MARINE MAMMALS HAULOUT USE IN BRISTOL BAY AND SOUTHERN KUSKOKWIM BAY, ALASKA, 2006

A Status Report of the 2006 Marine Mammal Monitoring Effort at Togiak National Wildlife Refuge

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ABSTRACT

Togiak National Wildlife Refuge's (Togiak Refuge) 2006 marine mammal program focused on monitoring the abundance and distribution of Pacific walrus, seals, and Steller sea lions at selected haulouts in northern Bristol Bay and southern Kuskokwim Bay. Togiak Refuge staff monitored these species from the ground at Cape Peirce from 5 May to 24 August. Ten aerial surveys were conducted over the marine mammal haulouts at Cape Peirce, Cape Newenham, and Hagemeister Island on 13 January through 20 December.

The peak ground count of walrus at Cape Peirce occurred on 2 and 3 August with 41 walrus hauled out. The peak aerial count at Cape Peirce was 886 on 8 December. The peak aerial count of walrus at Cape Newenham was 435 on 8 December. The peak aerial count on Hagemeister Island was 943 on 25 October.

No walrus were observed traveling up to the cliff tops at Cape Peirce this year. After 30 animals apparently fell to their deaths in the 2005, we erected a sand fence this season to begin rebuilding the sand dunes to reduce this form of walrus mortality.

No disturbances to walrus were documented at Cape Peirce this year. Lower jaw teeth and tusks were collected from stranded walrus carcasses. The tooth samples were sent to the U.S. Fish and Wildlife Service Marine Mammals Management in Anchorage for aging. The tusks will be available for sale at Beaver Round-Up in Dillingham or the Alaska Federation of Natives in Anchorage.

Nanvak Bay continues to be the largest known seal haulout in northern Bristol Bay. A peak count of 493 seals was recorded on 16 August. Harbor seal pups were observed in Nanvak Bay with a high count of 69 pups recorded on 3 July. There were five disturbances to seals in Nanvak Bay documented. No subsistence seal hunts were observed this year in Nanvak Bay.

Steller sea lions were documented at Cape Newenham from 13 January to 20 December in conjunction with aerial walrus surveys. The peak count was 245 on 12 October. In addition, incidental observations of sea lions were recorded at Cape Peirce.

Other marine mammals in northern Bristol Bay and southern Kuskokwim Bay were reported opportunistically, including gray whales, killer whales, and Steller sea lions.

INTRODUCTION

Togiak National Wildlife Refuge's (Togiak Refuge) rocky coast and sand beaches support a diverse and abundant marine mammal population. Cape Peirce, Cape Newenham, and Hagemeister Island are particularly rich in marine mammals, providing terrestrial haulouts for Pacific walrus, harbor seals, spotted seals, and Steller sea lions. Cape Seniavin, on the north side of the Alaska Peninsula, and Round Island, in the Walrus Islands State Game Sanctuary, also provide haulout areas for walrus and other marine mammal species. In addition to these marine mammal species, gray whales are observed each spring during their migration north and

approximately 12 other marine mammal species can occur in the area, including sei whales, minke whales, beluga whales, goosebeak whales, killer whales, Pacific white-sided dolphins, harbor porpoises, Dall's porpoises, northern fur seals, ribbon seals, ringed seals, and bearded seals.

Cape Peirce and Round Island are the two largest regularly-used terrestrial haulouts for Pacific walrus in the United States. Other terrestrial haulouts in southwest Alaska include Cape Newenham, Cape Seniavin, and Hagemeister Island, though it appears these are not used as frequently or by as many walrus as Cape Peirce and Round Island. Male, female, and young walrus that winter in and near Bristol Bay and Kuskokwim Bay migrate north in the spring. Some of the males remain behind and haul out at Cape Peirce and Round Island (Fay 1982) and other terrestrial haulouts in the area. Cape Peirce was historically used as a haulout but was abandoned sometime during the first half of the 20th century (Taylor, pers. comm.). Walrus began re-using the Cape Peirce haulout in 1981 (Togiak National Wildlife Refuge 1981) and have returned every summer since.

In 1987-1988 the number of walrus hauling out at Cape Peirce and Round Island declined (Alaska Department of Fish and Game unpublished data; Togiak Refuge unpublished data). During this time the yellow-fin sole fishery began in northern Bristol Bay with fishing activities concentrated in the Round Island area. Concerned that the decline in the number of walrus hauling out might be related to the initiation of the yellow-fin sole fishery, the North Pacific Fisheries Management Council (NPFMC) restricted 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 3-mile transit zone around Right Hand Point. The Togiak Refuge is working jointly with the U.S. Fish and Wildlife Service Marine Mammals Management (MMM) and the Alaska Department of Fish and Game (ADF&G) to determine the abundance and distribution of walrus in Bristol Bay and southern Kuskokwim Bay.

Pacific walrus hauling out along the Togiak Refuge coastline may be affected by human-induced disturbances. In other areas, human disturbances have been linked to both short-term and long-term haulout abandonments with regular and frequent disturbances most detrimental. However, haulout abandonments must be assessed carefully because changes in walrus distribution may occur for reasons not understood.

Harbor seals, and probably some spotted seals, haul out along the Togiak Refuge coast with the 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 1970's (Togiak Refuge unpublished data; Jemison 1991). Population trends examined in the Gulf of Alaska indicate a similar population decline. Limited data from Prince William Sound and southeastern Bering Sea suggest harbor seal numbers have declined since the mid 1970's (Pitcher 1990). Although these declines have been observed, the number of seals at Nanvak Bay have remained relatively stable since 1990.

Human-caused disturbances of hauled-out seals generally have widespread affects, often frightening all animals into the water. Possible long-term effects of repetitive disturbance

include increased neo-natal mortality (Bishop 1967; Johnson 1976; Streveler 1979) and abandonment of haulouts (Richardson 1973). The negative impact of disturbance is felt greatest in large, dense aggregations where confusion in mass flights is most likely to cause injury or permanent mother-pup separations (Johnson 1976). Because of the seals' dependency on haulouts during pupping (early June through early July at Nanvak Bay) and molting (late August and early September at Nanvak Bay), the potential impact of disturbance is greatest at those times (Lentfer 1988).

Cape Newenham and Round Island support the two largest Steller sea lion haulouts in northern Bristol Bay. Monitoring of the sea lions at Cape Newenham by Togiak Refuge staff, with funding from the National Marine Fisheries Service (NMFS), began in 1991 and continued through 1993. In 1991, concentrated efforts determined Cape Newenham is a haulout and pupping is rare. Sea lion populations have been monitored by ADF&G staff at Round Island since the late 1970's. From the late 1950's to the mid 1980's sea lion numbers have declined in Alaska (Merrick 1987). On April 10, 1990, the Steller sea lion was designated as Endangered in the population segment west of 144^{o} West longitude by NMFS, which includes the Togiak Refuge coastline. In most recent years, little formal monitoring of Steller sea lions was conducted by Togiak Refuge staff. Occasional observations of the sea lion haulout have been recorded and incidental observations of sea lions by personnel working on other projects have been recorded. However, in 2006, we documented Steller sea lions hauling out at Cape Newenham in conjunction with aerial walrus surveys.

During 2006, the Togiak Refuge, MMM, and the ADF&G worked jointly to determine the abundance and distribution of walrus in Bristol Bay and southern Kuskokwim Bay. In addition, the Togiak Refuge worked to assess the abundance and distribution of seals at Nanvak Bay and Hagemeister Island and Steller sea lions at Cape Newenham. A continued cooperative effort will help ensure responsible management of these species.

OBJECTIVES

1. Monitor the numbers of Pacific walrus, seal species, and Steller sea lions at Cape Peirce, Cape Newenham, and Hagemeister Island.

2. Document walrus and seal behavioral response to aircraft, boats, administrative activity, research, and visitor use at Cape Peirce and Cape Newenham.

3. Attempt to prevent walrus from traveling up the cliffs at Maggy Beach.

4. Monitor the number and location of walrus carcasses at Cape Peirce and Cape Newenham.

5. Provide support for other organizations conducting marine mammal research on and adjacent to the Togiak National Wildlife Refuge.

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 (Figure 1, Figure 2). The Cape Peirce and Cape Newenham area is located approximately 193 km west-southwest of Dillingham within the Togiak Refuge. Steep, jagged cliffs above rock and sand beaches characterize the coastline in this area. Hagemeister Island is a 17-mile long island located east of Cape Peirce and southwest of Togiak. Nanvak Bay is located approximately 3 km north of Cape Peirce Point.

METHODS

In 2006, Togiak Refuge staff undertook a two-part marine mammal monitoring effort. The first part consisted of ground counts of walrus and seals using terrestrial haulouts at Cape Peirce. The second part consisted of aerial counts of all marine mammal haulouts at Cape Peirce, Cape Newenham, and Hagemeister Island (i.e. Pacific walrus, Steller sea lion, and seal species).

WALRUS

Haulouts

Ground Counts: From 1998-2005, a counting protocol and database developed by the USFWS, ADF&G, USGS-BRD, and the University of Alaska was employed at the Bristol Bay walrus haulouts (Marine Mammals Management 1998). In 2006 at Cape Peirce, Togiak Refuge staff performed daily counts, which consisted of censussing walrus haulouts at one scheduled time each day (2:00 p.m.) with beaches counted in the same order each day. At each count, haulout beaches were counted a minimum of 3 times by each observer.

Beaches where walrus haul out at Cape Peirce were checked from 5 May to 24 August from ground observation points and the following information was recorded: date, time, weather (wind direction and speed, cloud cover, precipitation, barometric pressure, temperature), tide, beach conditions, Beaufort sea state, beach availability, percent beach occupied, number of animals hauled out, number of walrus in the water less than 10 meters from shore, number of walrus in the water greater than 10 meters from shore, and unusual scars or features on walrus.

Walrus were individually counted or their numbers estimated using binoculars and a tally meter from the same observation points each day to minimize inconsistencies. Observers estimated large haulouts by counting the number of animals in a highly visible group and then counting the number of groups judged to be of that size in the haulout.

For data analysis of haulout numbers, a peak was defined as the highest count for the three previous days and the three following days, based on Hills (1992). A lowest count was defined as the lowest count between peaks.

Aerial Counts: To better estimate the trends of walrus haulout use throughout the year, aerial surveys were planned to be flown at Cape Newenham and Hagemeister Island monthly from August 1 - June 30 while bi-weekly from July 1 -July 31. When the Cape Peirce field camp was not in operation, the Cape Peirce walrus haulouts were also to be observed from the air to document walrus numbers and activity there.

Walrus were individually counted or their numbers estimated. The walrus haulouts were observed from a Piper PA-18 Super Cub or a Cessna 185 flying 2,000 feet above ground level or higher to minimize disturbances to hauled out marine mammals. Observers estimated large haulouts by counting the number of animals in a highly visible group and then counting the number of groups judged to be of that size in the haulout. All walrus in the water were recorded. However, walrus in the water within 10 m of shore were recorded separately as per the methods for the Pacific walrus database.

Although this project was initiated to document walrus haulout use year-round, we also benefited by documenting seal use of the haulout in Nanvak Bay and Steller sea lion use of the haulout at Cape Newenham.

Disturbances

In the past at Cape Peirce, walrus have moved off the beach when boats or planes traveled near hauled-out animals (MacDonald 2001). Walrus response to boats and planes was observed opportunistically throughout the summer at Cape Peirce. Incidences of marine mammal disturbances were reported to Togiak Refuge headquarters where appropriate follow-up actions could be taken. Because the Cape Peirce field camp was opened early this summer for the tenth consecutive year, staff were able to monitor walrus response to boat and plane traffic during the commercial herring fishery.

To determine the degree of a response, walrus behavior was divided into three category levels based on Salter (1979). The number of walrus responding at each level was recorded.

Level 1: Walrus raise heads or move bodies, seen as a wave or ripple within a group of walrus (“Head Raise”).

Level 3: Walrus orient and/or move toward water, usually stopping on the beach or at the water line (“Orientation”).

Level 5: Walrus move directly into water, usually do not mill, and do not haul out again for at least several hours (“Dispersal”).

The number of walrus responding at a particular level is multiplied by the value of that level. The values per level are: Level 1 - multiply by 1; Level 3 - multiply by 3; Level 5 - multiply by 5. The sum of the products of these numbers determines the index category and associated degree of response (Hessing and Sheffield 1989). When more than one behavior is shown by the walrus, the behavior with the highest numerical response level is used to calculate the index

value.

INDEX	DEGREE OF RESPONSE
0-100	low
101-1,000	moderate
1,000+	high

For example: an aircraft flies over a haulout of 200 animals. Fifty animals raise their heads (Level 1) while 25 orient (Level 3). The degree of response [(50 x 1) + (25 x 3) = 125] would be classified as moderate.

Carcasses

The location and condition of carcasses were recorded when they first appeared or if they were moved by tides and storms. Lower jaw canines were collected and sent to MMM for aging. Tusks were removed by staff to prevent disturbances to walrus on haulouts by pilots and boaters in search of ivory. These tusks were registered and tagged in Dillingham and sent to MMM for sale to Alaskan Natives at the Alaska Federation of Natives gathering in Anchorage or the Beaver Round-Up Festival in Dillingham.

SEALS

Haulouts

Nanvak Bay: Seals hauled out on the tidal sand bars in Nanvak Bay were primarily censussed from the observation point "Watch Point Dune" (Figure 3). At times, the seals were also censussed from observation points "Cabin Bluff," "Lauri's Lookout," and "Waterfowl Tower." "Lauri's Lookout" is the only observation point where Nanvak Channel has to be crossed for access. Crossing Nanvak Channel to North Spit was accomplished in a sea kayak.

Counts were made at or close to the lowest tide of the day with various powered spotting scopes or occasionally with 8 x 42 binoculars. Data recorded were: date, time, weather, number of seals hauled out, number in the water, number of pups, and wounded or scarred seals. Attempts to count pups were stopped after 4 July when they became too big to distinguish from yearlings.

In conjunction with aerial walrus surveys described above, Togiak Refuge staff documented seal numbers using the haulout in Nanvak Bay. Flights were made at or above 2,000 feet AGL in a Piper PA-18 Super Cub or a Cessna 185.

Disturbances

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. As

in previous years, documentation has been descriptive and quantified approximate numbers of seals leaving their haulout in response to boats, planes, other human activity, or natural disturbances. Major disturbances were reported to Togiak Refuge headquarters where appropriate follow-up actions could be taken.

STELLER SEA LIONS

Both formal and incidental observations of Steller sea lions were made in 2006. In conjunction with aerial walrus surveys described above, Togiak Refuge staff documented Steller sea lion numbers using the haulout at Cape Newenham. Flights were made at or above 2,000 feet AGL in a Piper PA-18 Super Cub or a Cessna 185. In addition, incidental observations of Steller sea lions at Cape Peirce were recorded from ground-based observation points by staff members stationed on-site performing walrus and seabird monitoring programs.

RESULTS

WALRUS

Numbers/Haulout Patterns

Ground Counts: Walrus haulouts were censussed almost daily from ground-based observation points at Cape Peirce from 5 May to 24 August (Appendix A). Walrus were first observed hauled out on 25 May with one walrus at South Firebaugh Beach. On 24 August, the last day censussed, there were nine walrus using Cape Peirce haulouts.

The peak walrus count occurred on 2 and 3 August with 41 walrus hauled out. Nine peaks in the number of walrus hauled out occurred this season. The length of haulout periods between peaks ranged from 7 to 18 days and averaged 11.1 days. Haulouts at Cape Peirce were censussed 80 of the 112 days staff were present. Walrus were present 54% of the time, or on 43 of the days censussed.

Aerial Counts: Ten aerial surveys were conducted from 13 January and 20 December to document walrus haulout activity at Cape Peirce, Cape Newenham, and Hagemeister Island (Appendix A, Appendix B). Walrus were observed at Cape Peirce on seven of the surveys, with a peak of 886 walrus. Cape Newenham was surveyed for walrus eight times. Walrus were present on four surveys, with a peak of 435 individuals. The Hagemeister Island haulout was observed seven times, with walrus present on four of the surveys. The peak count at Hagemeister Island was 943 individuals.

In addition, Togiak Refuge staff observed the walrus haulout at Protection Point on 10 April while performing an aerial caribou survey. No walrus or signs of walrus activity were present on the beach.

Disturbances

No disturbances to walrus were observed at Cape Peirce this year.

Behavioral Observations

No walrus ascended to the cliff tops this season. This was due to the fact that overall, few walrus used Maggy Beach this summer and they never hauled out high enough to be of concern. In response to a walrus mortality event in the fall of 2005, Togiak Refuge staff erected a sand fence (Figure 4) this season to begin rebuilding the sand dunes to reduce this form of walrus mortality. The sand fence remained intact throughout the summer season. However, walrus were observed on October 25 having moved further up the sand dunes damaging the fence in the process (Figure 5).

Carcasses

Biological samples were removed from all accessible walrus carcasses this year, including 40 lower canine teeth for aging and an assortment of ivory. This ivory consisted of two whole tusks and five broken tusks or ivory chips that are available to be sold at the Beaver Round-Up Festival in Dillingham or the Alaska Federation of Natives gathering in Anchorage.

SEALS

Ground Counts

Numbers/Haulout Patterns: Seals hauling out in Nanvak Bay were censussed almost daily from the ground from 6 May to 23 August (Appendix C). The peak haulout count for the season occurred on 16 August with a total of 493 seals in Nanvak Bay.

Pupping: The first seal pups of the season were observed on 3 June. The high pup count of 69 occurred on 3 July. The peak haulout of all seals during the pupping period was 334 on 3 July.

Aerial Counts

Between 13 January and 20 December, ten aerial surveys were attempted to document marine mammals at Cape Peirce, Cape Newenham, and Hagemeister Island. Seals were observed during seven surveys (Appendix B, Appendix C). The peak seal count for Nanvak Bay aerial surveys was 454 on 5 October. Seals were only observed on Hagemeister Island on 31 October, with a count of 67.

Disturbances

In 2006, five disturbances to seals were documented in Nanvak Bay (Appendix D). One disturbance was caused by aircraft and four were caused by USFWS personnel.: two disturbances from field observations, one from a children's education camp, and one from the discharge of audible bear deterrent. All of these disturbances flushed seals into Nanvak Bay.

Subsistence Harvests

There were no subsistence seal hunts observed in Nanvak Bay while the Cape Peirce camp was open this season.

STELLER SEA LIONS

Cape Peirce: Because there are no Steller sea lion haulouts at Cape Peirce, formal ground surveys are not possible. However, incidental observations of sea lions swimming in the area resulted in 18 observations from 4 May to 10 July (Appendix E). A total of 23 sea lions were recorded. All but one of these observations were of sea lions swimming in the water. The lone exception was an animal hauled out on a beach.

Cape Newenham: Between 13 January and 20 December, ten aerial surveys were conducted to document walrus haulout activity at Cape Peirce and Cape Newenham (Appendix B). In conjunction with these surveys, Togiak Refuge staff also documented the numbers of Steller sea lions using the haulout at Cape Newenham. Sea lions were observed at Cape Newenham on seven surveys, with a peak count of 245 animals on 12 October.

OTHER MARINE MAMMAL OBSERVATIONS

On an opportunistic basis, other marine mammals were recorded when seen. In 2006, 39 gray whales and five killer whales were documented in the Cape Peirce area by Togiak Refuge field staff (Appendix E).

DISCUSSION

WALRUS

Limitations of Data

Inconsistencies exist in the walrus data collected at Cape Peirce from 1981-1986. The first walrus activity documented at Cape Peirce during the 1900's occurred in late November 1981 when approximately 2,500 walrus were observed on Maggy Beach (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 1984-1986 inconsistent counts resulted from untrained volunteers rotating through the field camp to census the walrus. 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 1984-1986 was to maintain a presence to deter wasteful taking of walrus (Hotchkiss, pers. comm.). Walrus counts have become more consistent since 1987 as personnel at Cape Peirce and Cape Newenham remained the entire season, had overlap with previous personnel to obtain training, and focused on standardizing counts. At Round Island and Cape Seniavin, the inability to census the entire island or to see all walrus hauled out under the cliff edges daily results in inconsistent or incomplete haulout data (Cody, pers. comm.; Hills, pers. comm.; Raymond, pers. comm.).

With these limitations in mind, the haulout numbers from the five Bristol Bay and southern Kuskokwim Bay haulouts have been used to estimate haulout numbers, general patterns in haulout behavior, and haulout trends over time.

Numbers/Haulout Patterns

Cape Peirce: Ground Counts: The peak walrus count at Cape Peirce during the summer field season in 2006 from ground-based observations was 41 animals. This is the second lowest peak count since we began monitoring walrus numbers in 1981 from ground-based observation points. The previous lowest count was 2004 when a peak count of 31 walrus was recorded. Other low peak counts occurred in 2000, 2002, 2003, and 2005 when we observed peak counts of 971, 284, 538, and 60 walrus at Cape Peirce, respectively. Walrus haulout counts in all other years have been above 1,000 animals. However, the range of walrus peaks recorded at Cape Peirce since 1981 has been extremely variable and wide-ranging (31-12,500).

Nine peak and nine low counts of walrus numbers occurred during the ground-census census period at Cape Peirce in 2006 (Figure 5). These strong fluctuations in numbers of walrus onshore may be synchronous with resting and feeding cycles, based on telemetry studies at Round Island (Jay et al. 1998; Taggart 1987). Such fluctuations may also be related to severity of storms and to anthropogenic disturbances.

During storms with strong on-shore winds and heavy surf, hauling grounds are usually abandoned (Nikulin 1947; O'Neil and Haggblom 1987). Preliminary analyses comparing wind speed to declines and increases in walrus numbers in 1993-1995 seem to suggest some relationships (Wilson and Jemison 1994; Wilson 1995; Moran and Wilson 1996). More detailed analysis of weather effects should be undertaken. Other environmental factors affecting numbers of walrus on haulouts, such as barometric pressure, tidal range, and wind direction, have been identified (Hills 1992) and need further investigation.

In 2006, as in many previous years, walrus numbers were low in May and June with relatively high numbers of animals present from July to August. Usually, seasonal peaks at Cape Peirce occur later in the year (July - September) than do peaks at Round Island (May - July) (Figure 7, Appendix A). Past trends may have been due to males migrating north in the fall to join females at the edge of the ice pack (Fay 1982).

There was very little activity on Maggy Beach at Cape Peirce this year. Maggy Beach is a large, sandy, exposed beach where typically the most walrus at Cape Peirce haul out. In 1989-1990, 1992, 1996, and 1999-2006 when overall walrus numbers were lowest at Cape Peirce, use of Maggy Beach was low. In these years walrus primarily hauled out on South Firebaugh Beach, North Firebaugh Beach, and on Odobenus Cove. These are smaller, more protected beaches below the cliffs. From field observations it seems when these smaller beaches "fill up," walrus begin hauling out on Maggy Beach. South Firebaugh Beach is normally occupied throughout the season as it was in 2006. Use of Odobenus Cove by walrus usually stops in late July every year.

In previous years, observers have remained at Cape Peirce into early or mid October (1995-1998) and walrus have been observed returning to Odobenus Cove in large numbers in late September to mid October. In 1999-2002, observers also remained until early October, however, this pattern was not seen. In 2003, observers remained at Cape Peirce until mid to late September and this pattern was not detected. In 2004-2006, observers remained at Cape Peirce only until late August.

This field season walrus were observed only on beaches that have been regularly used in the past at Cape Peirce. In 1997 two beaches not normally occupied by walrus had high numbers documented. These beaches are not normally surveyed as they are beyond the regular censussing route and were not surveyed in 2006. However, biological technicians performing seabird monitoring efforts this year were frequently in a position to observe these south-facing beaches and walrus were not observed by them. During all years Togiak Refuge staff have surveyed the area, only rarely has even a single walrus been observed on any south-facing beach between Cape Peirce Point and Puffin Creek.

Cape Peirce: Aerial Counts:
In 2006, ten aerial surveys were flown over Cape Peirce. Cape Newenham was surveyed eight times, and Hagemeister seven times.

The aerial surveys at Cape Peirce were conducted only when there were not ground-based observations being conducted. During ten flights to Cape Peirce, walrus were recorded on seven occasions. Counts ranged from 36-886 walrus. Peak monthly aerial counts conducted in 2004-2006, when ground observations were not being conducted, vary from 0-4818 (Figure 8), with the largest walrus numbers observed occurring in November 2005.

Cape Newenham: Aerial Counts: Walrus haulouts at Cape Newenham were monitored daily throughout the summer season in 1991-1993, 1996, and 1997. In 1998-2003 the walrus haulouts were monitored only from the end of June to the end of July following the Bristol Bay haulout monitoring protocol. In 2004-2006, only aerial surveys were conducted at Cape Newenham.

The Wildlife Inventory and Monitoring Plan for Togiak National Wildlife Refuge states that walrus numbers will be estimated daily at Cape Newenham every year during the month of July (USFWS 1996). This task is not rated for its importance and will be undertaken as funding permits. However, due to the very low walrus numbers at Cape Newenham in recent years, it

was decided to perform aerial surveys throughout the year instead of only during July. These surveys have been beneficial to show walrus activity on the haulouts throughout the year.

Walrus were present at Cape Newenham during four of eight survey flights over those haulouts. The peak aerial count was 435 walrus, observed 8 December (Figure 9). This compares to peak aerial counts of 1,094 walrus in 2005 and 42 in 2004. The peak counts observed in 2005 and 2006 are encouraging after peak counts at Cape Newenham of only 42 animals or less since 1999. However, the peak counts prior to 2004 occurred during the summer field season and may not be comparable to these three years' winter survey data. Peak monthly aerial counts conducted in 2004-2006 ranged from 0-1,094 (Appendix B), with the largest walrus numbers observed occurring in January 2005.

We found no walrus during seven summer flights in 2004 and two walrus in five summer flights in 2005. We conducted 0 summer flights in 2006.

Last year, 2005, marked the seventh consecutive year that walrus rarely used the Cape Newenham haulouts during the summer season and contrasts with the 1998 summer peak count of 1,494 and the 1992 summer peak count of 5,444 animals.

Such irregular use of Cape Newenham by walrus may be linked to disturbances. Fishing boats pass near the haulout beaches, aircraft frequently fly over the beaches in the process of accessing the Cape Newenham Long Range Radar Site in navigation, and aircraft take off and land weekly, sometimes daily, at the Cape Newenham airstrip. One beach, Air Force Cove, which has been used irregularly by walrus, lies at the foot of this runway. Noise from airstrip traffic is sometimes audible at the other haulout sites and aircraft arriving and departing on the airstrip sometimes pass over these beaches. However, aircraft and boat activity is also relatively high at Cape Peirce and those haulouts still have walrus using them.

The beaches at Cape Newenham appear to have been used sporadically by walrus during the last 14 years, although monitoring has not been consistent. In the 4 years of more regular censussing (1991-1993 and 1996), peak counts ranged from 870 to 5,444 (Figure 10). 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 to several thousand walrus were reported hauled out during the spring and fall months (Jemison 1992; TNWR 1986).

Hagemeister Island: Aerial Counts: In 2005, we began including flights to Hagemeister Island to record haulout activity on a previously known walrus haulout beach. During seven flights to the Hagemeister Island haulout in 2006, walrus were detected on four occasions. The peak count was 943 walrus, occurring on 25 October. Peak monthly aerial counts conducted in 2005-2006, vary from 0-943 (Appendix B), with the largest walrus numbers observed occurring in October 2006.

Disturbances

Cape Peirce: From 3 May to 24 August, 135 aircraft and 25 boats were observed in the Cape Peirce area. No disturbances to walrus resulted from this traffic in the Cape Peirce area. The

number of disturbances recorded per year at Cape Peirce since 1990 has ranged from 0 to 40 with counts below 10 disturbances this year and the previous 5 years (Figure 11) . This is encouraging and may be the result of education efforts to people accessing the sensitive Cape Peirce wildlife area.

Cape Newenham: During the eight air surveys over Cape Newenham, no boats, air traffic, or people were observed in the area. Walrus were observed at Cape Newenham on four occasions and no disturbances to these animals were observed.

Behavioral Observations

Cape Peirce: Because of the relatively low use of the Maggy Beach haulout by walrus in 2006 and the nine years prior to this year, we were not too concerned of the threat of walrus ascending to the cliff tops, going over, and resulting in injuries or mortalities. This was not an issue while the field camp was in operation this summer (camp closed 24 August).

However, after the October 2005 walrus mortality event we decided to take steps this year to lessen the ability of future walrus to access the cliff tops and possibly fall to their deaths. Togiak Refuge staff erected a sand fence across the 250' open sand slope leading up to the cliff tops. The project was designed to begin rebuilding the sand dunes to a height that would act as a barrier.

As of 11 September, the sand dune hadn't built up quite as much as we had hoped, but there was a very good base that should build over time if walrus do not access that area. One obvious benefit of the fence was the reduction of wind erosion on the sand slope which allowed natural re-vegetation of local sedge grasses. These grasses in turn act as sand fences and help trap sand, leading to enhanced sand deposition. A large mound grew in front of the sand fence because of this phenomena, about midline of the project. We have high hopes that the project will be a success.

Carcasses

The number of new carcasses at Cape Peirce this year (n=0) was much lower than the 12-year average of 24 new carcasses per year. (Figure 12). In previous years, the majority of the naturally-deposited new carcasses at Cape Peirce were found on Maggy Beach, a northwest-facing sand/gravel beach. The typical carcass at Cape Peirce is found near the high tide line and does not bloat for several days as they are cooled by the water temperatures of the Bering Sea.

In previous years, walrus died while hauled out among other walrus. Such carcasses often have been observed to bloat and turn black with large patches of epidermis peeling off within 24 hours. It was not known whether that rapid decomposition was the result of internal injuries or from heat produced by the surrounding walrus. We speculate some of these animals may have died from heat trauma or from trampling as some appeared a day or two after disturbances.

No carcasses were documented at Cape Newenham this year. In previous years there were few to no walrus carcasses observed in the Cape Newenham area. These low numbers could be attributed to several factors including lower numbers of walrus using the haulouts and a shorter field season during which observations were made. Currents, tides, and winds play a significant role in the movement of carcasses in the water and in the location of their deposition. Perhaps carcasses are more likely to wash up on Cape Peirce beaches than on Cape Newenham beaches.

During high tides and storms, carcasses can be deposited higher on sand/gravel beaches than on rocky beaches below cliffs and are likely to remain there longer. Walrus carcasses observed from 1990 to 2006 were found predominantly on sand/gravel beaches.

SEALS

Limitations of Data

In 1975 seals in Nanvak Bay were studied intensively (Johnson 1976). From 1976-1983 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 dune on North Spit. From 1984-1988 the seal population was censussed only from the south shore of Nanvak Bay. From 1990-2006 the seals were observed from both the North Spit and the south shore observation points.

The average peak counts of seals at Nanvak Bay from 1984-2005 was 525 with a range of 194 to 698 (Figure 13). The 2006 peak count of 493 is below this average. Looking at Figure 13, note that some of the counts were made with inconsistent data collection where higher numbers of seals may have been present, but not observed. The peak count in 1993 was made by an inexperienced observer who did not follow standardized censussing protocols. This count may not be comparable to other years. Since 1998, effort has been placed to gather higher quality seal data at Nanvak Bay.

Numbers/Haulout Patterns

As in the past ten years, the censussing in 2006 began almost a month earlier than in previous years. In most years, a pattern of haulout use has been shown by the seals where the number of animals is low from early June to mid-July during pupping, numbers rise steadily to peak in August to mid-September during molting, and then declining. This trend appeared present in 2006. However, we closed the camp in late August this year and were not able to record seals into late September ().Figure 14).

In 2006 the peak seal count on 16 August was slightly earlier than the average peak seal count of 27 August since 1984. This falls within the range of peak dates recorded in that time of 6 August to 22 September (Figure 13).

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. In 2006, the peak seal count in Nanvak Bay occurred on 16 August.

If the peak seal count for each year of reliable censussing (1989-2006) is an accurate reflection of that year's population trend in Nanvak Bay, seal numbers have slightly increased at Nanvak Bay since 1989 and remained steady since about 1992. In 1975 an estimated 3,100 seals were present in Nanvak Bay in late August (Johnson 1976). From 1976-1983, little information is available. No accurate counts over 700 animals have been recorded since.

The decline in the number of seals in Nanvak Bay since the 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, pollution, subsistence harvest, entanglement in nets or other debris, incidental and direct take by fishermen, and changes in prey abundance and availability (Lowry 1990). A long-term oceanic warming trend may be influencing marine mammal populations and their prey base (Ono 1995).

Bering Sea harbor seals have been classified as 1 of 3 separate stocks in Alaska, based on geographical separation, population response data, and clinal variation in body size and color phase (Hill et al. 1996). Bering Sea harbor seal numbers continue to decline an average of about 3.5% annually (Withrow, pers. comm.). However, since 1990, the seal population at Nanvak Bay has remained relatively stable (Jemison et al. undated).

The Nanvak Bay seal haulout is unique because it is the northernmost pupping area for harbor seals in Bristol Bay as well as a region where the ranges of harbor seals and spotted seals overlap. In past reports it has been stated that both spotted and harbor seals haul out in Nanvak Bay. This has not been confirmed at Nanvak Bay for the past 31 years since Johnson (1976) reported skulls taken from the Nanvak Bay region in 1975 were identified as belonging to both spotted and harbor seals. However, in recent years, seals captured and fitted with satellite transmitters on the north side of the Alaska Peninsula (especially Egegik Bay) have been shown to be both harbor seals and spotted seals (Small, pers. comm.). This has been shown by both the movements and genetics of the seals.

In 2000-2001, seal haulout patterns and molting phenology work was conducted by the Alaska Department of Fish and Game in Nanvak Bay to provide more detailed information about the seals using the area. The seal haulout pattern work was undertaken since previous seal count data was not collected over various times of the day, only during low tide in the late afternoon or evening. ADF&G staff wanted to be certain that our efforts were put into seal counts when most seals were present on any given day. Their work basically showed that there were more seals late in the day or in the early evening. This had been suspected, but now confirmed. The seals are usually easiest to count at low tide as they haul out on sand bars in Nanvak Bay. Due to the oddities in the tides in the Cape Peirce area, low tide is almost always in the late afternoon to evening, not following the normal two high tides and two low tides per day. So, our seal counts are scheduled to occur during this timeframe to begin with.

The molting phenology work was undertaken to learn more about seals in the northern Bristol Bay area. Nanvak Bay offers great views of seals and is an ideal setting to conduct the work.

General patterns of timing of molting is a little later than seals in the Gulf of Alaska (Jemison, pers. comm.) However, this is expected since pupping occurs later in northern Bristol Bay than in the Gulf of Alaska.

Pupping

The maximum number of seal pups counted in 2006 was 69 on 3 July (Figure 15) and is more than twice the average of 29 seal pups documented from 1990-2005. The peak number of seal pups had previously ranged from 6 to 51 pups, with all but one count above 15 seal pups total. The differences in pup numbers between years is probably related to time spent observing seals, frequency of use of the North Spit observation point, and observer experience. The previous high seal pup counts obtained in 2000 and 2001 may be attributed to an ADF&G observer with previous experience counting seal pups and the extra time the individual had to conduct the counts.

Most newborn pups in Nanvak Bay during June and July are probably harbor seals rather than spotted seals, based on their time of birth and pelage. The pupping season of spotted seals is generally regarded as February-May, peaking in mid-April (Quakenbush 1988) and of harbor seals in Bristol Bay as June-July (Reeves et al. 1992). Harbor seal pups are usually born with adult-like pelages but spotted seal pups, by contrast, have long white lanugo for about 1 month after birth (Nowat 1991). The first seal pups in 2006 were observed on 3 June and fits the timing for harbor seals. Most all pups observed were on Mid Bay Bar and Far Bar where all seals consistently hauled out until early August.

Disturbances

Although no method has been standardized for assessing the degree of anthropogenic disturbances to seals in Nanvak Bay, disturbances have been monitored for several years. Throughout the 2006 field season, disturbances were caused by aircraft traffic and USFWS personnel.

Seal haulout monitoring counts can be severely hampered by human-induced disturbances throughout the field season. Counts are impaired when the animals flush into the water before a count is completed as their haulout patterns change for upwards of a full day.

No natural disturbances to seals were recorded this year. However, in most years, we record disturbances to seals by birds in Nanvak Bay. In previous years, disturbances by birds interacting with the seals increased during the last two weeks of August and into September (Jemison, pers. comm.). In 2000, it was noted that bird disturbances were taking place 6-14 times per day. These birds were mostly juvenile ravens and gulls and their disturbances generally flushed only a portion of the seals into the water. The seals returned to the same haulout usually within an hour, although some did not. In comparison, when an aircraft or direct handling during a tagging operation cause a disturbance, the seals altered their haulout patterns until the next day.

STELLER SEA LIONS

The Western United States stock of the Steller sea lion population (west of Cape Suckling, 144°W and includes the Togiak Refuge coastline) was listed as endangered on April 10, 1990 by NMFS. Counts of Steller sea lions at trend sites for the western U.S. stock decreased 27% from 1990 to 1996 (Ferrero et al. 2000) and experienced a decline of 37.4% from 1989-1994 (Hill et al. 1996). Counts at trend sites during 1998 indicate that the number of sea lions in the Bering Sea/Aleutian Island regions has continued to decline (7.8% since 1996) (Ferrero et al. 2000). This is a critical time to monitor major sea lion haulout sites such as Cape Newenham and Round Island.

Cape Newenham and Round Island are the major sea lion haulouts in northern Bristol Bay (Jemison 1991). Regular monitoring of all the sea lion haulouts at Cape Newenham was funded in 1991 and 1992. In 1993-1996 data was collected opportunistically. In 1997 only Sentry Beach was censussed on a regular weekly schedule. Sentry Beach is one of four haulout areas observed in previous years. In 1998 and 1999 Sentry Beach was the only beach censussed, however, there was no regular schedule and the data was collected only on two or three separate days during the time the camp was operated. Ground-based counts of Steller sea lions at Sentry Beach were not conducted in 2000-2006. However, aerial surveys of the Cape Newenham Steller sea lion haulouts were conducted in 2004-2006 in conjunction with aerial walrus surveys in the area.

Comparisons of the number of sea lions hauled out at Sentry Beach between years may be misleading as an indicator of relative abundance of sea lions at Cape Newenham because they move between several haulout sites at Cape Newenham (Jemison, pers. comm.). Also, observers may have surveyed sea lions from different vantage points over the years.

In 2006, we observed an average of 36 Steller sea lions at Cape Newenham during eight aerial surveys from 13 January to 20 December. The peak count was 245 sea lions on 12 October.

In general, sea lion numbers at Cape Newenham are typically highest in late April to early May. Numbers were relatively consistent on Sentry Beach in May and June during 1991-1993 and 1997, averaging 177. Although we were not able to fly the Cape Newenham Steller sea lion haulouts this year during that timeframe, we did record an average of 144 during these months in 2005.

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Appendix A. Walrus haulout census and weather data, Cape Peirce, Cape Newenham, Hagemeister Island, Alaska, 2006.

DATE	TIME	CLD CVR	WIND SPEED (MPH)	WIND DIR	PRECIP	BAR-AM	BAR-PM	TIDE	MAX TEMP (F)	MIN TEMP (F)	CP TOT	CN TOT	HAG IS TOT	CP+CN+HI TOT
13 Jan	--	--	--	--	--	--	--	--	--	--	0*	0*	--	0*
21 Feb	--	--	--	--	--	--	--	--	--	--	0*	313*	0*	313*
5 May	1138	O	0	n/a	S	985		H	59	31	0	--	--	0
6 May	1138	O	9	N	S	994	1001	L	47	28	0	--	--	0
7 May	1735	O	9	SW	S	1001	1004	L	47	28	0	--	--	0
8 May	1832	B	12	N	N	1004	1006	L	40	26	0	--	--	0
9 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10 May	1600	C	5	N	N	976	986	H	42	32	0	--	--	0
11 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12 May	1400	C	6	W	N	1026	1032	L	38	34	0	--	--	0
13 May	1145	O	2	S	N	1036	1042	R	34	32	0	--	--	0
14 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 May	1300	O	3	E	N	1036	1010	H	34	32	0	--	--	0
17 May	1745	O	7	E	RF	1007	1007	L	36	32	0	--	--	0
18 May	1500	C	6	S	N	1003	1007	F	45	38	0	--	--	0
19 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22 May	1600	O	5	W	N	1006	1016	L	42	34	0	--	--	0
23 May	1530	C	3	W	N	1013	1013	L	48	36	0	--	--	0
24 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
25 May	1500	C	5	W	N	1016	--	L	60	38	1	--	--	1
26 May	1400	C	2	E	N	1026	1026	F	68	58	0	--	--	0
27 May	1345	C	4	W	N	1016	--	F	68	40	0	--	--	0

28 May	2015	C	2	W	N	1006	1006	L	73	40	0	--	--	0
29 May	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30 May	1500	C	3	S	N	1009	1009	L	64	38	0	--	--	0
31 May	1530	C	4	W	N	1009	1009	L	50	34	0	--	--	0
1 Jun	1545	C	5	W	N	1009	1009	L	54	36	0	--	--	0
2 Jun	1615	C	10	W	N	1011	1009	L	44	38	0	--	--	0
3 Jun	1500	F	8	W	N	1016	1016	F	52	38	0	--	--	0
4 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6 Jun	1400	S	4	E	N	1013	--	F	66	36	0	--	--	0
7 Jun	1400	O	5	SW	RF	1009	--	F	60	34	0	--	--	0
8 Jun	--	B	13	N	N	1006	--	F	52	41	0	--	--	0
9 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10 Jun	1500	O	12	E	R	1002	--	F	56	42	0	--	--	0
11 Jun	1900	O	6	W	RF	1007	--	L	56	42	1	--	--	1
12 Jun	2300	O	2	E	N	1007	--	F	50	42	1	--	--	1
13 Jun	2300	O	8	W	N	1011	1011	F	60	40	3	--	--	3
14 Jun	1430	C	16	W	N	947	980	H	45	40	0	--	--	0
15 Jun	1530	S	16	W	N	947	1000	H	45	40	0	--	--	0
16 Jun	1520	B	17	W	R	1000	999	H	45	40	0	--	--	0
17 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19 Jun	1520	O	2	S	N	1011	1013	L	60	60	0	--	--	0
20 Jun	1530	C	2	S	N	1014	1014	L	68	48	0	--	--	0
21 Jun	1535	S	2	S	N	1014	1014	L	62	58	1	--	--	1
22 Jun	1410	F	2	W	F	1018	1020	L	45	40	0	--	--	0
23 Jun	1520	C	10	W	--	1023	1023	L	50	44	1	--	--	1
24 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
25 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
26 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--

27 Jun	1520	B	4	N	R	1016	1018	--	52	48	0	--	--	0
28 Jun	1530	O	6	N	N	1018	1018	L	50	48	2	--	--	2
29 Jun	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30 Jun	1735	B	3	W	N	1026	1026	L	50	50	1	--	--	1
1 Jul	1637	B	3	S	N	1023	1023	L	60	44	4	--	--	4
2 Jul	1535	S	5	W	F	1028	1028	L	--	--	5	--	--	5
3 Jul	1512	--	9	W	N	1028	1028	H	58	42	1	--	--	1
4 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6 Jul	1530	O	8	S	N	1006	1006	L	58	58	0	--	--	0
7 Jul	1547	O	8	W	F	1013	1013	L	--	--	1	--	--	1
8 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9 Jul	1530	C	8	S	--	1015	1007	L	50	42	10	--	--	10
10 Jul	1515	O	20	S	N	966	966	L	52	42	7	--	--	7
11 Jul	1510	C	10	N	N	1004	1004	L	58	48	8	--	--	8
12 Jul	1445	C	11	W	N	1011	1014	L	50	48	6	--	--	6
13 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
14 Jul	1525	--	10	W	RF	1013	1013	L	48	42	3	--	--	3
15 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 Jul	1700	O	10	E	N	1011	1011	F	60	46	17	--	--	17
17 Jul	1520	C	23	W	N	1013	1011	L	58	52	18	--	--	18
18 Jul	1500	B	15	E	N	1009	1009	L	52	48	20	--	--	20
19 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20 Jul	1510	C	18	W	N	1002	1002	L	55	48	14	--	--	14
21 Jul	1430	F	0	n/a	N	1011	1011	L	62	58	9	--	--	9
22 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
23 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24 Jul	1900	S	5	NW	R	1004	1004	F	70	46	21	--	--	21
25 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
26 Jul	1500	B	5	W	RF	1046	1001	L	60	52	8	--	--	8

27 Jul	1505	B	5	E	N	1046	1046	L	60	54	12	--	--	12
28 Jul	1505	B	12	N	N	1018	1018	L	60	48	13	--	--	13
29 Jul	1445	O	22	NW	N	1019	1019	L	52	48	0	--	--	0
30 Jul	1435	O	25	N	D	1011	1011	L	52	42	0	--	--	0
31 Jul	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1 Aug	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2 Aug	1525	F	3	N	N	1007	1007	L	60	58	41	--	--	41
3 Aug	1515	B	5	N	N	1002	1001	--	58	52	41	--	--	41
4 Aug	1510	B	18	NW	N	1009	1009	L	58	50	10	--	--	10
5 Aug	1505	C	2	N	N	1013	1013	L	52	48	5	--	--	5
6 Aug	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7 Aug	1435	O	6	N	N	1018	1018	L	52	42	6	--	--	6
8 Aug	1500	O	2	N	N	1013	1013	L	50	42	0	--	--	0
9 Aug	1445	O	10	NW	R	1013	1015	L	50	42	0	--	--	0
10 Aug	1535	O	1	N	D	1002	1002	L	52	48	2	--	--	2
11 Aug	1510	O	8	NW	D	1007	1007	L	58	48	4	--	--	4
12 Aug	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13 Aug	--	--	--	--	--	--	--	--	--	--	--	--	--	--
14 Aug	1530	S	2	E	N	1002	1002	L	50	42	1	--	--	1
15 Aug	1515	S	11	W	N	1006	1006	L	52	48	17	--	--	17
16 Aug	1515	F	9	W	N	1001	1001	L	52	48	12	--	--	12
17 Aug	1505	S	11	W	N	1016	1016	L	62	60	11	--	--	11
18 Aug	1530	O	20	W	D	1018	1018	L	62	52	0	--	--	0
19 Aug	1445	O	4	W	N	1009	1009	L	54	52	3	--	--	3
20 Aug	1000	C	8	W	N	1006	1007	L	58	44	6	--	--	6
21 Aug	1520	O	10	W	R	1007	1007	L	54	46	4	--	--	4
22 Aug	1400	O	11	W	N	1017	1013	L	54	48	15	--	--	15
23 Aug	1400	F	10	W	N	1013	1009	L	54	48	16	--	--	16
24 Aug	1430	S	20	W	N	1007	1001	L	52	42	9	--	--	9
11-Sep											36*	--	--	36*

5-Oct	1450	B	20	SW	RF	--	--	L	46	--	115*	0*	1*	1168*
12-Oct	1429	B	4	N	N	--	--	L	40	--	600*	125*	190*	915*
20-Oct	1301	B	21	SE	N	--	--	L	39	--	121*	360*	0*	481*
25-Oct	1326	B	20	NW	N	--	--	L	30	--	445*	0*	943*	1388*
31-Oct	1425	C	10	N	N	--	--	L	28	--	93*	0*	384*	477*
8-Dec	1321	--	--	--	--	--	--	L	--	--	886*	435*	0*	1321*
20-Dec	1323	--	25	N	--	--	--	L	-4	--	0*	--	--	0*

* = Aerial Survey Data (All Aerial Survey Data Compiled in Appendix B).

CLD CVR = Cloud cover: C = clear, F = few, S = scattered, B = broken, O = overcast

PRECIP = Precipitation: N = no precipitation, R = rain, F = fog, S = snow, RF = rain and fog

BAR-AM = Barometric pressure at 8:00 am in millibars

BAR-PM = Barometric pressure at 8:00 pm in millibars

TIDE: H = high, F = falling, L = low, R = rising

TOT = total number of walrus (in water + hauled out)

Appendix B. Marine mammal aerial census data, Cape Peirce, Cape Newenham, and Hagemeister Island, Alaska, 2004-2006.

DATE	Cape Peirce Walrus	Cape Newenham Walrus	Hagemeister Island Walrus	Cape Newenham Steller Sea Lion	Nanvak Bay Seals	Hagemeister Island Seals
14-Jan-04	--	0	--	20	--	--
16-Apr-04	--	--	--	--	--	--
23-Apr-04	0	--	--	--	20	--
7-May-04	--	--	--	--	--	--
18-May-04	--	26	--	200	--	--
17-Jun-04	--	0	--	125	--	--
25-Jun-04	--	0	--	275	--	--
30-Jun-04	--	0	--	300	--	--
9-Jul-04	--	--	--	--	--	--
12-Jul-04	--	--	--	--	--	--
15-Jul-04	--	0	--	152	--	--
6-Aug-04	--	0	--	225	--	--
16-Aug-04	--	0	--	82	--	--
30-Aug-04	--	0	--	190	--	--
23-Sep-04	--	0	--	172	--	--
4-Nov-04	60	42	--	140	150	--
7-Jan-05	320	1094	--	128	5	--
27-Jan-05	0	0	--	110	0	--
10-Feb-05	0	0	--	0	0	--
17-Mar-05	3	327	--	128	0	--
13-Apr-05	2	0	--	150	0	--
11-May-05	--	0	--	171	--	--
31-May-05	--	0	--	205	--	--
16-Jun-05	--	0	--	90	--	--
27-Jun-05	--	0	0	111	--	35
15-Jul-05	--	0	--	63	--	--
27-Jul-05	--	--	80	--	--	0
1-Aug-05	--	2	--	62	--	--
11-Aug-05	29	--	--	--	--	--
12-Aug-05	--	--	37	--	--	--
13-Aug-05	19	--	--	--	--	--
15-Aug-05	12	0	115	39	--	--
16-Aug-05	13	--	136	--	--	--
18-Aug-05	--	--	51	--	--	--

17-Sep-05	30	0	855	162	144	0
5-Oct-05	150	--	--	--	300	--
27-Oct-05	2488	631	--	242	180	--
14-Nov-05	4818	2	12	194	110	0
19-Nov-05	0	--	--	--	0	--
13-Jan-06	0	0	--	35	0	--
21-Feb-06	0	313	0	37	0	0
11-Sep-06	36	--	--	--	78	--
5-Oct-06	115	0	1	194	454	--
12-Oct-06	600	125	190	245	300	--
20-Oct-06	121	360	0	0	265	0
25-Oct-06	445	0	943	147	167	0
31-Oct-06	93	0	384	169	285	67
8-Dec-06	886	435	0	85	118	0
20-Dec-06	0	--	--	--	0	--

Appendix C. Seal haulout census and weather data, Nanvak Bay, Alaska, 2006.

DATE	TIME	% Cloud Cover	WIND SPEED (mph)	WIND DIR	PRECIP	TEMP (F)	OBS POINT	% Bar Exposed	NO. LAND	NO. PUPS	NO. WATER	TOTAL
13 Jan	1408	0	5	N	0	11	--	--	0*	0*	0*	0*
21 Feb	1516	0	0	n/a	0	28	--	--	0*	0*	0*	0*
6 May	2134	100	12	W	0	30	WPD	5	16	0	0	16
7 May	2148	5	8	E	0	58	WPD	5	0	0	26	26
8 May	2130	100	12	N	0	45	WPD	7	1	0	30	31
9 May	2030	100	10	N	0	40	WPD	10	0	0	33	33
10 May	1430	100	4	N	0	42	WPD	5	4	0	22	26
11 May	2030	100	10	W	0	34	WPD	40	40	0	25	65
12 May	1230	100	10	W	0	34	WPD	50	72	0	2	74
13 May	--	--	--	--	--	--	--	--	--	--	--	--
14 May	2030	100	5	E	0	33	WPD	50	28	0	25	53
15 May	--	--	--	--	--	--	--	--	--	--	--	--
16 May	1730	100	4	E	0	34	WPD	70	1	0	43	44
17 May	1630	100	6	E	R	36	WPD	40	60	0	34	94
18 May	2030	100	2	S	0	40	WPD	85	0	0	63	63
19 May	--	--	--	--	--	--	--	--	--	--	--	--
20 May	--	--	--	--	--	--	--	--	--	--	--	--
21 May	--	--	--	--	--	--	--	--	--	--	--	--
22 May	1600	100	15	N	0	36	WPD	10	50	0	0	50
23 May	1700	10	2	W	0	48	WPD	50	5	0	39	44
24 May	--	--	--	--	--	--	--	--	--	--	--	--
25 May	2130	100	8	W	0	48	WPD	80	82	0	14	96
26 May	1500	100	2	E	0	64	WPD	80	0	0	14	14
27 May	2000	0	5	W	0	63	WPD	100	157	0	3	160
28 May	2200	0	5	W	0	64	WPD	100	0	0	55	55
29 May	1400	10	4	W	0	75	WPD	--	200	0	0	200
30 May	1500	75	3	N	0	64	WPD	40	1	0	16	17
31 May	1920	10	5	W	0	50	WPD	80	138	0	27	165
1 June	1815	40	8	W	0	54	WPD	100	142	0	6	148
2 June	1945	50	10	W	0	42	WPD	88	150	0	36	186
3 June	2000	15	8	W	0	46	WPD	88	113	3	64	180
4 June	2045	10	5	W	0	45	WPD	88	190	1	14	205
5 June	2030	10	5	W	0	--	WPD	88	159	1	6	166
6 June	--	--	--	--	--	--	--	--	--	--	--	--
7 June	--	--	--	--	--	--	--	--	--	--	--	--
8 June	--	--	--	--	--	--	--	--	--	--	--	--
9 June	1930	100	16	NE	R	46	WPD	88	181	0	12	193
10 June	--	--	--	--	--	--	--	--	--	--	--	--

11 June	1400	80	--	--	0	--	WPD	88	220	0	8	228
12 June	--	--	--	--	--	--	--	--	--	--	--	--
13 June	--	--	--	--	--	--	--	--	--	--	--	--
14 June	1430	100	16	W	0	48	WPD	80	130	0	25	155
15 June	2000	100	16	W	0	45	WPD	100	0	0	0	0
16 June	1915	100	16	W	0	42	WPD	100	118	0	19	137
17 June	--	--	--	--	--	--	--	--	--	--	--	--
18 June	2030	80	4	SE	0	60	WPD	88	227	8	3	238
19 June	2000	100	3	S	0	68	WPD	100	48	0	5	53
20 June	--	--	--	--	--	--	--	--	--	--	--	--
21 June	2000	100	1	S	0	64	WPD	100	128	0	5	133
22 June	--	--	--	--	--	--	--	--	--	--	--	--
23 June	1845	100	2	N	0	52	WPD	100	228	0	5	233
24 June	--	--	--	--	--	--	--	--	--	--	--	--
25 June	--	--	--	--	--	--	--	--	--	--	--	--
26 June	--	--	--	--	--	--	--	--	--	--	--	--
27 June	1915	100	3	N	0	48	WPD	100	218	0	5	223
28 June	2015	100	3	N	0	48	WPD	100	48	0	1	49
29 June	--	--	--	--	--	--	--	--	--	--	--	--
30 June	1930	100	3	N	0	42	WPD	100	89	0	3	92
1 July	1928	100	5	N	0	50	WPD	88	145	2	6	153
2 July	2030	45	6	W	0	--	LL	100	200	3	0	203
3 July	1930	100	8	W	0	58	WPD	100	259	69	6	334
4 July	--	--	--	--	--	--	--	--	--	--	--	--
5 July	1930	100	2	N	0	62	WPD	100	56	5	6	67
6 July	1900	100	8	S	0	62	WPD	100	229	19	6	254
7 July	1830	50	8	S	0	52	WPD	100	76	0	3	79
8 July	--	--	--	--	--	--	--	--	--	--	--	--
9 July	1930	100	8	S	0	60	WPD	100	139	9	5	153
10 July	1930	100	20	NW	0	52	WPD	100	229	9	0	238
11 July	1830	100	4	W	0	52	WPD	100	228	0	0	228
12 July	--	--	--	--	--	--	--	--	--	--	--	--
13 July	--	--	--	--	--	--	--	--	--	--	--	--
14 July	1900	100	8	W	0	48	WPD	80	196	0	0	196
15 July	--	--	--	--	--	--	--	--	--	--	--	--
16 July	--	--	--	--	--	--	--	--	--	--	--	--
17 July	1900	100	22	W	0	50	WPD	80	129	0	7	136
18 July	2030	70	15	E	0	55	WPD	88	225	0	5	230
19 July	--	--	--	--	--	--	--	--	--	--	--	--
20 July	1900	100	20	W	0	48	WPD	80	89	0	5	94
21 July	1900	100	0	n/a	0	60	WPD	0	9	0	0	9
22 July	--	--	--	--	--	--	--	--	--	--	--	--
23 July	1800	70	5	NW	R	70	BT	88	247	0	3	250
24 July	1900	100	2	W	0	70	WPD	100	238	0	0	238

25 July	--	--	--	--	--	--	--	--	--	--	--	--
26 July	1900	100	3	NW	0	60	WPD	100	39	0	10	49
27 July	1900	100	15	NW	0	52	WPD	100	236	0	12	248
28 July	1800	100	20	NW	0	42	WPD	100	238	0	10	248
29 July	--	--	--	--	--	--	--	--	--	--	--	--
30 July	1900	100	15	NW	0	50	WPD	100	241	0	5	246
31 July	--	--	--	--	--	--	--	--	--	--	--	--
1 August	--	--	--	--	--	--	--	--	--	--	--	--
2 August	1900	100	10	N	0	48	WPD	100	329	0	2	331
3 August	1900	100	5	N	0	48	WPD	100	348	0	5	353
4 August	1900	100	20	NW	0	42	WPD	100	129	0	4	133
5 August	1900	100	1	NW	0	58	WPD	100	229	0	6	235
6 August	1900	100	10	W	0	52	WPD	100	234	0	8	242
7 August	1900	100	2	N	0	42	WPD	100	249	0	6	255
8 August	1900	100	--	N	R	48	WPD	100	229	0	7	236
9 August	1900	100	--	NW	RF	42	WPD	0	0	0	0	0
10 August	1900	100	--	N	RF	40	WPD	0	0	0	0	0
11 August	1900	100	--	W	F	48	WPD	80	128	0	5	133
12 August	1900	100	--	N	RF	42	WPD	0	0	0	0	0
13 August	1900	100	--	NW	F	48	WPD	60	156	0	6	162
14 August	1900	100	20	W	RF	42	WPD	0	0	0	0	0
15 August	1900	100	15	W	0	58	WPD	100	262	0	5	267
16 August	1900	100	20	W	0	60	WPD	100	487	0	6	493
17 August	1700	100	20	W	0	58	WPD	100	325	0	5	330
18 August	1900	100	15	N	0	58	WPD	100	346	0	5	351
19 August	--	--	--	--	--	--	--	--	--	--	--	--
20 August	1940	10	10	W	0	58	WPD	100	150	0	0	150
21 August	2030	100	10	W	R	54	WPD	100	150	0	4	154
22 August	2030	100	10	W	0	54	WPD	100	100	0	2	102
23 August	2040	5	8	W	0	54	WPD	100	117	0	1	118

PRECIP = Precipitation: 0 = none, R = rain, F = fog, RF = rain and fog,
SL = sleet
OBS POINT = Observation Point: CB = Cabin Bluff or cliffs, LaLo = Lauri's Lookout, LL = Lee's Landing, WPD = Watch Point Dune
* = Aerial Survey
Data

Appendix D. Seal response to aircraft, boat, human, and natural disturbance, Nanvak Bay, Alaska, 2006.

Date	Time	Disturbance source	Location	Altitude (meters)	Lateral distance (meters)	No. of seals hauled out	No. of seals orienting	No. of seals going into water	No. of seals after disturbance
6 May	2120	USFWS personnel	CB	0	250	16	0	16	0
5 June	2100	USFWS personnel	MBB	0	450	159	0	159	0
6 June	1445	aircraft	MBB	100	400	150	0	150	0
26 July	2000	EE camp personnel	MBB	0	400	n/a	n/a	n/a	n/a
30 July	1900	USFWS personnel	MBB	0	400	n/a	n/a	n/a	n/a

Location: MBB = Mid Bay Bars, FB = Far Bars, NS = North Spit, IB = bars other than MBB or FB, CB = Channel Bar

Appendix E. Other marine mammal sightings, northern Bristol Bay and southern Kuskokwim Bay, Alaska, 2006.

Date	Time	Species	Number	Location	Direction of Travel
3 May	2030	gray whale	4	NW of Cape Peirce Point	NW
4 May	2114	Steller sea lion	1	Off Maggy Beach	NW
5 May	1216	gray whale	2	NW of Cape Peirce Point	NW
5 May	1234	gray whale	2	NW of Cape Peirce Point	NW
5 May	1244	Steller sea lion	4	Cape Peirce Point	E
5 May	1325	Steller sea lion	2	South Firebaugh Beach	E
5 May	1358	Steller sea lion	2	Cape Peirce Point	E
7 May	1340	Steller sea lion	unknown	Cape Peirce	unknown
7 May	1743	gray whale	1	Off Cape Peirce Point	NW
7 May	1833	gray whale	4	Off Cape Peirce Point	NW
7 May	1845	gray whale	2	Off Cape Peirce Point	NW
8 May	1810	Steller sea lion	unknown	Cape Peirce	unknown
8 May	2140	gray whale	3	NW of Cape Peirce Point	NW
9 May	1230	Steller sea lion	unknown	Cape Peirce	unknown
10 May	1330	Steller sea lion	unknown	Cape Peirce	unknown
11 May	1330	Steller sea lion	unknown	Cape Peirce	unknown
12 May	1230	Steller sea lion	1	North Firebaugh Baech	unknown
15 May	1730	gray whale	2	NW of Cape Peirce Point	NW
23 May	1430	gray whale	2	Odobenus Cove	NW
23 May	1430	gray whale	1	Off Cape Peirce Point	NW
23 May	1500	Steller sea lion	1	Odobenus Cove	unknown
26 May	1500	gray whale	3	S of the Twins	W
27 May	1400	gray whale	1	W of Odobenus Cove	--
27 May	1430	Steller sea lion	1	Odobenus Cove	in cove
4 June	1430-1800	gray whale	12	S of Cape Peirce Point	NW
4 June	1600	Steller sea lion	1	Odobenus Cove	unknown
16 June	1500	killer whales	5	W of Odobenus Cove	N
21 June	1530	Steller sea lion	3	W of Odobenus Cove	W
1 July	1450	Steller sea lion	1	Odobenus Cove	unknown
2 July	1541	Steller sea lion	1	Odobenus Cove	unknown
3 July	1430	Steller sea lion	1	North Firebaugh Baech	unknown
10 July	1405	Steller sea lion	4	Cape Peirce	unknown

Figure 1. Marine mammal study areas, Cape Peirce, Cape Newenham, Cape Seniavin, and Round Island, Alaska.

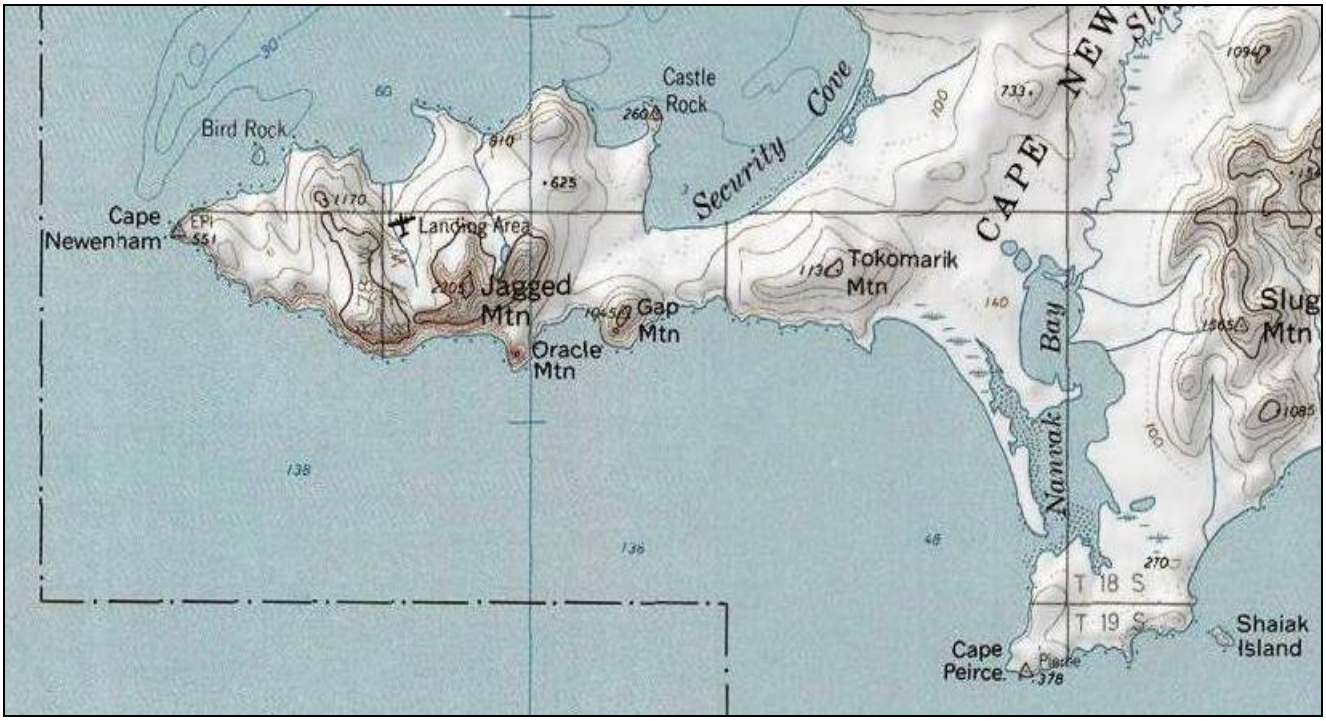

Figure 2. Cape Peirce and Cape Newenham, Togiak National Wildlife Refuge, Alaska

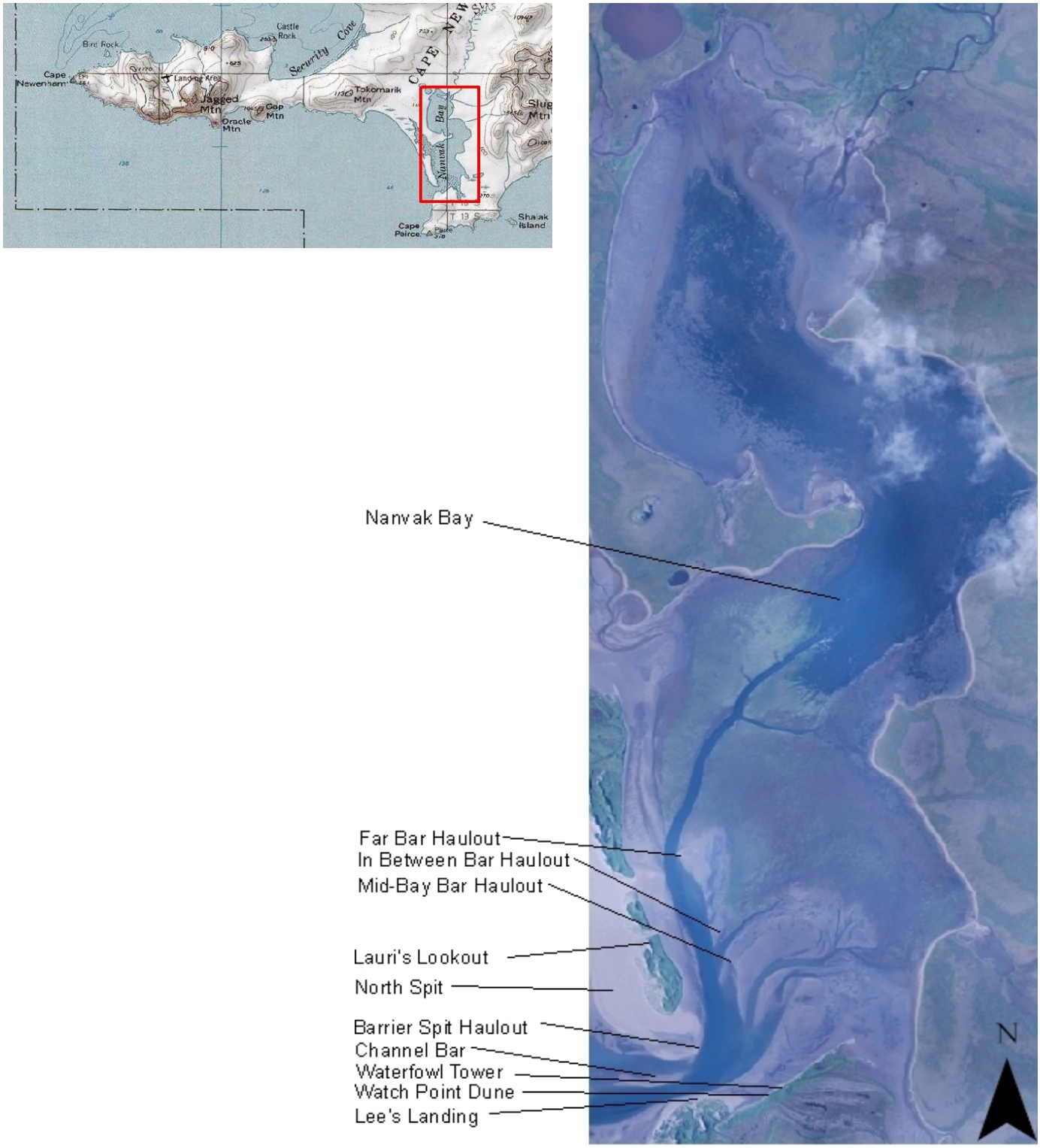

Figure 3. Seal count locations on Nanvak Bay. Photo taken during low tide.

Figure 4. Sand fence erected in June, 2006.

Figure 5. Aerial survey observations of walrus above Maggy Beach and beyond the erected sand fence on October 25, 2006.

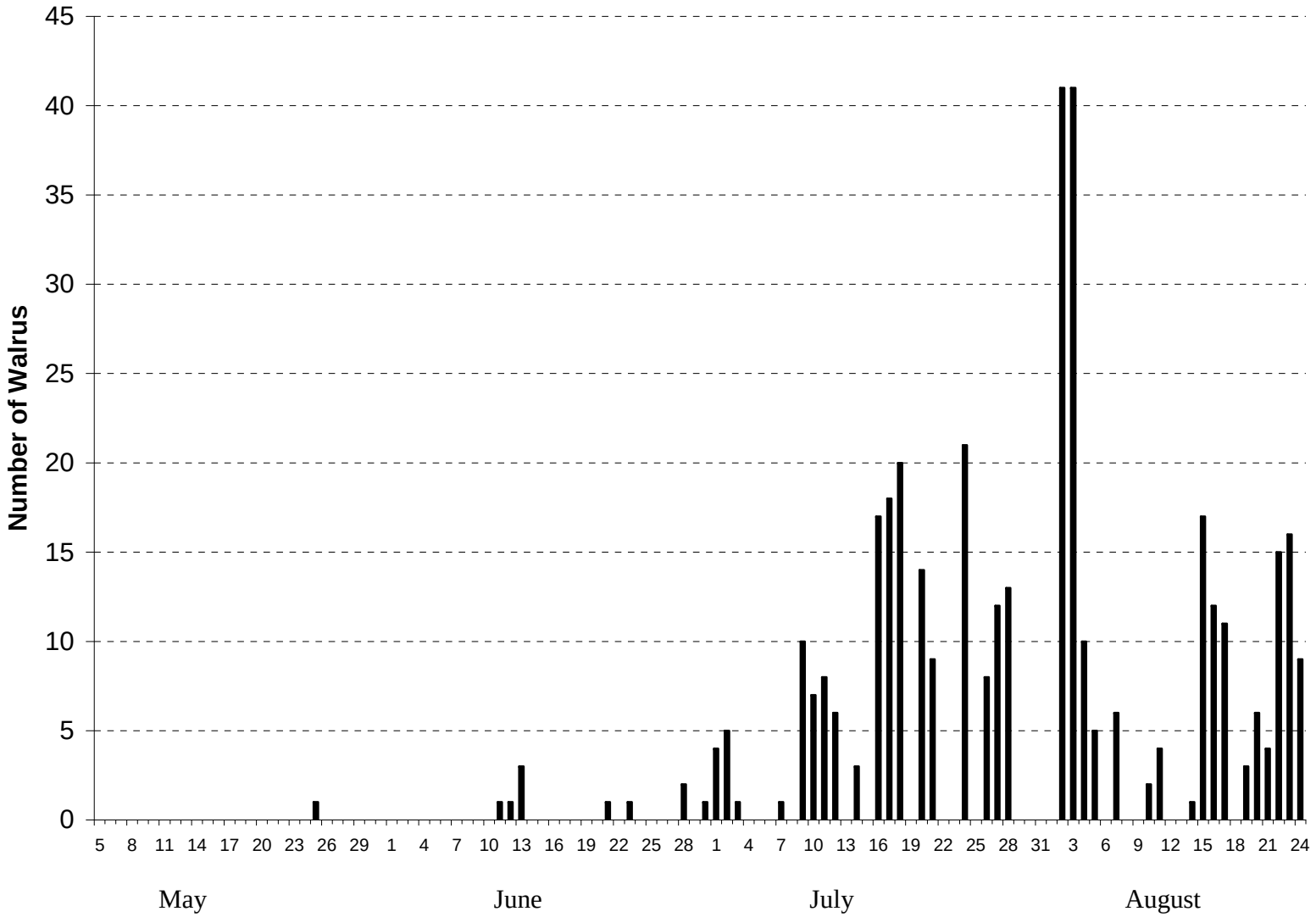

Figure 6. Number of walrus hauled out at Cape Peirce, Alaska, 2006.

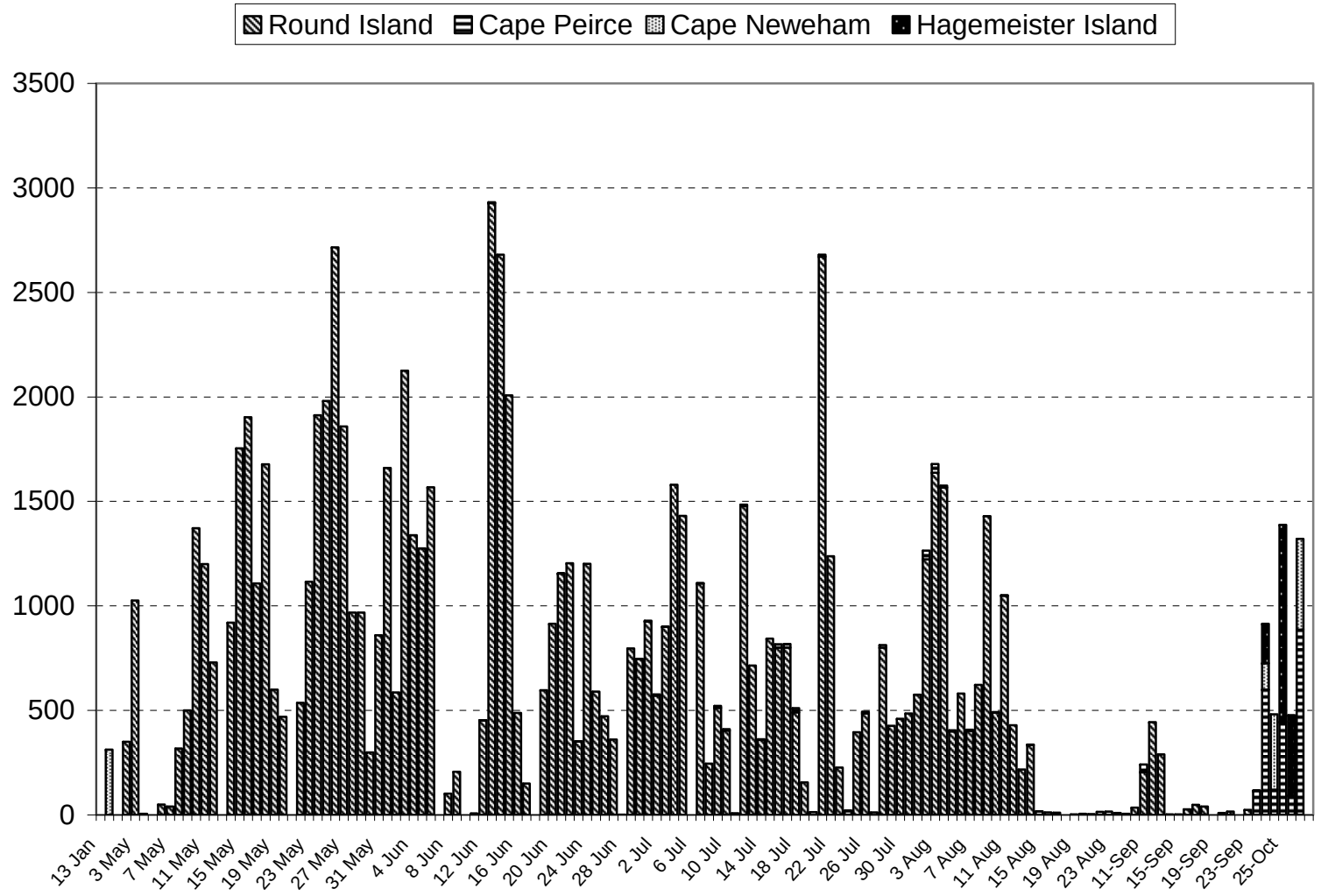

Figure 7. Total walrus haulout counts from Cape Peirce, Cape Newenham, Hagemeister Island, and Round Island, Alaska, 2006.

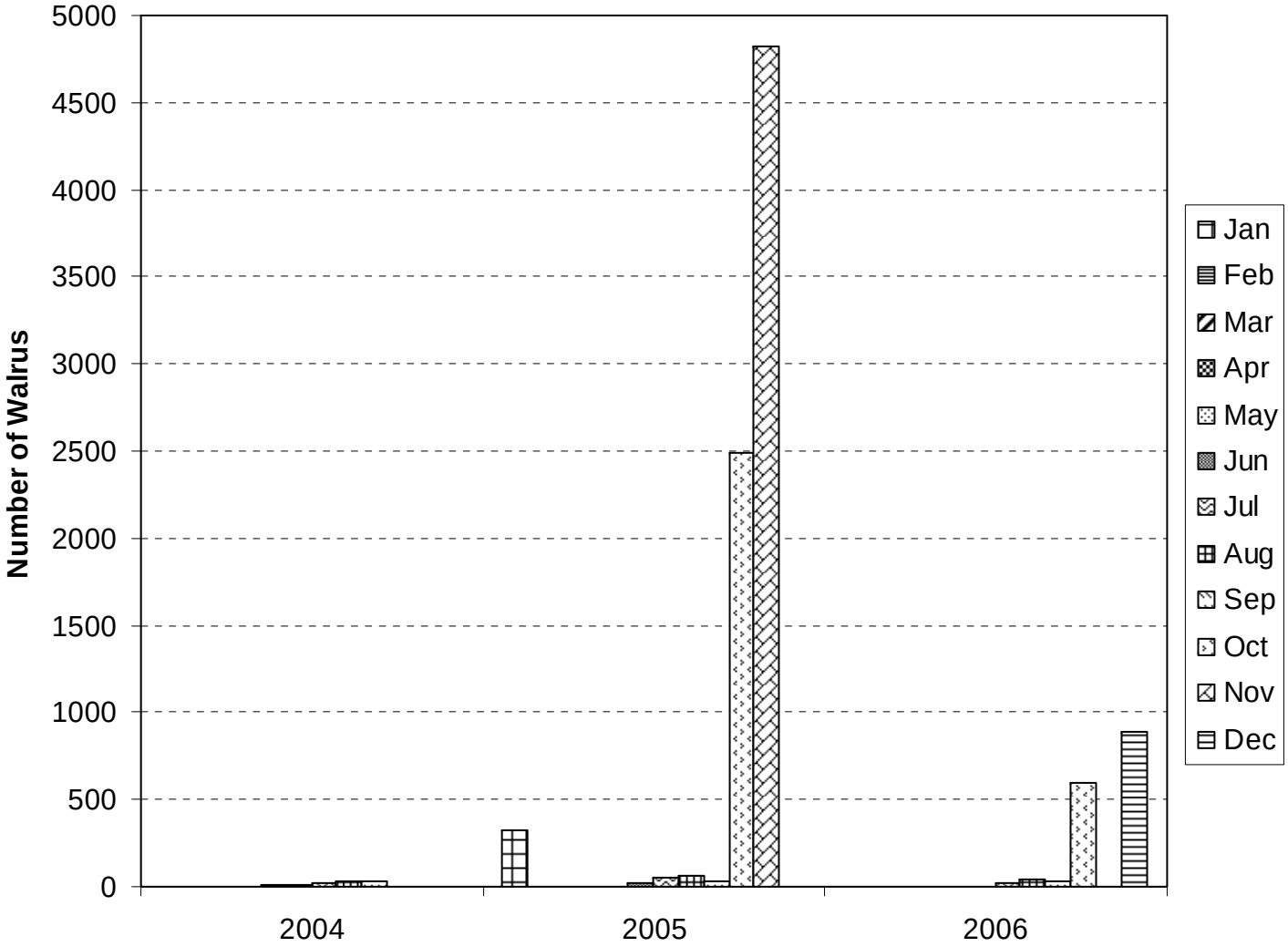

Figure 8. Monthly walrus haulout peaks at Cape Peirce, Alaska, 2004-2006.

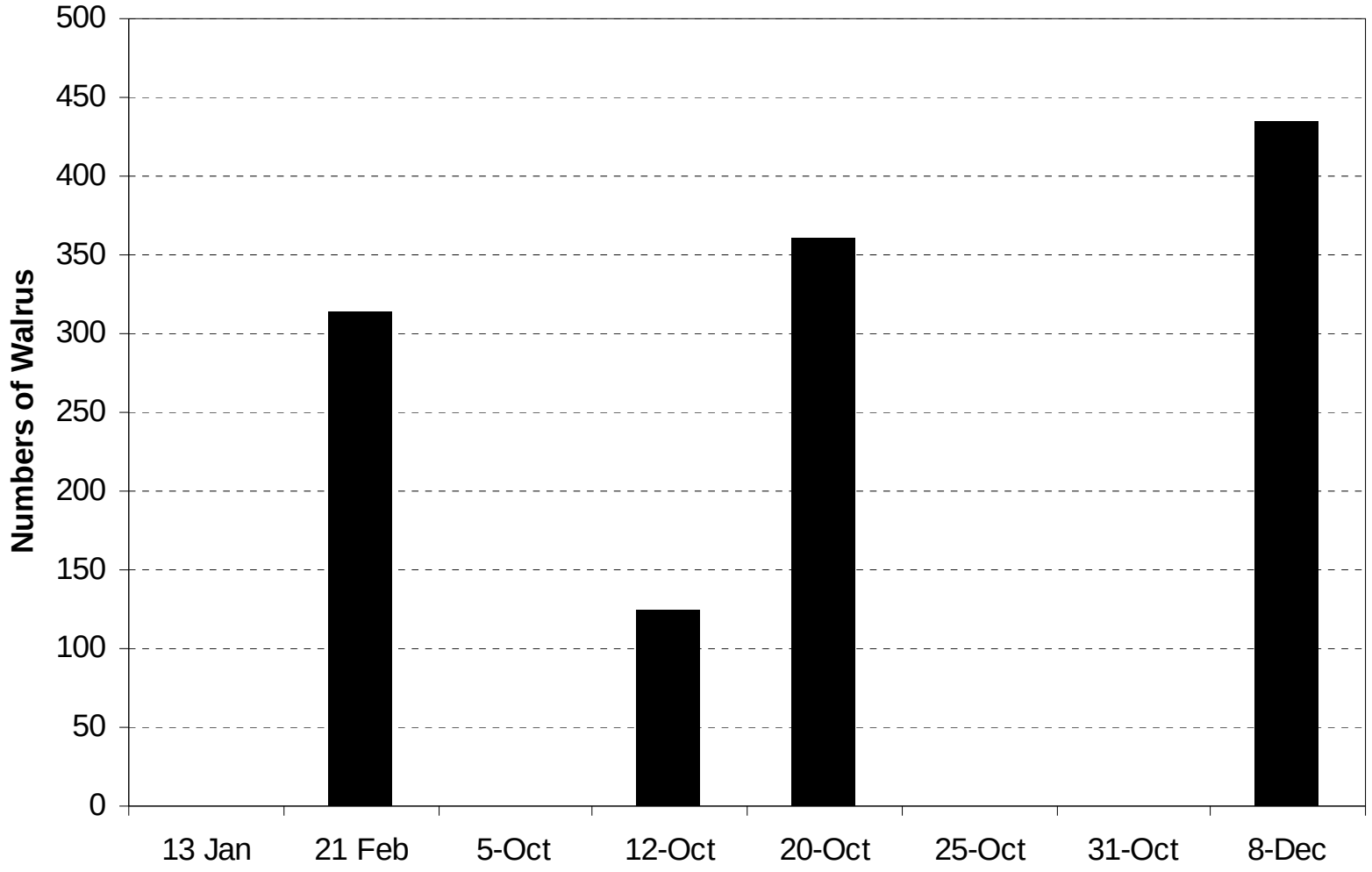

Figure 9. Number of walrus hauled out at Cape Newenham, Alaska, 2006.

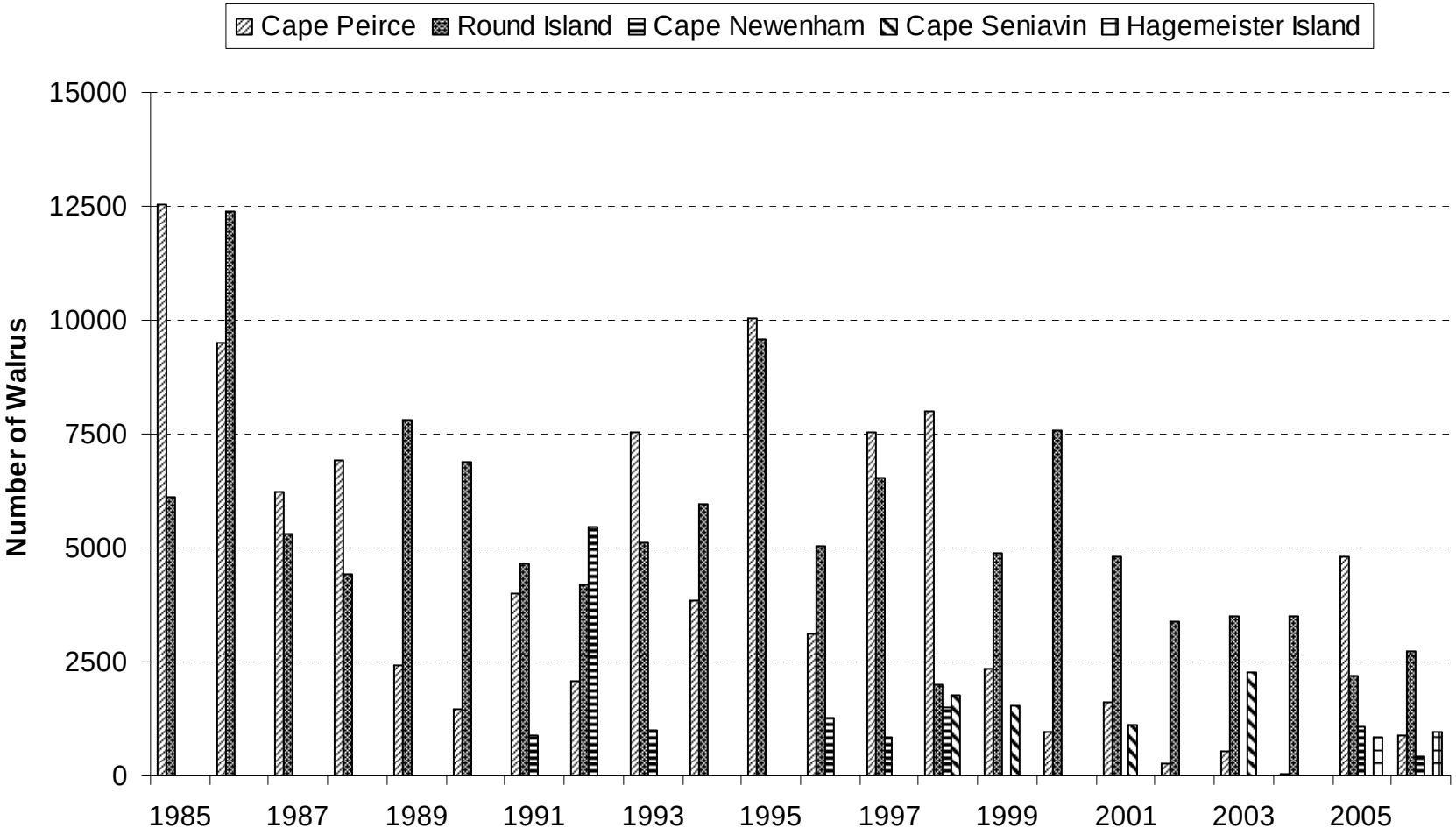

Figure 10. Comparison of annual walrus haulout peaks in Bristol Bay , 1985-2006.

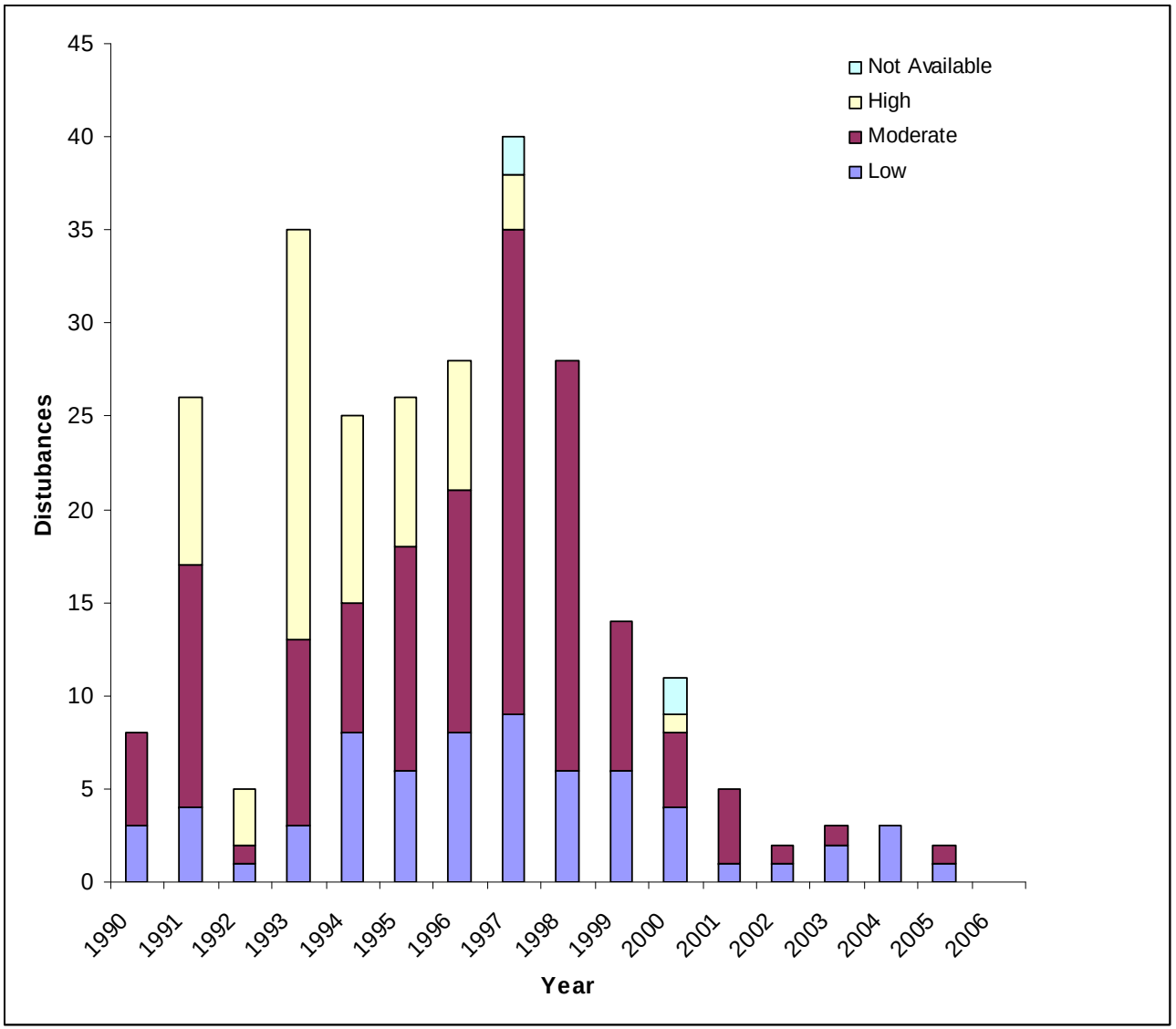

Figure 11. Annual walrus disturbance from 1990-2006, Cape Peirce.

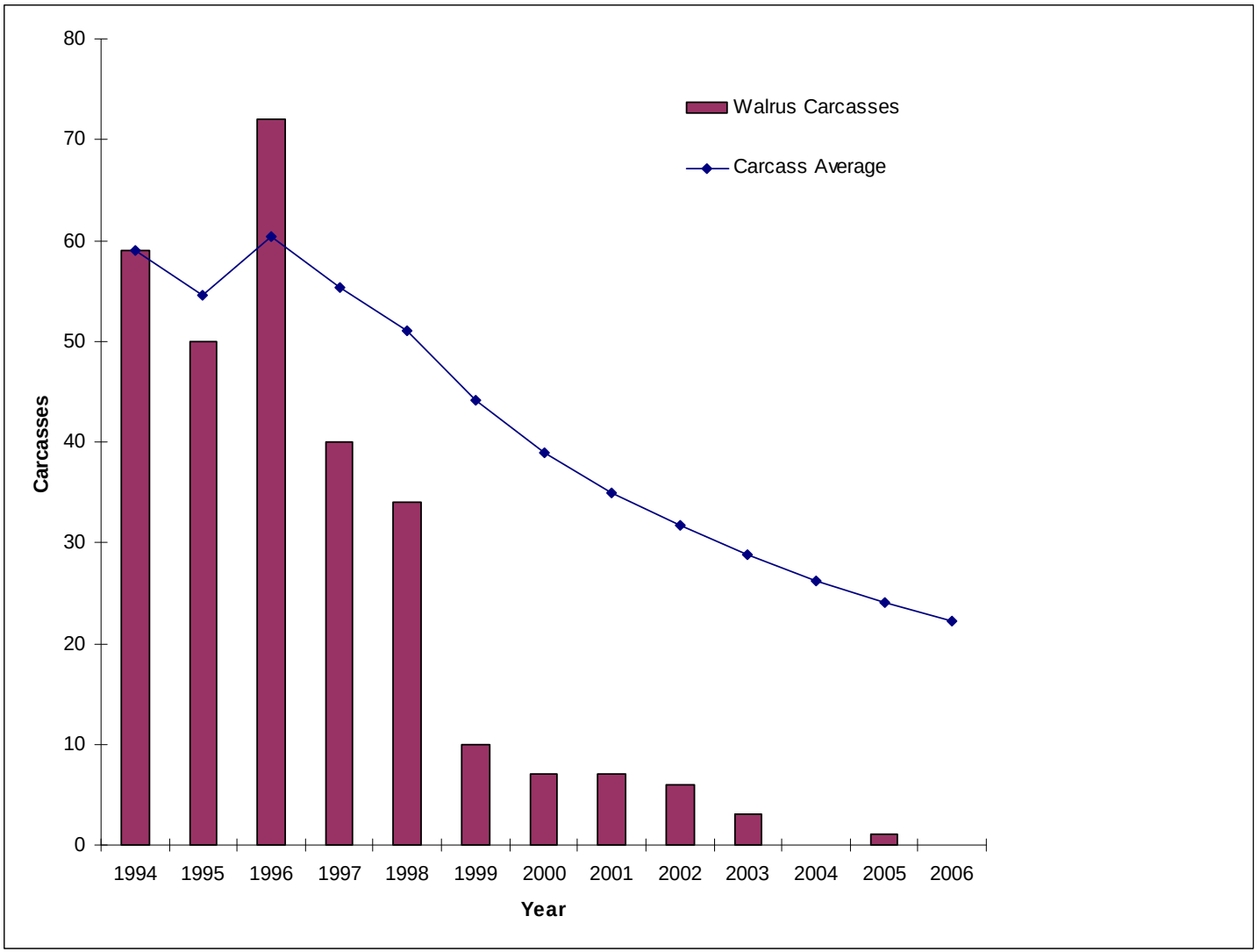

Figure 12. Walrus carcass totals from 1994-2006, Cape Peirce.

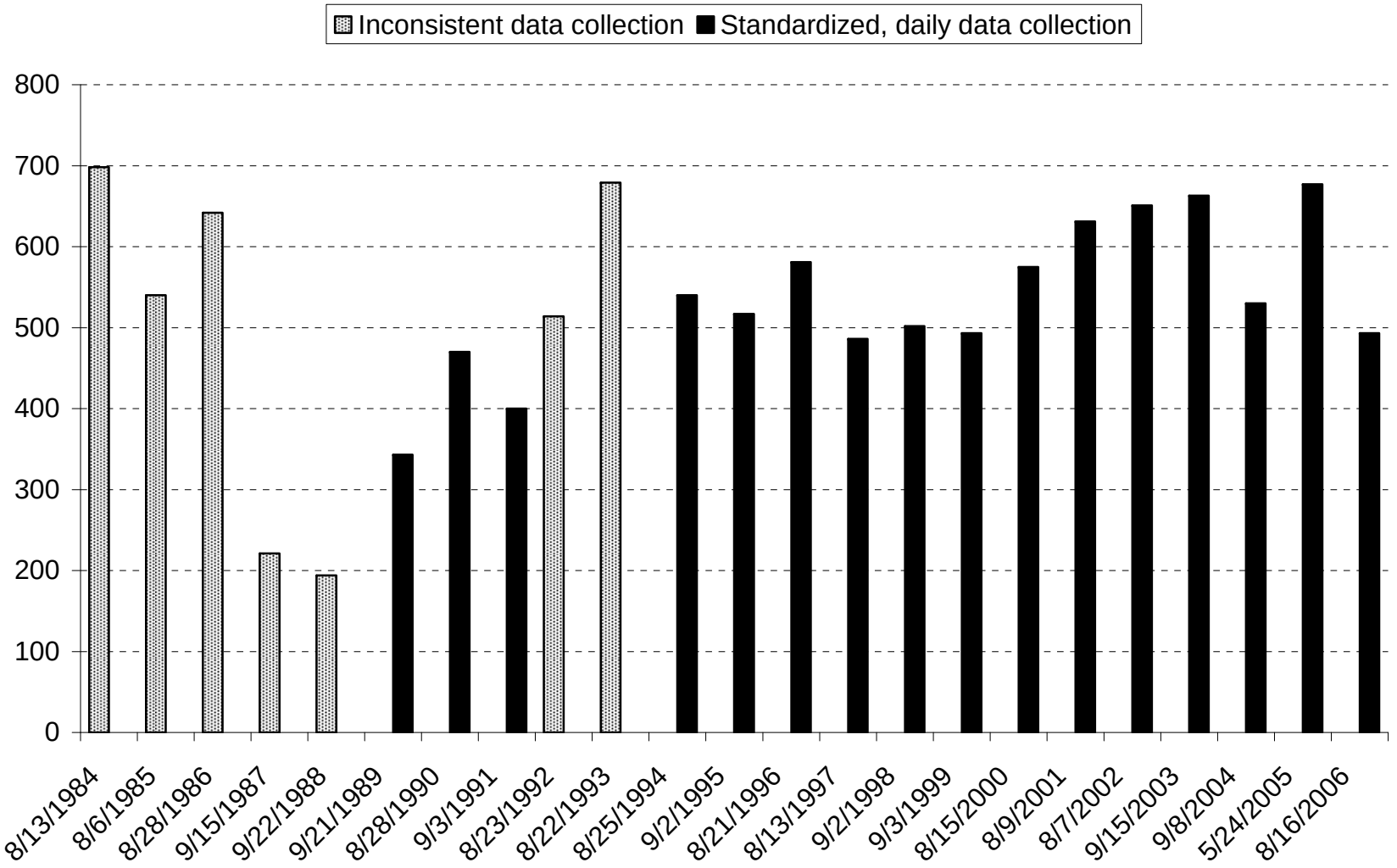

Figure 13. Annual seal haulout peaks in Nanvak Bay, Alaska, 1984-2006.

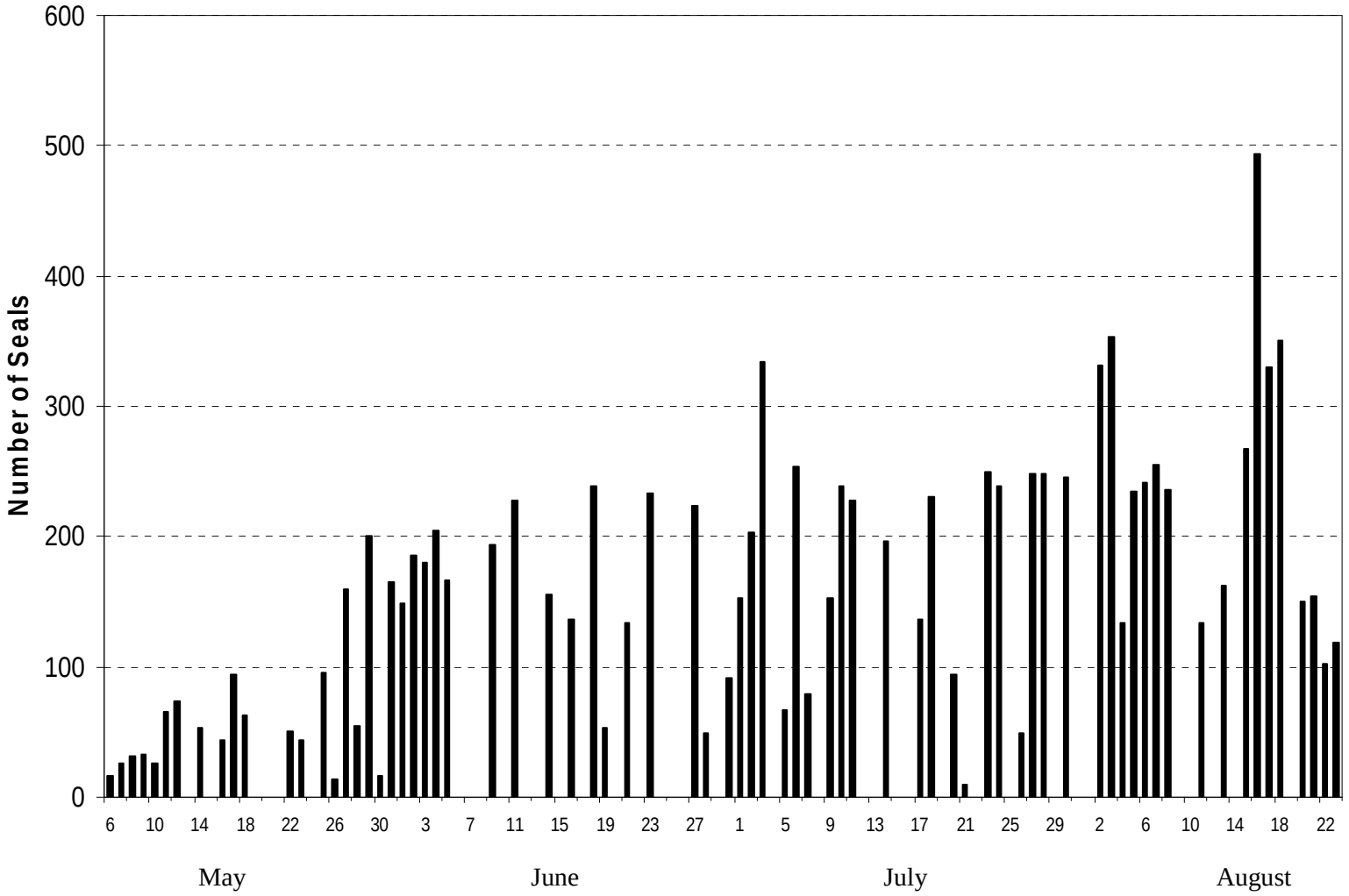

Figure 14. Number of seals hauled out in Nanvak Bay, Alaska, 2006.

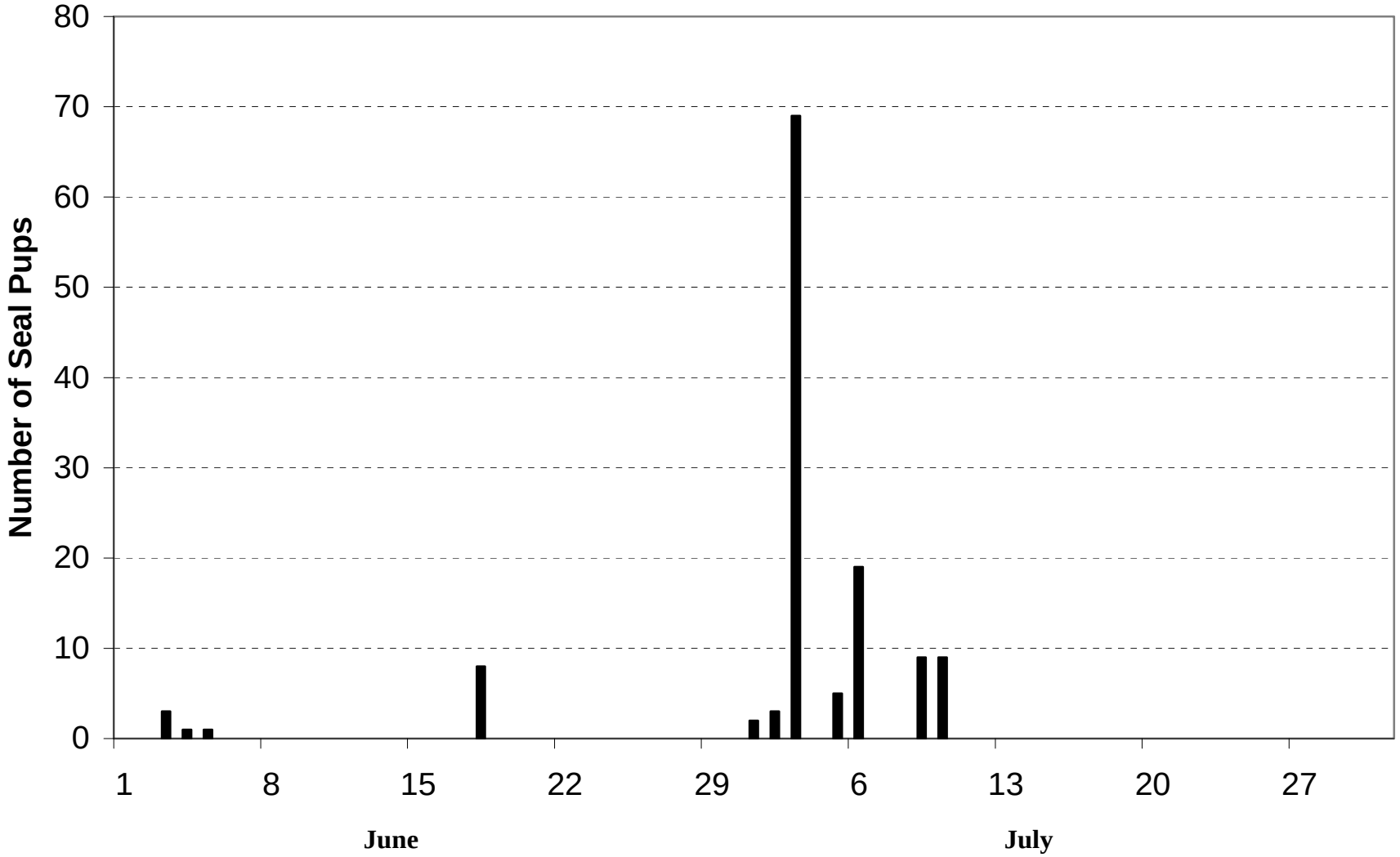

Figure 15. Number of seal pups in Nanvak Bay, Alaska, 2006.