	29.06	58	39	1	18:30		SB	17	984	1001	E. Main	753	1754
6	27	1	1	15	7	0	29.06	56	38	2	22:49		SB,OC	22	1288	1310	E. Main	612	1922
6	28	1	1	12	7	0	29.14	56	43	3	14:16		MB,SB,OC	18	1009	1027	E. Main	444	1471
6	29	0	0	5	6	0	29.17	67	38	3	15:50		SB,OC	31	972	1003	Tot Isl	932	1935
6	30	1	2	25	4	0	29.14	62	41	3	18:26		SB,OC	8	888	896	E. Main	1431	2327
7	1	1	2	10	6	1	28.79	56	45	3	14:58		SB,OC	1	262	263	E. Main	857	1120
7	2	1	2	9	6	1	28.98	59	44	4	14:20		SB,OC	9	270	279	E. Main	2405	2684
7	3	2	2	10	6	1	29.17	52	45	3	11:25		SB	5	439	444	E. Main	2496	2940
7	4	1	2	17	6	0	28.99	58	45	3	14:21		SB	19	889	908	E. Main	2557	3465
7	5	1	2	15	6	1	29.04	54	43	3	12:45		MB,NB,SB	33	1323	1356	E. Main	1665	3021
7	6	0	0	15	8	0	29.2	60	45	1	16:59		MB,SB	0	590	590	E. Main	851	1441
7	7	0	0	5	6	0	29.22	64	45	2	21:30		SB	20	1168	1188	E. Main	1282	2470
7	8	1	2	15	6	1	29.21	55	44	1	17:53		MB,SB,OC	15	1040	1055	E. Main	1256	2311
7	9	2	2	3	6	1	29.03	54	44	3	13:41		SB,OC	11	592	603	E. Main	777	1380
7	10	2	1	7	4	0	29.16	64	43	4	10:58		MB,SB,OC	49	838	887	E. Main	1026	1913
7	11	1	2	12	4	1	29.12	50	49	3	15:44		MB,NB,SB,OC	20	1715	1735	E. Main	899	2634
7	12	1	2	12	4	1	29.18	56	44	3	17:07		NB,SB,OC	13	1106	1119	E. Main	709	1828
7	13	1	0	5	5	0	29.24	63	51	3	14:55		NB,SB,OC	61	1040	1101	Tot Isl	3323	4424
7	14	0	0	5	3	0	29.32	67	51	3	15:23		NB,SB,OC	41	985	1026	E. Main	1059	2085
7	15	0	2	35	4	1	29.08	57	50	3	15:05		SB,OC	10	710	720	E. Main	224	944
7	16	0	2	35	2	1	28.62	60	52	3	15:58		SB,OC	10	240	250	E. Main	0	250
7	17	0	2	25	2	1	28.51	57	53	3	11:40		SB	8	194	202	E. Main	16	218
7	18	2	2	20	8	0	28.56	62	52	3	15:08		SB	11	655	666	E. Main	169	835

APPENDIX 1. Walrus haulout data, Cape Peirce and Round Island, southwest Alaska, May-September, 1994.

													R. I. DATA							
MO	DA	BC	CLD	WND	WND		PC	BAROM	MA	MI	TD	TIME	LOC'N	CP	CP	CP	R. I.	Count	RI	CP + RI
			CVR	SPD	DIR									WTR	LND	TOT		LOC'N	TOT	TOT
7	19	2	2	15	8	1	28.56	50	46	3	13:59		MB,SB	36	1894	1930	E. Main	181	2111	
7	20	1	2	20	3	1	28.8	52	46	3	14:45		MB,SB	29	1890	1919	E. Main	140	2059	
7	21	1	2	10	3	1	28.72	54	44	3	13:31		SB	28	1755	1783	E. Main	82	1865	
7	22	0	1	5	3	0	28.95	58	51	3	16:60		MB,SB	361	1747	2108	E. Main	343	2451	
7	23	1	1	10	4	0	29.01	58	50	3	12:45		MB,SB	43	3192	3235	E. Main	1428	4663	
7	24	1	1	5	5	1	29.01	56	50	3	15:53		SB	7	361	368	E. Main	1524	1892	
7	25	1	1	10	7	0	28.96	63	50	3	18:55	MB,NB,SB,OC	41	1063	1104	Tot Isl	2917	4021		
7	26	1	1	5	7	0	29.1	67	48	3	15:20		MB,SB,OC	62	1540	1602	E. Main	1093	2695	
7	27	1	2	5	4	1	29.16	64	50	3	12:29		MB,SB,OC	26	1634	1660	E. Main	604	2264	
7	28	1	2	10	4	1	29.35	52	52	3	14:52		MB,SB	23	1227	1250	E. Main	209	1459	
7	29	1	2	10	4	1	29.15	58	52	2	20:44		MB,SB	127	2065	2192	E. Main	238	2430	
7	30	1	2	10	4	1	29.12	58	54	3	15:20		MB	80	3275	3355	E. Main	359	3714	
7	31	2	2	10	6	1	29.12	64	55	3	13:32		MB,SB	107	1068	1175	E. Main	256	1431	
8	1	1	2	10	6	0	29.26	62	48	3	14:32		MB	32	1111	1143	Tot IIs	598	1741	
8	2	1	2	10	8	1	29.29	53	42	3	13:45		MB,SB	277	1242	1519	E. Main	309	1828	
8	3	1	2	10	7	1	29.12	58	50	3	13:08		MB,SB	27	1883	1910	E. Main	380	2290	
8	4	1	2	8	3	0	29.2	59	52	1	15:25		MB,SB	78	1322	1400	E. Main	421	1821	
8	5	0	2	7	4	0	29.24	60	51	1	16:00		MB,SB	53	1913	1966	Tot Isl	1144	3110	
8	6	0	2	10	4	0	29.32	57	52	1	18:57		MB	77	2830	2907	E. Main	770	3677	
8	7	1	2	10	4	0	29.37	59	52	3	14:02		MB	98	2897	2995	E. Main	697	3692	
8	8	1	2	10	4	0	29.39	60	50	4	12:28		MB	38	1821	1859	E. Main	771	2630	
8	9	2	2	30	5	1	28.91	52	52	3	11:43		MB	7	482	489	E. Main	16	505	
8	10	2	2	15	6	0	29.22	60	50	3	15:27		MB,SB	19	517	536	E. Main	128	664	
8	11	2	2	4	6	1	29.52	64	52	4	11:47		MB,NB	8	551	559	E. Main	248	807	
8	12	1	2	15	7	1	29.53	56	48	1	16:54		MB	124	1367	1491	E. Main	228	1719	
8	13	1	2	5	8	0	29.54	61	45	3	15:32		MB	119	2211	2330	E. Main	344	2674	
8	14	1	2	15	7	0	29.51	62	46	3	13:10		MB	53	2329	2382	E. Main	247	2629	
8	15	1	2	10	7	0	29.46	65	48	3	11:19		MB	125	3054	3179	E. Main	326	3505	
8	16	1	2	10	4	0	29.35	60	38	3	16:07		MB	N/D	2304	2304				
8	17	2	2	20	6	1	29.38	59	40	3	14:47		MB	118	307	425				
8	18	1	2	5	7	0	29.66	60	46	3	21:26		MB,SB	11	238	249				
8	19	1	2	8	6	0	29.59	59	47	3	29:59	MB,NB,SB	65	684	749					
8	20	3	2	30	7	1	29.18	54	46	3	13:31		MB,SB	52	840	892				
8	21	2	2	25	7	0	29.21	58	47	3	13:45		MB,SB	53	497	550				
8	22	3	2	37	6	1	29.07	54	47	4	13:00		MB,SB	13	144	157				
8	23	2	2	15	6	1	29.14	54	47	3	13:56		MB,SB	47	723	770				
8	24	3	2	38	6	1	29.11	54	47	1	17:24		MB,SB	70	1551	1621				
8	25	3	2	23	6	0	29.22	58	51	3	12:25		MB,SB	158	2046	2204				
8	26	3	1	50	7	0	28.94	53	50	1	17:04		MB	232	952	1184				
8	27	3	1	25	8	0	29.40	49	41	1	15:55		MB,SB	46	771	817				
8	28	2	2	15	7	0	29.48	59	41	1	10:33		MB,SB	25	909	934				
8	29	1	2	12		1	29.42	56	47	1	18:11	MB,SB,NB	51	1829	1880					
8	30	1	2	7	6	1	29.25	56	47	3	11:51		MB,SB	56	1794	1850				
8	31	1	2	10	5	1	29.17	52	48	1	17:45		MB,SB	156	1423	1579				
9	1	2	1	20	8	0	29.17	57	47	2	19:57		MB,SB	74	3771	3845				
9	2	1	1	10	8	0	29.27	57	46	3	14:48		MB,SB	135	2319	2454				
9	3	2	1	15	8	0	29.04	61	47	2	17:29		MB,SB	20	1435	1455				
9	4	2	1	30	8	1	29.15	53	47	4	09:56	MB,SB,OC	20	750	770					
9	5	2	0	40	8	0	29.48	54	44	3	12:01		MB,SB	3	142	145				
9	6	2	2	5	6	0	29.49	62	40	2	18:28		MB,SB	45	360	405				
9	7	1	2	5	6	1	29.38	56	40	3	12:04	MB,SB,NB	100	1439	1539					
9	8	2	1	17	7	0	29.15	57	48	3	13:41		MB,SB	81	2116	2197				
9	9	1	2	20	4	0	29.17	55	43	2	17:58		MB,SB	135	3503	3638				
9	10	1	1	17	3	1	28.95	54	48	3	12:44		MB,SB	10	1925	1935				

APPENDIX 1. Walrus haulout data, Cape Peirce and Round Island, southwest Alaska, May-September, 1994.

													R. I. DATA					
MO	DA	BC	CLD	WND	WND	PC	BAROM	MA	MI	TD	TIME	LOC'N	CP	CP	CP	R. I. Count	RI	CP + RI
			CVR	SPD	DIR								WTR	LND	TOT	LOC'N	TOT	TOT
9	11	1	2	4	9	0	28.81	58	50	1	15:30	MB,SB,OC	68	2673	2741			
9	12	2	2	20	8	0	28.97	55	48	3	12:05	MB,SB	68	1861	1929			
9	13	3	2	20	6	1	28.39	49	46	3	12:50	MB,SB	29	260	289			
9	14	3	2	43	8	0	28.31	48	46	3	11:40	MB,SB	4	19	23			
9	15	3	1	35	8	1	28.56	48	43	2	13:00	all	0	0	0			
9	16	1	1	3	1	0	28.52	49	29	1	12:48	SB	3	83	86			
9	17	0	2	15	3	1	28.52	54	32	2	14:30	MB,NB,SB	11	536	547			
9	18	1	1	22	4	1	28.53	50	43	3	12:43	MB,SB	62	1044	1106			
9	19	1	2	15	4	0	28.84	52	37	3	13:22	MB,SB	57	2349	2406			
9	20	2	2	43	4	1	28.06	49	41	2	12:38	MB,clf,SB	88	1246	1334			
9	21	3	2	25	4	0	28.55	N/D	45	3	11:26	MB,SB	6	1332	1338			
9	22	3	2	18	6	1	N/D	51	N/D	3	11:00	MB,clf,NB,SB	20	812	832			
9	23	1	1	20	3	0	28.7	51	39	2	18:58	MB,clf,NB,SB	169	1738	1907			
9	24	3	1	40	8	0	28.65	45	42	3	13:06	MB,SB,OC	31	1701	1732			
9	25	2	2	30	8	1	28.91	43	41	2	12:07	MB,SB	6	986	992			
9	26	2	1	17	8	0	29.18	44	37	3	13:23	MB,SB	19	950	969			
9	27	1	1	15	8	0	29.3	40	34	2	20:00	MB,SB	13	1290	1303			
9	28	1	1	10	4	0	29.3	49	27	2	16:44	MB,SB,OC	149	2330	2479			
9	29	N/D	1	20	4	0	29.27	N/D	34	1	12:50	MB	N/D	1000	1000			

MO = Month

DA = Day

BC = Beach Conditions: calm=0, moderate waves=1, rough=2, very rough=3

CLD CVR = Cloud Cover: clear=0, broken=1, overcast=2

WND SPD = Wind Speed in mph

WND DIR = Wind Direction: 1=N, 2=NE, 3=E, 4=SE, 5=S, 6=SW, 7=W, 8=NW, 9=Variable

PC = Precipitation: yes=1, no=0

MA = Maximum Temperature (degrees Fahrenheit)

MI = Minimum Temperature (degrees Fahrenheit)

TD = Tide: high=4, low=1, rising=2, falling=3

TIME = Time of count

LOC'N = Location of haulout (beach); clf = cliffs just south of MB; MB = Maggy Beach; NB = North Firebaugh

OC = Odobenius Cove; P = Parlier; SB = South Firebaugh

CP WTR = Number of walrus in water at Cape Peirce observation points

CP LND = Number of walrus hauled out at Cape Peirce observation points

CP TOT = Total number of walrus (in water + hauled out) at Cape Peirce observation points

RI Count LOC'N = Location of count; E. Main = East Main Beach; Tot Isl = Total Island

RI TOT = Total number of walrus (in water + hauled out) at Round Island observation points

CP + RI TOT = CP Total + RI Total number of walrus

APPENDIX 2. Walrus response to aircraft, boats, and human disturbance at Cape Peirce, southwest Alaska, 1994.

Date	Vehicle (or other)	Loc'n	Alt (feet)	Lateral distance	No. of wal h/o	No. wal responding at each level	Degree of response
07 Jun (13:54)	Cessna 206 on floats	SFB	landed	2.5 km	3	L1:2, L5:1	low
07 Jun (18:15)	Bowpicker and skiff	SFB	N/A	100 m	13	L3:5, L5:8	low
08 Jun	Lund skiff	SFB	N/A	100 m	45	L5:10	low
07 Jul	Aerocommander plane	SFB	1000	0	1450	L1:20	low
19 Jul (14:49)	DC6 or C130	MB	3000	0	1200	L1:100, L3:20	moderate
19 Jul (15:14)	Camper on foot	MB	N/A	7-15 m	1198	L1:10	low
19 Jul (15:14)	small live-trap went off when a walrus h/o on top of it	MB	N/A	0	1198	L3: 5	low
22 Jul (09:37)	high-flying jet	MB	3000	0	3000	L3:20	low
22 Jul (10:32)	DeHavilland Beaver-on-floats	MB	0	4 km	930	L3:63, L5:32	moderate
22 Jul (12:54)	C12	MB SFB	75-100 <300	0 200 m	3000 300	L5:1000, L3:2000 L5:100, L3:150	high high
22 Jul (16:21)	Twin Beech	MB	2000-3000	0.8 km	2000	L5:600, L3:900, L1:500	high
02 Aug	Cessna 207 (mail-run from D'ham-CN)	MB	1000-1200	4 km	871	L1:368, L3:299, L5:33	high
04 Aug	unseen jet (heard)	MB	above 500	0	1200	L3:600, L5:200	high
08 Aug	high-flying jet	MB	1500	1.5-2 km	1821	L1:170, L3:44, L5:209	high
11 Aug	Cessna 207 on wheels	MB	400-450	0	550	L1:130, L3:70, L5:350	high
26 Aug	C130, twin engine	MB	2000	0	800	L1:600, L3:100, L5:100	high
31 Aug	Cessna 185 (or similar plane) on wheels	MB	100	0	1000	L3:125, L5:150	high
02 Sep	C130, twin engine (or similar)	MB	6000	0	2250	L1:100	low
12 Sep	Walrus hunters	MB	N/A	0	1819	L1:300, L3:400, L5:969	high
13 Sep	DeHavilland Beaver-on-floats	MB	landed	400 m	100	L1:15, L5:85	moderate
23 Sep	high-flying jet	MB cliffs	5000	0 m	1050 120	L3:20, L5:40 L1:30	moderate
26 Sep	3 jets & 1 unidentified plane all high-flying	MB	above 800'	0	138	L1:70, L5:10 accurate #'s for last plane only; some walrus @ L1 for all planes	moderate
28 Sep	DeHavilland Beaver-on-floats	MB	landed	400 m	30	L5:30	moderate
29 Sep	Cessna 185 on floats (Refuge)	MB	landed	400 m	800	L1:200, L3:90, L5:40	moderate
CAPE NEWENHAM DATA **							
21 May	32' aluminum boat & skiff	WHY	N/A	100 m & less	100's	L5:100's	high

Loc'n = Location of haulout; MB=Maggy Beach; SFB=South Firebaugh; WHY=Whitey Cove; cliffs=cliffs near MB

Alt = Altitude of aircraft (in feet, to correspond with aircraft altimeters)

Lateral distance (estim) = Estimated lateral distance from vehicle or other stimulus to haulout (units included with measurement); for aircraft, 0 = directly over haulout

No. of wal h/o = Number of walrus hauled out on the beach

No. of wal responding at each level = Number of walrus responding at Levels 1 (heads raised), 3 (orienting), 5 (leaving the beach); see METHODS for details

Degree of response = high, moderate or low ; see METHODS for details

**Cape Newenham data provided by government-contracted employees at Cape Newenham Long-Range Radar Site

APPENDIX 3. Seal haulout census data, Nanvak Bay, southwest Alaska, May-September 1994

MO	DA	CNT LOC'N	CLD CVR	WND SPD	WND DIR	PC	BAROM	MA	MI	TD	TIME	LOC'N	NO. PUP	TOT
5	26	LL	2	20	2	1	N/D	44	38	3	N/D	MBB	0	150
5	27	aerial	1	20	2	0	N/D	51	40	3	15:00	MBB	0	250
5	28	No count									9 seals at Rugged Point			N/D
5	29	WPD	1	10	8	0	29.00	42	36	1	21:30	MBB, FB	0	117
5	30	NSD	1	7	2	0	28.90	42	27	1	19:52	MBB, FB	0	200
5	31	NSD	0	5	8	0	28.95	53	33	1	20:40	MBB, FB	1	281
6	1						No count due to thick fog & limited visibility							N/D
6	2	cliffs	2	10	8	0	28.95	56	35	3	20:00	MBB	0	200
6	3	LALO	1	15	8	0	N/D	56	35	3	20:24	MBB, FB	0	199
6	4	NSD	1	13	4	0	29.05	56	36	3	21:04	MBB	3	204
6	5	CB	1	30	4	0	28.85	54	39	3	20:04	MBB, FB	3	250
6	6	CB	1	30	4	0	28.75	53	44	1	19:26	MBB	2	139
6	7	cliffs	2	20	4	0	28.83	55	42	1	16:30	MBB	N/D	200
6	8	LALO	2	10	4	1	28.97	56	45	3	21:50	MBB, FB	4	217
6	9	NSD	1	4	8	0	29.12	62	42	1	21:00	MBB, FB	2	118
6	10	LALO	2	10	8	0	29.10	68	46	1	21:21	MBB, FB	0	116
6	11	WPD	1	12	8	0	29.01	66	46	1	19:36	MBB, FB	N/D	
6	12	LL	0	10	8	0	28.93	68	43	1	20:27	MBB	0	59
6	13	CB	0	25	8	0	28.9	66	45	3	17:41	MBB, FB	N/D	171
6	14	CB	1	20	8	0	29.10	54	45	1	21:07	MBB, FB	N/D	143
6	15	NSD	2	17	8	0	29.24	50	41	3	20:39	MBB, FB	5	306
6	16	LALO	0	15	8	0	29.34	59	40	1	21:25	MBB, FB	7	279
6	17						No count due to thick fog & limited visibility							N/D
6	18	WPD	2	15	7	0	29.26	58	38	2	18:00	MBB	0	192
6	19	LALO	2	15	6	1	29.16	N/D	39	2	18:55	MBB, FB	5	146
6	20	LL	2	5	7	1	N/D	61	43	1	12:00	MBB	N/D	225
6	21	CB	2	25	6	0	28.73	54	N/D	2	19:03	MBB, FB	3	183
6	22	LALO	2	15	6	1	N/D	54	43	3	15:52	MBB, FB	8	338
6	23	CB	2	10	6	1	29.14	50	44	1	18:32	MBB, FB	8	181
6	24	CB	2	25	7	0	29.08	56	44	1	20:15	MBB, FB	2	136
6	25	LALO	2	9	7	0	29.14	56	42	1	21:03	MBB, FB	10	299
6	26	CB	1	7	7	0	29.06	58	39	2	19:40	MBB, FB	4	143
6	27	LALO	1	15	8	0	29.06	56	38	1	20:06	MBB, FB	13	169
6	28	CB	1	20	8	0	29.14	56	43	1	19:40	MBB, FB	2	98
6	29	CB	0	7	7	0	29.17	67	38	1	17:45	MBB, FB	0	225
6	30	CB	2	25	4	0	29.14	62	41	1	20:15	MBB, FB	9	153
7	1	LALO	2	8	7	1	28.79	56	45	1	20:33	MBB, FB	15	218
7	2	LALO	2	15	7	0	28.98	59	44	1	20:21	MBB, FB	6	211
7	3	LALO	2	12	5	1	29.17	52	45	1	20:01	MBB, FB	7	194
7	4	CB	2	17	7	0	28.99	58	45	1	19:12	MBB, FB	8	152
7	5	CB	2	22	7	1	29.04	54	43	1	20:30	MBB, FB	N/D	170
7	6	LALO	0	10	7	0	29.2	60	45	1	20:51	MBB, FB	11	205
7	7	LALO	0	7	7	0	29.22	64	45	1	19:12	MBB, FB	4	152
7	8	LL	2	15	6	1	29.21	55	44	3	15:15	MBB	N/D	150
7	9	WPD	2	4	5	1	29.03	54	44	1	20:38	MBB, FB	3	62
7	10	LALO	1	7	7	0	29.16	64	43	1	19:25	MBB, FB	9	176
7	11	LALO	2	15	4	1	29.12	50	49	1	20:40	MBB, FB	11	208
7	12	CB	2	8	4	1	29.18	56	44	1	20:25	MBB, FB	11	201
7	13	LALO	0	5	7	0	29.24	63	51	3	20:10	MBB, FB	3	184
7	14	CB	1	15	4	1	29.32	67	51	3	21:30	MBB, FB		103
7	15	CB	1	35	4	1	29.08	57	50	3	19:19	MBB, FB		140
7	16	CB	1	20	3	1	28.62	60	52	2	22:03	MBB		95
7	17	CB	1	15	3	1	28.51	57	53	2	21:48	MBB, FB		164
7	18	LALO	2	20	8	1	28.56	62	52	2	19:49	MBB, FB	3	223
7	19	CB	2	10	7	1	28.56	50	46	1	21:52	MBB, FB		134

APPENDIX 3. Seal haulout census data, Nanvak Bay, southwest Alaska, May-September 1994

MO	DA	CNT	CLD	WND	WND	PC	BAROM	MA	MI	TD	TIME	LOC'N	NO.	
		LOC'N	CVR	SPD	DIR								PUP	TOT
7	20	CB	2	10	2	1	28.8	52	46	1	22:05	MBB, FB		193
7	21	CB	2	10	3	1	28.72	54	44	1	21:52	MBB, FB		162
7	22	LALO	1	5	4	1	28.95	58	51	3	20:23	MBB, FB	3	239
7	23	CB	2	5	5	0	29.01	58	50	3	20:12	MBB		227
7	24	CB	2	5	6	1	29.01	56	50	3	19:45	MBB		158
7	25	CB	1	10	7	0	28.96	63	50	3	18:55	MBB, FB		191
7	26	LALO	1	10	8	0	29.1	67	48	2	21:06	MBB		18
7	27	CB	2	10	4	1	29.16	64	50	3	18:51	MBB		160
7	28			No count due to poor visibility										
7	29	LALO	2	10	5	1	29.15	58	52	3	17:43	MBB		211
7	30	LALO	2	10	4	1	29.12	58	54	3	19:14	MBB, FB		272
7	31	CB	2	10	6	1	29.12	64	55	3	21:54	MBB, FB		279
8	1	CB	2	5	4	0	29.26	62	48	3	20:45	FB		17
8	2	CB	2	10	1	1	29.29	53	42	3	22:13	MBB, FB		170
8	3	CB	2	10	8	1	29.12	58	50	3	20:45	MBB		184
8	4	CB	1	3	2	0	29.2	59	52	1	22:49	MBB, FB		263
8	5	LALO	2	5	6	1	29.24	60	51	1	20:53	MBB		227
8	6	CB	2	10	4	0	29.32	57	52	1	20:49	MBB, FB		319
8	7	LALO	2	15	5	0	29.37	59	52	3	19:51	MBB, FB		420
8	8	WPD	2	20	3	0	29.39	60	50	1	18:59	MBB, FB		271
8	9	LL	1	18	5	0	28.91	52	52	4	19:26	MBB, NS		267
8	10	WPD	2	7	6	0	29.22	60	50	2	19:55	MBB, NS		475
8	11	CB	2	6	6	0	29.52	64	52	1	18:10	MBB, FB, NS		389
8	12	WPD	2	10	7	0	29.53	56	48	1	19:01	NS		382
8	13	WPD	2	12	7	0	29.54	61	45	1	17:27	MBB, NS		417
8	14	LL	1	12	8	0	29.51	62	46	1	18:09	MBB, NS		440
8	15	WPD	2	6	6	1	29.46	65	48	1	18:26	MBB, NS		404
8	16	WPD	1	12	6	0	29.35	60	38	1	19:43	MBB		411
8	17	WPD	2	23	6	0	29.38	59	40	3	18:48	MBB, NS		260
8	18	WPD	1	7	7	0	29.66	60	46	3	17:29	MBB, NS		433
8	19	WPD	1	11	7	0	29.59	59	47	1	21:38	MBB, NS		402
8	20	WPD	1	30	7	1	29.18	54	46	4	19:19	NS		325
8	21	LL	2	18	7	1	29.21	58	47	1	18:06	MBB, NS		437
8	22	WPD	2	25	7	1	29.07	54	47	1	18:05	MBB, NS		215
8	23	WPD	2	17	7	1	29.14	54	47	1	16:41	MBB, NS		446
8	24	WPD	2	37	6	1	29.11	54	47	3	16:15	MBB, NS		324
8	25	WPD	1	20	5	0	29.22	58	51	3	16:47	MBB, NS		540
8	26	WPD	1	35	7	1	28.94	53	50	1	18:14	NS		373
8	27	WPD	2	20	8	1	29.4	49	41	2	17:14	MBB, NS		488
8	28	WPD	1	15	7	0	29.48	59	41	2	13:30	NS		462
8	29	WPD	1	12	6	0	29.42	56	47	2	19:37	MBB, NS		327
8	30	WPD	2	10	7	1	29.25	56	47	1	20:21	NS		386
8	31	WT	2	10	5	1	29.17	52	48	2	16:00	MBB, NS		425
9	1	WPD	1	18	8	0	29.17	57	47	2	18:25	NS		455
9	2	WPD	1	12	8	0	29.27	57	46	2	17:48	NS		304
9	3	LL	1	15	8	0	29.04	61	47	3	12:00	NS		206
9	4	WPD	1	45	1	0	29.15	53	47	1	16:10	MBB		326
9	5	WPD	0	20	8	0	29.48	54	44	1	15:39	MBB, NS		345
9	6	WPD	1	5	5	0	29.49	62	40	2	16:59	MBB		255
9	7	LALO	2	10	6	0	29.38	56	40	1	16:05	MBB		313
9	8	WPD	2	15	7	0	29.15	57	48	1	16:26	MBB, NS		377
9	9	ZOD	2	18	4	0	29.17	55	43	1	14:30	MBB		375
9	10	WPD	2	20	4	1	28.95	54	48	3	14:36	MBB		319
9	11	CB	2	2	9	1	28.81	58	50	3	14:04	MBB		350
9	12	WPD	1	17	8	0	28.97	55	48	1	16:32	MBB		107

APPENDIX 3. Seal haulout census data, Nanvak Bay, southwest Alaska, May-September 1994

MO	DA	CNT	CLD	WND		PC	BAROM	MA	MI	TD	TIME	LOC'N	NO.	
		LOC'N	CVR	SPD	DIR								PUP	TOT
9	13	WPD	2	20	9	1	28.39	49	46	1	19:03	MBB		132
9	14	LL	2	35	1	0	28.31	48	46	4	11:45	NS		262
9	15	WPD	1	35	8	1	28.56	48	43	3	14:52	NS		395
9	16	WT	1	3	1	0	28.52	49	29	1	12:17	MBB		208
9	17	WPD	2	15	3	1	28.52	54	32	2	14:49	MBB, NS		383
9	18	WPD	2	23	4	0	28.53	50	43	2	14:49	MBB, NS		391
9	19	WPD	2	25	4	0	28.84	52	37	1	15:45	MBB, NS		445
9	20		2	45	3	1	28.06	49	41	No seals h/o - big storm & no low tide				
9	21	WPD	2	25	4	0	28.55	N/D	45	4	14:30	MBB		350
9	22	CB	2	18	6	1	N/D	51	N/D	2	16:43	MBB, NS		291
9	23	WPD	1	20	4	0	28.7	51	39	1	17:13	MBB		302
9	24	WPD	2	45	8	0	28.65	45	42	1	17:10	MBB		154
9	25	WPD	2	25	8	1	28.91	43	41	2	13:40	NS		216
9	26	WPD	1	15	1	0	29.18	44	37	1	11:00	MBB, NS		245
9	27	LL	1	15	8	0	29.3	40	34	1	20:00	NS		264
9	28			No count - breaking camp										
9	29	LL	1	22	4	0	29.27	N/D	34	2	15:23	MBB		180

MO = Month

DA = Day

CLD CVR = Cloud Cover

WND SPD = Wind Speed in mph

WND DIR = Wind Direction: 1=N, 2=NE, 3=E, 4=SE, 5=S, 6=SW, 7=W, 8=NW, 9=Variable

PC = Precipitation: yes=1, no=0

MA = Maximum Temperature (degrees Fahrenheit)

MI = Minimum Temperature (degrees Fahrenheit)

TD = Tide: high=4, low=1, rising=2, falling=3

TIME = Time of count

LOC'N = Location of haulout; MBB=Mid-bay bars, FB=Far bars, NS=North Spit tip

NO. PUP = Number of pups

TOT = Total number of seals hauled out and in water

CNT LOC'N = Location of observation point; CB=Cabin Bluff, cliffs=estimate from cliff trail,

LALO=Lauri's Lookout (aka Big Dune), LL=Lee's Landing,

NSD=North Spit Dune, WPD=Watch Point Dune, WT=Walrus Tower

APPENDIX 4. Other marine mammal sightings, northern Bristol Bay and Kuskokwim Bay, southwest Alaska, May-September 1994.

Bristol Bay

Cetaceans

Grey whales (*Eschrichtius robustus*) were sighted 33 times travelling north along the coast of Cape Peirce during June. At least 7 females with calves were sighted. Most of the whales swam within 100m of the shoreline, and some appeared to be feeding.

Four orcas (*Orcinus orca*) were seen travelling south past South Firebaugh Cove at Cape Peirce on 02 July. Two of medium size swam swiftly into the cove, directly up to a tightly packed group of 7-9 walruses, nosed into some of them and swam off, continuing south. Shortly afterward, an orca female and her calf swam by the cove, leaping and porpoising frequently out of the water (see Results; Walruses-Other Observations).

One Minke whale (*Balaenoptera acutorostrata*) was sighted swimming in Hagemeister Strait on 24 May during an aerial survey.

A harbor porpoise (*Phocoena*) surfaced between Shaiak Island and the mainland as crew members aboard *Rex M*, a USFWS research vessel, surveyed the coast for seabirds. Crew members also saw two harbor porpoises between Summit Island and Nunavachak Bay on 27 June (Hagblom, 1994).

Kuskokwim Bay

Cetaceans

One adult male and one medium-sized and two small orcas of unknown sex were spotted swimming south about 20m offshore, east of the Chagvan Bay waterfowl camp on 08 May. The two smaller ones appeared to be playing and rolling, and all four stopped for a few minutes, possibly fishing. Two orcas were seen near Carter Spit on 13 July by the BLM shorebird crew.

One grey whale was seen 10m off the coast just south of Chagvan Bay on 12 May by TNWR staff during their two-week stay at a waterfowl camp.

Two harbor porpoises were spotted on 8 July and three on 14 July offshore near Carter Spit by the BLM crew.

A pod of approximately fifty belukha whales (*Delphinapterus leucas*), including 10 juveniles, was seen swimming close to shore at high tide, off Cripple Creek spit on 21 July by the BLM crew.

Carcasses

Between 06 July-07 August on Carter Spit, the BLM crew found a total of 5 grey whale and 3 belukha whale carcasses in varying degrees of decay.