Section 7

MARINE MAMMALS

by

Declan M. Troy
LGL Alaska Research Associates, Inc.
Anchorage, Alaska

and

Stephen R. Johnson
LGL Limited
Sidney, British Columbia, Canada

Section 7

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7.1 SUMMARY

The most common marine mammals reported to occur in the North Aleutian Shelf (NAS) nearshore zone include Steller sea lion, harbor seal, sea otter, Dal1 porpoise, harbor porpoise, and gray whale. Gray whale populations migrate through the area in spring and fall; small proportionsofthepopulations of each spend the summerthere.Northern fur seals migrate through the adjacent Unimak Pass, and small numbers are found in western portions of the NAS study area. Sea otters and harbor seals are present year-round.

Ship surveys in this study in waters beyond about20 m deep showed sea otters to be by far the most common marine mammal in these areas. Otters seemed to shift their center of abundance from shallow to deeper water in winter.

The mammal component of the biotic community includes both benthic and water-column feeders. Sea otter, the most abundant benthos consumer, eat primarily bivalves. The only otherimportantbenthic feeder is the gray whale; it may consume benthic amphipods or orangonid shrimp. The other species--Steller sea lion, northern fur and harbor seals, and porpoises-- are mainly piscivorous.

7.2 INTRODUCTION

The southeastern Bering Sea is extremely rich in its marine mammal resources. Marine mammals common in the area include Steller sea lion (Eumetopias jubatus), northern fur seal (Callorhinus ursinus), harbor seal (Phoca vitulina), walrus (Odobenus rosmarus), sea otter (Enhydra lutris), gray whale (Eschrichtius robustus), beluga (Delphinapterus leucas), and harbor porpoise (Phocoena Dhocoena). Several of these species, however, are relatively scarce within the NAS study area and will not be considered in detail here; these are northern fur seal (found mainly to the west in Unimak Pass and perhaps in deeper waters offshore of the study area), and walrus and beluga (found mainly to the east in Bristol Bay). Walrus formerly hauled out on Amak Island but have not done so for several years.

Small numbers are occasionally found at the extreme east end of our study area at Cape Seniavin and in Port Moller.

A considerable volume of research, much of it sponsored through the OCSEAP program, has described the distribution and abundance of organisms in the study region as a whole. On a site-specific basis, however, relatively few quantitative data are available to describe the timing and abundance of marine mammals in the nearshore zone. Our objectives are to describe in a more quantitative way than was previously possible the timing, abundance, and distribution of marine mammals within this area. Trophic dependencies will also be addressed.

7.3 CURRENT STATE OF KNOWLEDGE

7.3.1 Gray Whale (*Eschrichtius robustus*)

The gray whale is the most numerous and most thoroughly studied whale occurring within the study area. It is a coastal species with regular, well-defined patterns of migration. Although classed as an endangered species (reduced to low populations by intensive whaling), gray whales in the eastern Pacific have recovered to population levels at or near their pre-exploitation stock size (Braham 1984b). Results of the numerous recent studies of this species have been summarized by Lowry et al. (1982b).

The majority of the estimated 17,000 eastern Pacific gray whales (Rugh 1984, Reilly 1984) migrate annually from breeding/calving lagoons off Baja California and mainland Mexico to feeding grounds that extend from the central Bering Sea northward and eastward into the Chukohi and Beaufort seas. All (or most) of the gray whales entering the Bering Sea travel through Unimak Pass (Braham et al. 1982, Hessing 1981). Scattered groups summer along much of the migration corridor, possibly including areas around Nelson Lagoon and Port Moller in our study area.

The northward migration occurs in two pulses, the first consisting of nonparturient adults and immature animals, the second principally of females and their calves of the year (Braham 1984a). These migrants move through Unimak Pass near the eastern shore (=west coast of Unimak Island) between March and June (Braham 1984a) and then continue along a narrow coastal corridor into Bristol Bay. A few may migrate directly northwestward to the Pribilof and St. Matthew islands.

The southbound migration has not been as clearly described. Based on shore censuses of gray whales migrating through Unimak Pass in fall 1977-79, Rugh (1984) concluded that the exodus from the Bering Sea occurs from late October through early January, with peak numbers passing during mid-November and mid-December. Again gray whales remain very close to shore as they transit the Unimak Pass area (Rugh and Braham 1979). Rugh (1984) found no whales more than 3.7 km west of Unimak Island; the observed animals moved by a median distance of 0.5 km from shore. Most gray whales that Leatherwood et al. (1983) saw in the Bering Sea were within 1 km of shore, many (45%) in waters less than 18 m deep. Gray whales feed almost exclusively on nektobenthic, epifaunal, and infaunal invertebrates (see Nerini 1984 for a complete list of known prey genera). Primary prey in certain parts of the northern Bering and Chukchi seas are ampeliscid and gammarid amphipods that form dense mats. Important amphipods in the summer diet include Ambelisca macrocephala, Lembos arcticus, Anonyx nugax, Pontonoreia femorata, Eusirus sp., and Atylus sp. (Tomilin 1957).

Gray whales (contrary to previous belief) apparently feed during migration (Braham 1984a), although the frequency and intensity of feeding during migration is much less than during the summer. Some feeding activity has beenobserved in the NAS area. Gill and Hall (1983), during an April aerial survey, classified 50% of the whales seen along Unimak Island as feeding. Gray whales these authors saw feeding in the Nelson Lagoon area were believed to be preying on shrimp (Gill and Hall 1983). Leatherwood et al. (1983) observed gray whale feeding behavior in the Port Moller/Nelson Lagoon area on their September 1982 survey.

The summer distribution of gray whales is undoubtedly strongly affected by the distribution of their favored prey. They probably feed where prey densities are unusually high (Lowry et al. 1982). In the northern Bering Sea, feeding activities of the whales are highest in areas with a higher than average standing crop of amphipods (Thomson and Martin 1983). Virtually nothing is known of the identity, distribution, or abundance of their prey in the NAS study area.

Gray whales in the eastern Pacific were once severely depleted by commercial whaling but have in recent years, in the absence of commercial hunting, recovered to what is probably near the pre-exploitation population size (Lowry et al. 1982b). Whether their population will continue to grow, and whether it will eventually become limited by shortages of food, are not known.

7.3.2 Dall's Porpoise (*Phocoenoides dalli*)

Dall's porpoise is present year-round in the Bering Sea but, because it is more characteristic of deeper waters, its status in the NAS is uncertain. It is distributed widely within the cool temperate to subpolar waters of the North Pacific; most sightings in the Gulf of Alaska have been made in waters in the 7° to 14°C range (Braham and Mercer 1978).

Dall's porpoises are most abundant in deep pelagic waters and in areas along the continental shelf break. Summer observations, particularly June and July (e.g., Wahl 1978), indicate that Dall's porpoise are abundant near the Aleutian Islands and along the edge of the continental shelf, particularly from the Pribilof Islands to Unimak Pass (Fig. 7.1).

Leatherwood et al. (1983) show Dall's porpoise being widespread in the Bering Sea but scarce or absent from the NAS and most other shallow areas. Migratory movements are not well understood but seasonal movements are evidently present (Braham et al. 1982). The distribution shifts southward in winter, with some animals leaving the Bering Sea (Fiscus 1980).

Dall's porpoises feed primarily upon a deepwater-based food web. Small meso- and bathypelagio fishes and cephalopods are the primary prey types. Squid, especially those of the family Gonatidae, are heavily utilized by Dall's porpoise. Myctophids constitute over 94% of all the fish consumed by Dall's porpoise (Crawford 1981), with capelin, herring, hake, sand lance, cod, and deep-sea smelts also constituents of their diet. Many of these prey species undergo a diel vertical migration toward the surface at night. Preliminary data suggest that Dall's porpoises take advantage of this movement by feeding primarily at night. Taxa occurring in stomachs of seven animals collected near Unimsk Pass and in the Bering Sea were as follows (# stomachs in parentheses, 1 stomach was empty): squid (3), capelin (3), and pollock (1). Available data have not been

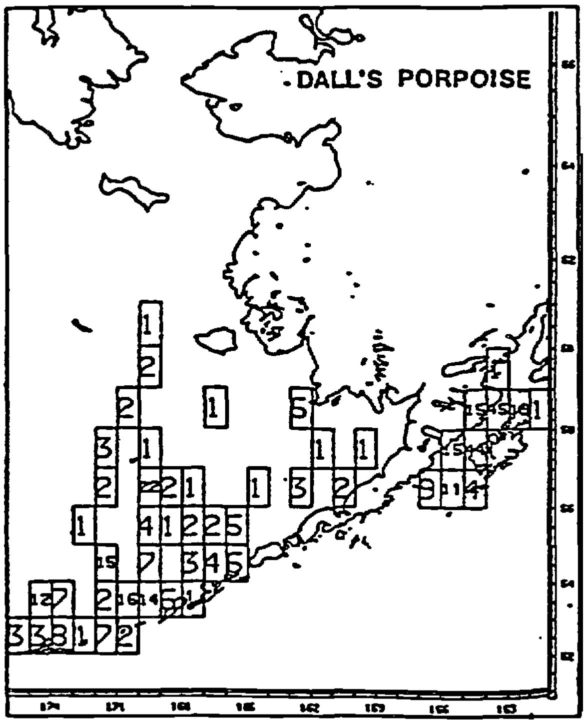

Figure 7.1. Distribution of Dall porpoise (individuals sighted) in lo blocks in the southeastern Bering Sea (1982-1983). From Leatherwood et al. (1983).

examined for seasonal and regional feeding patterns. Since almost all samples have been collected during the summer months, they are probably not adequate to examine seasonal dietary differences.

7.3.3 Harbor Porpoise (*Phocoena phocoena*)

Little detailed information is available regarding the distribution of these small but common cetaceans. In southern portions of their range, they are generally seen near the coast in waters less than 20 m deep (Leatherwood and Reeves 1978). Seasonal shifts in abundance suggest that migrations of some sort occur (Leatherwood and Reeves 1978) but data are insufficient to detail the patterns. Leatherwood et al. (1983) report that harbor porpoises are almost entirely absent from the Bering Sea in winter. Leatherwood et al. (1983) frequently recorded harbor porpoises within Bristol Bay, generally (79%) nearshore of the 128 m contour. They show only two sightings within our NAS study area; these were off Izembek Lagoon during the spring.

Stomachs from only three harbor porpoises taken in the Bering Sea have been examined (Frost and Lowry 1981). All were animals caught in salmon nets in Norton Sound. Contents of all three consisted principally of small fishes and small amounts of benthic crustaceans. Based on identifiable remains (principally otoliths), 31 of 34 fishes eaten were saffron cod. In the Atlantic, herring, cod, and sand lance are major prey (Rae 1973, Smith and Gaskin 1974).

7.3.4 Steller Sea Lion (Eumetocias jubatus)

The Steller sea lion ranges north in the North Pacific Ocean from California and Japan to the Pribilof Islands in the Bering Sea (Fig. 7.2). The total Alaska population is about 200,000 (Braham et al. 1980). Sea lions haul out in the study area from mid-March to mid-October. Pupping occurs in June (Braham et al. 1977). Sea Lion Rock near Amak Island is the only large breeding rookery on the north side of the Alaska Peninsula (Fig. 7.3), and Amak Island is used as a haulout site. About 4000 animals may use Amak Island and Sea Lion Rock; a few males and subadults currently haul out at other locations in the study area, including sites on Unimak Island (Frost et al. 1983).

The total estimated population for the eastern Aleutians (including Amak Island and Sea Lion Rock) is 30,000. The number of sea lions within the area of interest has been changing markedly over the past couple of decades , therefore population estimates for the area and for particular colonies/haulout areas should not be relied on for more than general indices of current abundance. During winter there is apparently an influx of sea lions into the eastern Aleutians and northeastern Pacific Ocean.

Most studies of Steller sea lion food habits have been made in the Gulf of Alaska. Here, fish represented 73% of stomach contents, with walleye pollock accounting for 58% of total volume (Calkins and Pitcher 1983). Fiscus and Baines (1966) reported on a small sample (7) from the Unimak Pass area and found the prey ranking in order of importance to be capelin, sand lance, and sculpins. Pollock comprised the majority of stomach contents of four sea lions collected near the Pribilof Islands (Lowry et al. 1982b). In other areas as well, fish appear to be the main prey (Schusterman 1981). Major long-term diet changes in relation to changes in the composition of fish stocks have been documented in the Gulf of Alaska (Calkins and Pitcher 1983).

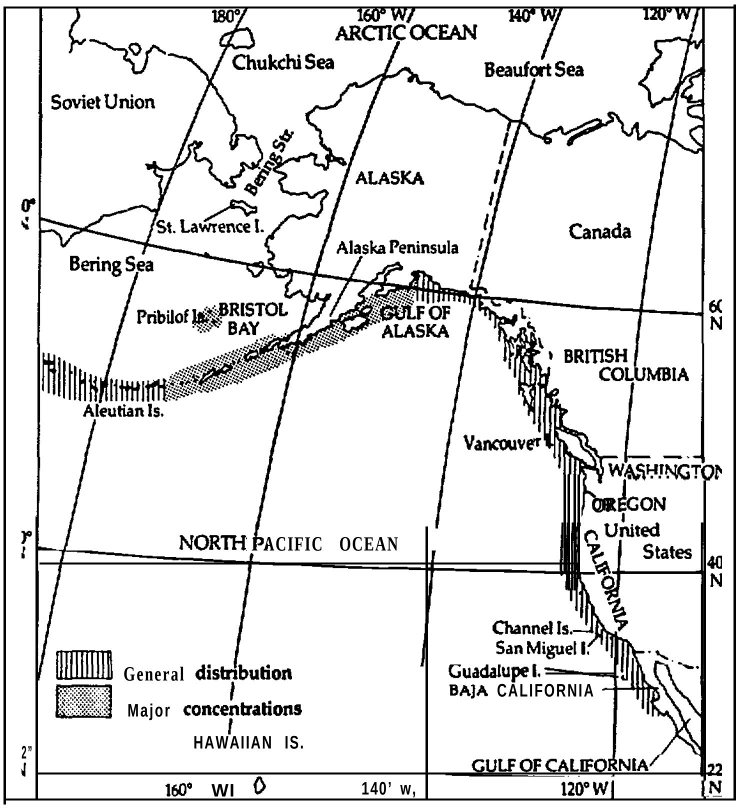

Figure 7.2. Steller sea lion distribution. From Gentry and Withrow (1978).

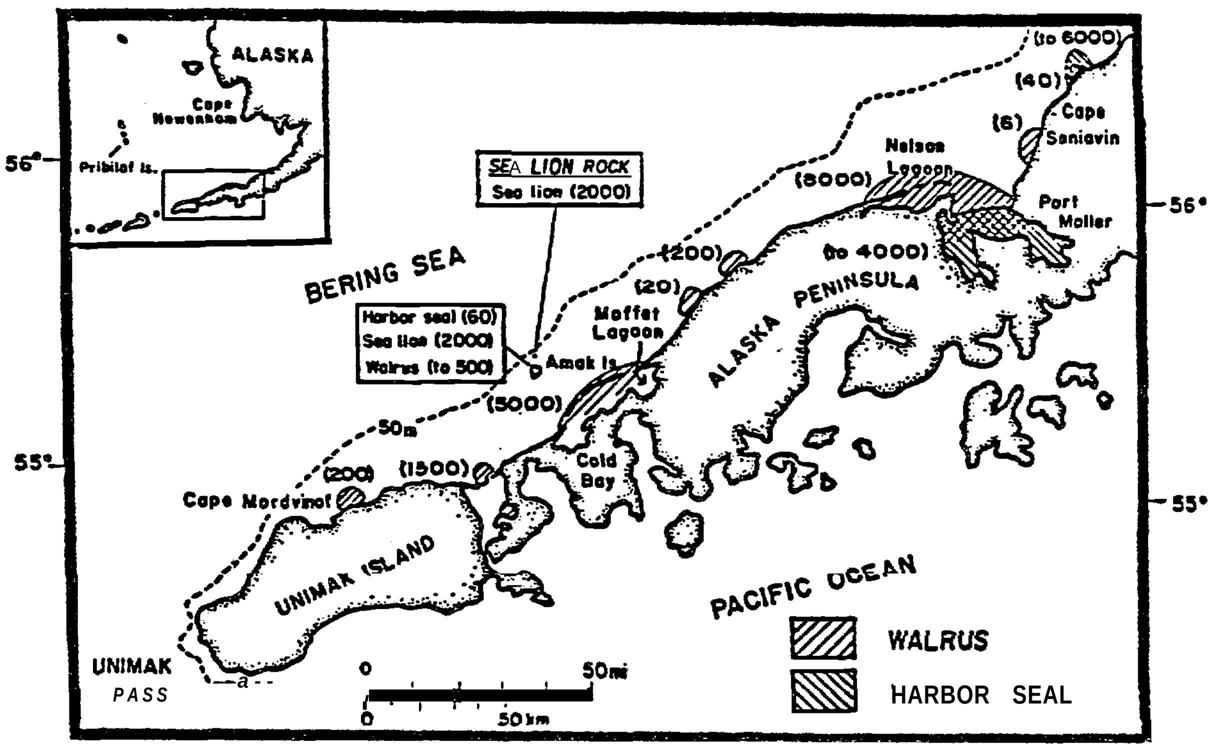

Figure 7.3. Haulout sites used by harbor seals, sea lions, and walrus on the North Aleutian Shelf, with approximate numbers in brackets. From Frost et al. (1983).

Generally, sea lions forage over the continental shelf in water depths of less than 90 m (Kenyon and Rice 1961) but Leatherwood et al. (1983) found some animals at and beyond the shelf break. They use traditional haulout sites for breeding and for resting (males, subadults) and it is near these areas that most sea lions appear to be concentrated. Fiscus and Baines (1966) reported that sea lions in Unimak Pass foraged 5 to 15 miles away from their haulout areas. Little is known about factors that regulate sea lion abundance. In the last 20 years, sea lion populations have declined about 50% in the study area (Braham et al. 1980, Gentry and Withrow 1978). Counts at the haulout areas on Umimak Island Island, including Sea Lion Point/Cape Sarichef, Oksenof Point, and Cape Mordvinof, have been as high as 4000 in the past (1960) but were less than 100 in 1975-77. Postulated causes of the sea lion decline in the study area include (1) migration to the west, (2) decrease in reproductive success due to pathogens, (3) commercial harvesting, and (4) increased competition with commercial fisheries for food. Off California, Ainley et al. (1982) have shown a relationship between the abundance of Pacific whiting and seasonal fluctuations in sea lion numbers. The apparent sea lion decline in the eastern Aleutians corresponds to a concurrent increase in commercial groundfish fisheries for preferred sea lion foods (Braham et al. 1980). Fowler (1982) has recently suggested that entanglement with net fragments in areas of intense foreign fishing may be a significant 05%) source of mortality for fur seals, and the same may be true for sea lions. King (1983) lists the pathogen Leptospira pomona as possibly being responsible.

7.3.5 Harbor Seal (Phoca vitulina)

The harbor seal occupies ice-free coastal waters from the Bering Sea to Baja California (Newby 1978) (Fig. 7;4). The southeastern Bering Sea population of harbor seals is thought to number about 30,000 to 35,000 (Braham et al. 1977). Most of these are found along the north Alaska Peninsula and eastern Aleutian Islands (Frost et al. 1983).

Harbor seals occur in littoral waters throughout the area of interest. There are substantial seasonal movements but no large-scale migrations (Frost et al. 1983). During summer, local movements are made for the purposes of feeding and breeding (Bigg 1981). Major haul-out

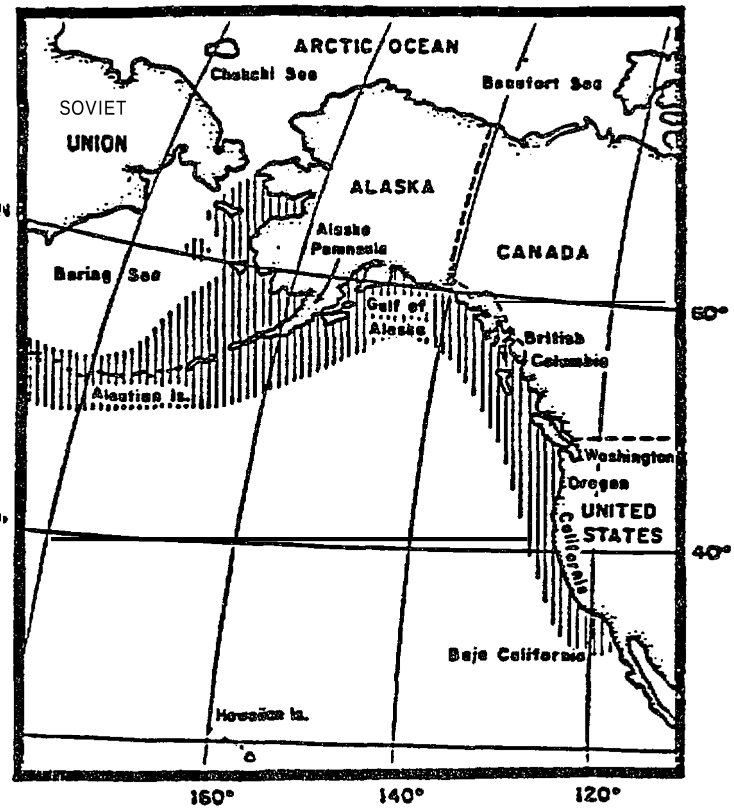

Figure 7.4. Pacific harbor seal distribution. From Newby (1978).

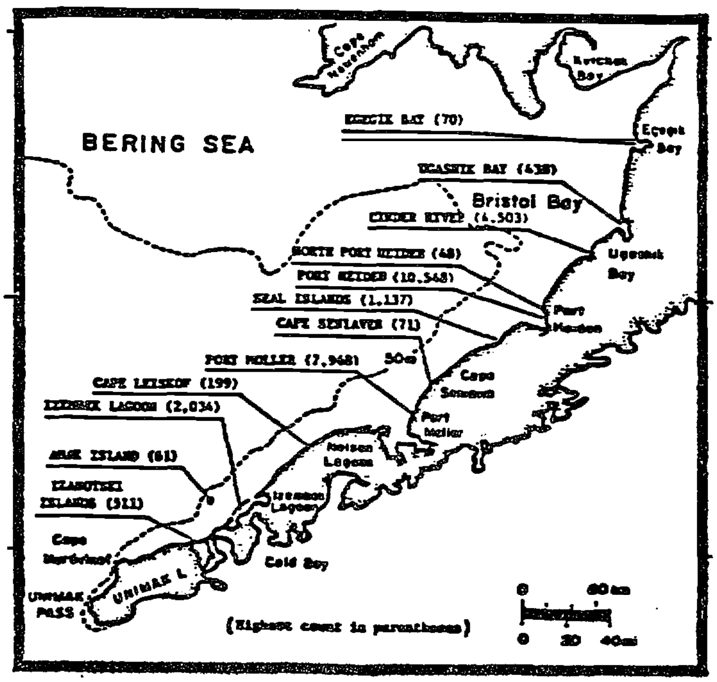

Figure 7.5. Locations of harbor seal concentration areas on the north side of the Alaska Peninsula with highest total sighted at each location by Everitt and Braham (1980) from 1975 to 1977. After Lowry et al. (1982b).

areas in the primary study area are in the False Pass region, Izembek Lagoon/Moffet Lagoon, and Nelson Lagoon/Port Moller regions (Fig. 7.5) (Frost et al. 1983); outside the study area large numbers are found at Port Heiden and Cinder River. Smaller numbers are found in other areas. Haulouts are used for resting, molting, and care of young. Seals haul out on sand bars and other areas exposed by the tides and more animals have been observed hauled out at low than high tides (Everitt and Braham 1980). Peak use of haulout areas occurs during the molt in June and July and apparently tapers off in September and October, after which seals spend more time in the water.

The harbor seal preys primarily on fish. In the Gulf of Alaska fish (mainly pollock and capelin) accounted for 75% of occurrences of all items *in* stomachs (Pitcher 1980). Off Amchitka Island, harbor seals had fed on Atka mackerel and to a much lesser extent on octopus (Kenyon 1965). Nineteen harbor seals collected in fall in the southeastern Bering Sea had eaten mainly sand lance, smelt, and sculpins (Table 7.1).

Major geographical differences sometimes exist in prey consumed (Lowry et al. 1982). Lowry et al. (1979) reported that seals collected in three different locations in the Aleutian Islands had different items in their stomachs. Pollock and cod were found in three stomachs from Unalaska Island. Five seal stomachs from Akun Island contained primarily Pacific cod, octopus, and pollock (Lowry et al. 1982b).

In summer, the harbor seal hauls out *at* traditional sites on offshore rocks and sand and gravel bars and spits (Frost et al. 1983). Its abundance and distribution *may* be dependent on the abundance and distribution of its principal prey (Calkins and Pitcher 1983) as well as the availability of haulout sites. It is restricted in its distribution northward in winter by the occurrence of sea ice.

7.3.6 Sea Otter (Enhydra lutris)

Most of the world's sea otters are found in Alaskan waters (Fig. 7.6). Sea otters were formerly widespread and abundant near land throughout the southern Bering Sea, but fur hunting reduced their population *to a small* colony near Unimak Island and perhaps a few individuals in the Fox Islands by the beginning of the present century. During the past 70 *years,* however, the number of sea otters has increased

Table 7.1. Rank order of importance of major items in stomachs of harbor seals collected in the south-eastern Bering Sea, 4-12 October 1981. Numbers in parentheses indicate the estimated total number of fishes of each group consumed. Sample sizes include only stomachs containing food (from Lowry et al. 1982b).

Rank	Nunivak Island n=2	Cape Peirce n=3	Port Heiden n=5	Port Moller n=4	Akun Island n=5
1	Greenling (12)	Rainbow smelt(42)	Sculpins (87)	Sand lance (250)	Pacific cod (5)
2	Sculpins (1)	Greenling (2)	Sand lance (63)	Pollock (10)	octopus
3		Lamprey (1)	Flatfishes (9)		Pollock (3)
4			Pollock (8)		Pacific Halibut (2)
5			Pacific cod (4)		Rockfishes (1)
6			Rainbow smelt (4)		Sculpins (1)

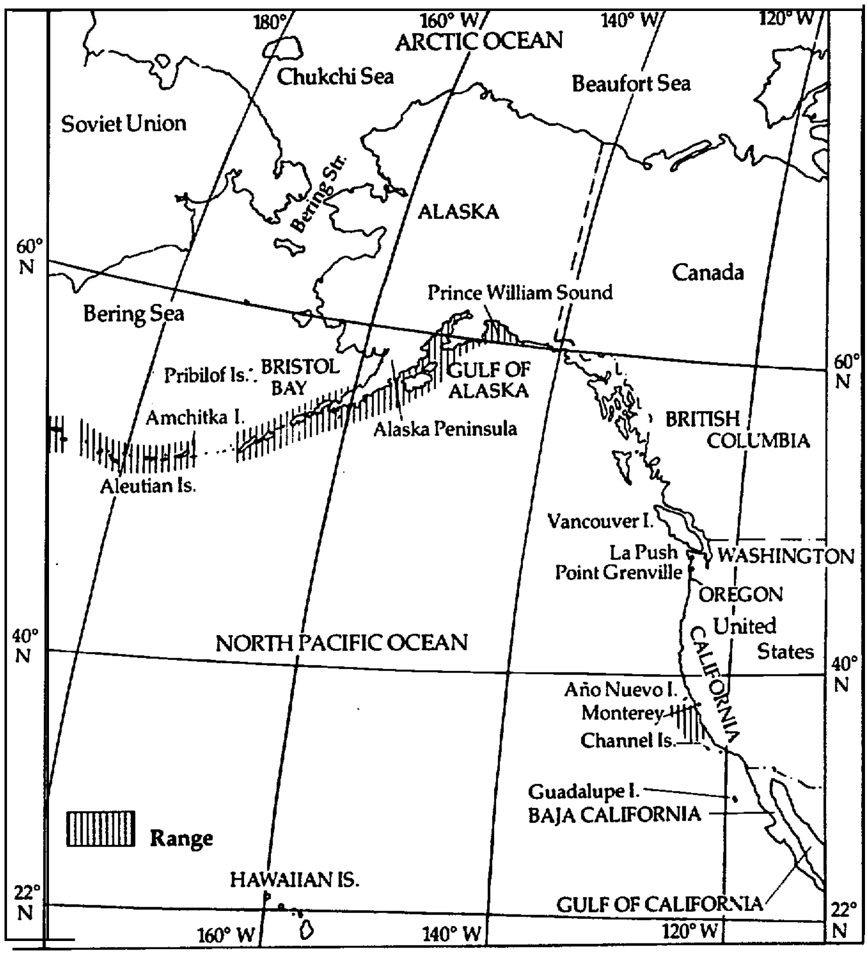

Figure 7.6. Sea otter distribution. From Kenyon (1978).

remarkably, though large areas of uninhabited or partly repopulated habitat remain (Schneider 1981).

The presently-growing Alaska population of sea otters may be over 100,000 (Lowry et al. 1982); 11,700 to 17,200 of these are found on the north side of the Alaska Peninsula (Schneider 1981, Frost et al. 1983). Sea otters occur all along the coast of the study area between Unimak Island and Port Moller, but most are found from Cape Mordvinof to the Moffet Lagoon area (Fig. 7.7) (Frost et al. 1983). From mid-June to mid-July large numbers are found in the Izembek/Moffet Lagoon area; highest densities are found within the 40-m isobath (Schneider 1981). Recent work (Cimberg et al. 1984) shows that a large proportion of this population probably migrates out of the area (south?) in winter. Leatherwood et al. (1983) found sea otters to be present yea-round on the north side of the

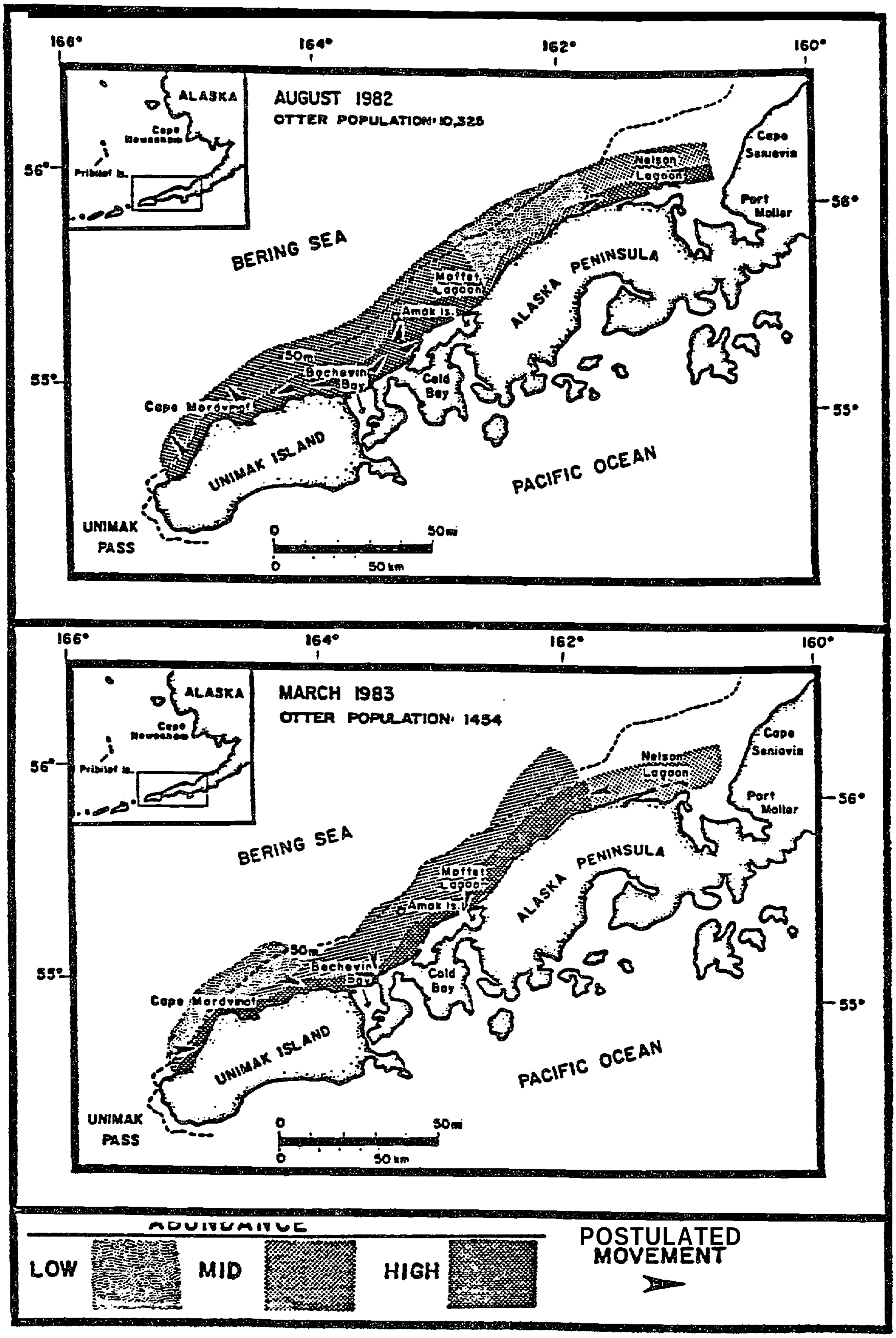

Figure 7.7. Sea otter distribution and abundance on the North Aleutian Shelf in winter (March) and summer (August). From Cimberg et al. (1984).

Alaska Peninsula, close to shore during winter and spring but more dispersed (occurring further offshore) during summer.

Sea otters are shallow-water animals rarely seen in water deeper than 55 m. Leatherwood et al. (1983) did find "significant" numbers of individuals to depths of 128 m. Distribution and movements within the Bering Sea have been described by Schneider (1981). The area of highest abundance is entirely within our area of interest, extending from mid-Unimak Island east to beyond Izembek Lagoon. Sea otters eat a wide variety of bottom-dwelling invertebrates (Calkins 1978), but also eat fishes when invertebrate populations are depleted. (Kenyon 1969, Estes et al. 1982). Sea urchins appear to be the preferred food of the sea otter (Estes et al. 1982). But as the sea otter population has increased in some areas in the Aleutian Islands, the diversity of prey has increased, sea urchins have decreased in relative importance (Estes and Palmisano 1974), and fish and molluscs have become more important. This and other evidence suggests that sea otters will often deplete favored prey, necessitating an eventual switch to less preferred items.

The few scat samples that have been collected from the NAS study area indicate that the otters there feed mainly on bivalves (mussels), crabs, echinoderms (sand dollars), and fish (yellowfin sole) (Cimberg et al. 1984). (Studies relying on scat analyses do not permit direct evaluation of the proportion each taxon contributes to the overall diet; e.g., sand dollars have much more indigestable material in relation to flesh than do flatf ish.) Kenyon (1969) reported on three sea otters collected in 15-20 fathoms of water north of Unimak Island (July 1960). By volume, the stomachs contained predominantly clams, hermit crabs, and fish (greenling), all benthic species.

Sea ice apparently limits sea otter distribution northward, and unusually heavy ice has in some years caused large-scale mortality, or at least temporary displacement, of populations in the study area (Schneider and Faro 1975). Colder waters in the NAS in winter apparently displace some otter prey (flatfishes, crabs) to deeper waters farther offshore, perhaps causing the reported exodus of much of the otter population in winter (Cimberg et al. 1984). At present sea otters seem to have reached equilibrium density in some areas (e.g., Amchitka Island, Estes et al. 1982), where their populations are apparently regulated by food supply.

Their densities are higher in some coastal habitats (e.g., rocky areas with macroalgae, extensive shallow nearshore areas) than in others, presumably because of a better food supply.

7.4 METHODS

7.4.1 Distribution and Abundance

Information on distributions and abundances of marine mammals was collected by aerial and shipboard surveys, conducted simultaneously with marine bird surveys. A detailed description of these methods is presented in Section 6.4, this report.

7.4.2 Trophic Relationships

New information on trophic relations of mammals was collected only for sea otters. Scats (excrement) were collected in July and September 1984 and May 1985 from the beach on the northeast side of the Cape Glazenap entrance (most southwesterly entrance) to Izembek Lagoon; at least 100 sea otters have been recorded to haul out on the beach at this location, mainly during low tide. These samples no doubt indicate the general feeding habits of sea otters that forage primarily in the general area of this haul-out location, but otters may eat different foods farther offshore or at other coastal locations.

7.5 RESULTS AND DISCUSSION

7.5.1 Distribution and Abundance

7.5.1.1 Species Composition by Season

Densities of marine mammals observed during aerial surveys are summarized in Table 7.2. Relative to birds, most marine mammals occur at very low densities, thus many density estimates are zero, even when some animals are present and the data are presented to two decimal places.

Table 7.2. Average densities of marine mammals (#/km^2) on aerial survey transects east of Cape Mordvinof, North Aleutian Shelf, Alaska. Highest densities are shown in boldface; lowest in italics.

PECIES	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Brown Bear	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Sea Otter	0.15	0.35	0.19	0.52	0.28	0.30	0.15	0.57	0.21	0.97	0.26	0.57
Steller's Sea Lion	0.19	0.22	0.05	0.06	0.17	0.21	0.01	0.13	0.01	0.01	0.01	0.17
Northern Fur Seal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Walrus	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Harbor Seal	0.00	0.02	0.00	0.01	0.20	0.32	0.25	0.44	0.00	0.01	0.01	0.02
Killer Whale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pac. Wh.-sided Dolph	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Harbor Porpoise	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Dall Porpoise	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Gray Whale	0.00	0.00	0.00	0.02	0.02	0.02	0.00	0.00	0.01	0.00	0.00	0.00
small whale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	0.34	0.60	0.24	0.82	0.67	0.86	0.42	1.17	0.23	1.00	0.28	0.77

These low-density species are accounted for later, when actual population estimates are presented.

Twelve species of mammals were observed during aerial surveys of the nearshore zone. Species observed on the upper portions of the beach (red fox, wolf) are excluded. Brown bears, included in Table 7.2, were occasionally observed on or seaward of the beach (within the transect limits) scavenging marine mammal carcasses or fishing.

Sea otters were consistently the most numerous marine mammal seen during aerial surveys and were present year-round. Densities were not particularly low during winter (the December-Feburary density was similar to the June-August density); this provided little support for the reported winter exodus of otters from the area.

Steller sea lions were also relatively common and present year-round. Most sightings were along the coast at the western end of the study area. They were often encountered hauled out on low cliffs near Cape Mordvinof.

Harbor seals were most often seen during the summer months. The winter decline may indicate an exodus from the study area or simply a reduced sightability when they are not hauled out.

At least six species of cetaceans were seen during the aerial surveys in the study area. All the small whales identified were minke whales, those not specifically identified were likely this species as well. The most numerous cetaceans were harbor and Dall porpoises, the sightings demonstrating no particular seasonal pattern. Of interest were the sightings of Pacific white-sided dolphins. This species was not expected to occur in the eastern Bering Sea. We recorded them on three occasions, two aerial surveys and one cruise. Gray whales were present during 5 surveys-- 3 during spring migration (April-June) and two during fall migration (September and December). A probable gray whale was also seen in January west of Cape Mordvinof and just outside of the study area (Table 7.2). Spring sightings were more frequent than fall sightings.

Densities of marine mammals observed on each of the Miller Freeman cruises are shown in Table 7,3 (see also Fig. 7;8). Sea otters were *seen* in far higher densites than other species on all cruises; the highest densities recorded were in January, in contradiction to what might have been expected (see Cimberg et al. 1984). Densities of other species were, in addition to being relatively low, variable among survey periods. These

Table 7.3. Densities (#/km^2) of marine mammals by cruise, North Aleutian Shelf, Alaska. Highest densities are shown in boldface; lowest in italics.

SPECIES	May 84	Sept 84	Jan 85	May 85	July 85
Sea Otter	**0.202**	**0.147**	**0.313**	**0.165**	**0.294**
Steller Sea Lion	**0.023**	**0.000**	**0.000**	**0.000**	**0.000**
Northern Fur Seal	0.000	**0.006**	**0.000**	**0.000**	**0.008**
Harbor Seal	0.000	0.000	**0.015**	*0.000*	**0.000**
seal	0.000	**0.006**	**0.000**	**0.000**	**0.000**
Killer Whale	0.000	**0.006**	**0.000**	**0.000**	**0.000**
Harbor Porpoise	0.000	0.000	**0.000**	**0.025**	**0.032**
Dali Porpoise	0.000	0.000	0.000	**0.007**	**0.032**
Gray Whale	0.000	**0.003**	**0.000**	**0.000**	**0.000**
Minke Whale	0.000	0.000	**0.000**	**0.007**	**0.016**
whale	0.000	0.000	**0.000**	**0.004**	**0.000**
TOTAL	**0.225**	**0.767**	**0.328**	**0.207**	**0.387**

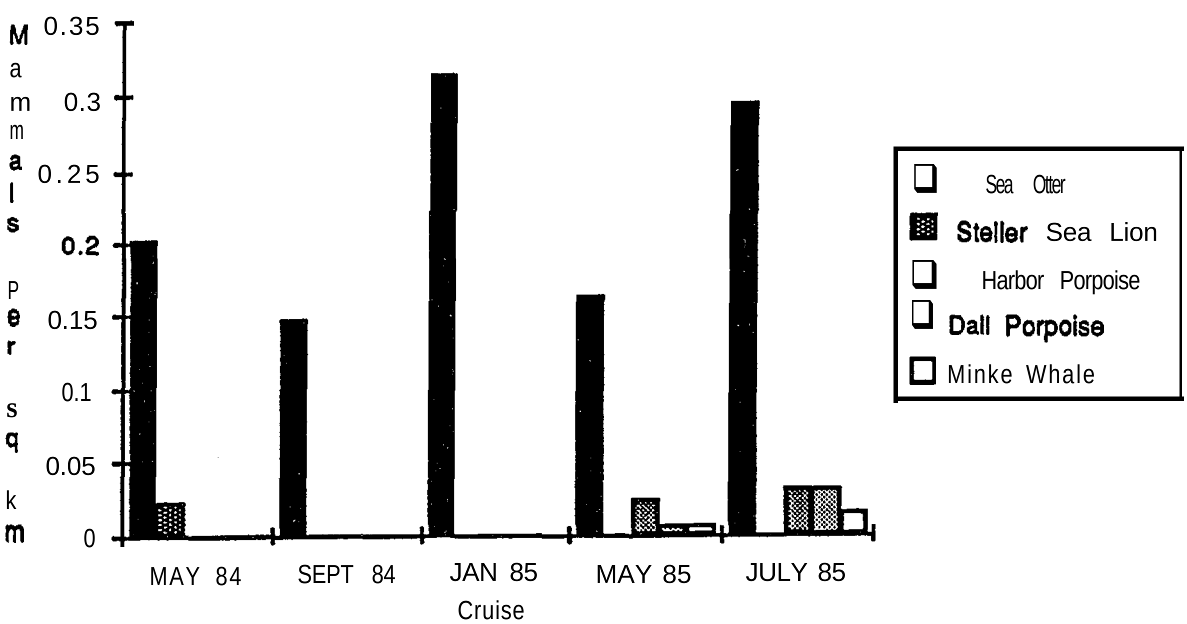

Figure 7.8. Density of marine mammals in the North Aleutian Shelf, Alaska by cruise. Highest densities are shown in boldface; lowest in italics.

cruise data demonstrate the near absence of Steller sea lion, harbor seal, and gray whale when the area surveyed does not include the strictly coastal band (virtually no sampling occurred from the Miller Freeman in waters less than 20 m deep.

7.5.1 .2 Segregation By Depth

Marine mammal abundance along aerial survey bands parallel to shore are depicted in Figure 7.9 **for 5** common species. (Depth ranges of survey bands are described in Section 6.5.1.2, this report.) Steller sea lion, walrus, harbor seal, and gray whale were all restricted to the coastal transects. (The Unimak sightings were also along the shore). Sea otters, although occurring at their highest densities along the coast, were found as far offshore as we surveyed; their abundance decreased with increasing distance from shore (and thus with depth).

The shipboard sightings, though more accurately described as to depth, do not include shallow-water observations (Table 7.4). Sea otters are relatively common to about the 50-m isobath (Fig. 7.10), peaking (on average) in the 30-40 m depth range. Gray whales and most Steller sea lions were found in the shellowest waters sampled, as would be expected based on the aerial survey results. In contrast, northern fur seals were restricted to the deeper areas, largely outside the area of focus for this study. During the July cruise, Dall porpoises were found in quite shallow waters (30-40 m) even though they are considered a deep-water species; previous sightings **of** this species, as in May 1985, were in areas > 60 m. These shallow-water observations coincided with the shoreward shift in distribution of several bird species and the inner front in July (see Sections 2.0 and 6.0, this report). Minke whale and harbor porpoise sightings in July were also in shallower waters than during prior cruises, although we have insufficient data to decide whether these sightings were atypical. Sea otter distribution was not noticably affected by the shoreward shift of the inner front in July.

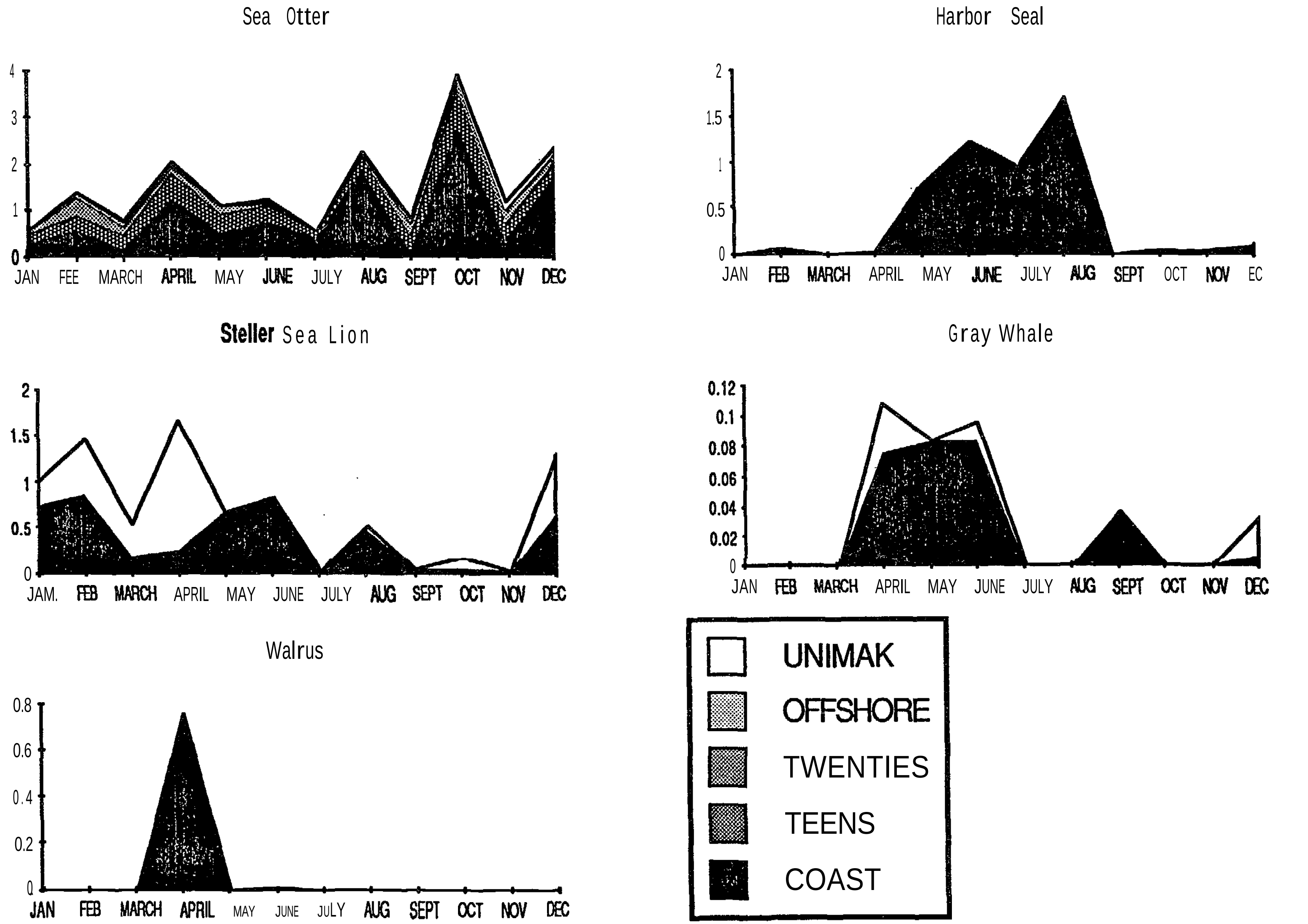

Figure 7.9. Monthly trends in abundance (#/km^{-2}) of marine mammals by transect group (depth class) in the North Aleutian Shelf. "Unimak" was not sampled during the May, July, and September surveys.

Table 7.4. Densities of marine mammals (#/km*) by water depth classes during cruises on the North Aleutian Shelf, Alaska. Highest densities are shown in boldface; lowest in italics.

SPECIES	< 30 M	30 - 40 M	40 - 50 M	50 - 60 M	> 60 M
May 1984					
Sea Otter	0.14	0.46	0.06	0.09	0.00
Steller Sea Lion	0.09	0.00	0.02	0.00	0.00
TOTAL	0.23	0.46	0.07	0.09	0.00
May 1985					
Sea Otter	0.65	0.44	0.15	0.02	0.01
Harbor Porpoise	0.00	0.00	0.11	0.00	0.00
Dall Porpoise	0.00	0.00	0.00	0.00	0.02
Minke Whale	0.00	0.00	0.03	0.00	0.00
whale	0.00	0.00	0.00	0.00	0.01
Total	0.65	0.44	0.29	0.02	0.05
September 1984					
Sea Otter	0.23	0.20	0.16	0.00	0.00
Northern Fur Seal	0.00	0.00	0.00	0.00	0.04
seal	0.02	0.01	0.00	0.00	0.00
Killer Whale	0.00	0.00	0.02	0.00	0.00
Gray Whale	0.02	0.00	0.00	0.00	0.00
TOTAL	0.27	0.21	0.18	0.00	0.04
January 1985					
Sea Otter	0.00	0.60	0.51	0.00	0.00
Harbor Seal	0.00	0.04	0.00	0.00	0.00
TOTAL	0.00	0.64	0.51	0.00	0.00
July 1985					
Sea Otter	0.37	0.61	0.36	0.00	0.08
Northern Fur Seal	0.00	0.00	0.00	0.00	0.04
Harbor Porpoise	0.10	0.00	0.00	0.00	0.00
Dall Porpoise	0.00	0.16	0.00	0.00	0.00
Minke Whale	0.00	0.08	0.00	0.00	0.00
TOTAL	0.47	0.86	0.36	0.00	0.12

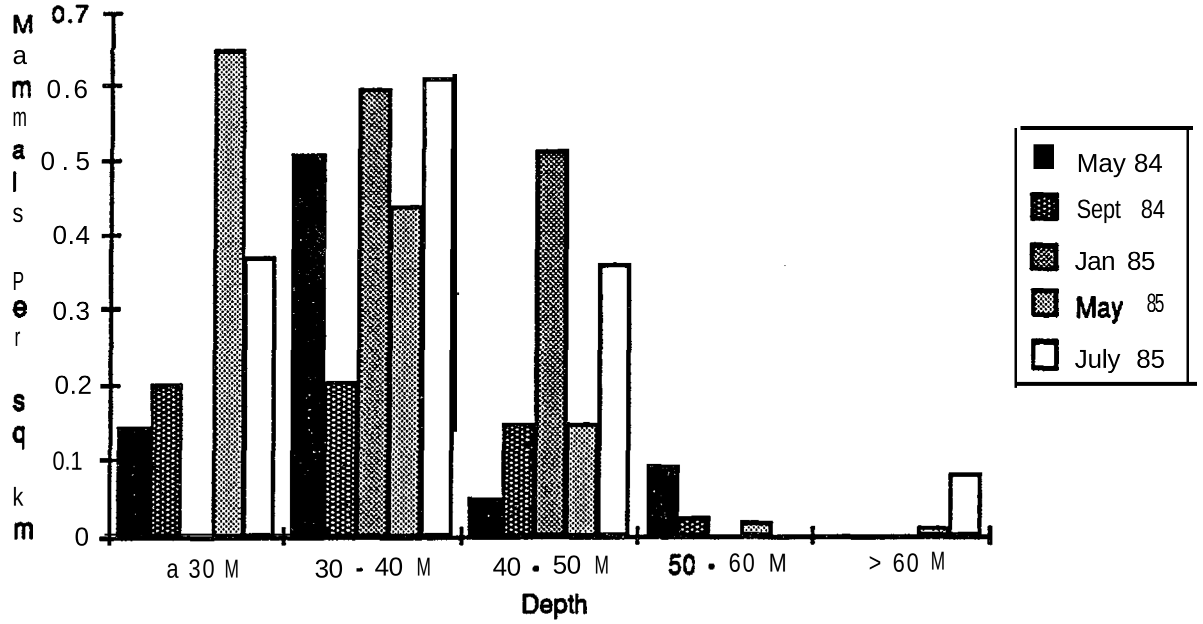

Figure 7.10. Abundance of sea otters by depth class in the North Aleutian Shelf, Alaska.

7.5.1.3 Population Estimates

Rough population estimates for use in the energy flow analyses (Section 8.0, this report) are presented in Table 7.5. The occurrence of rare species is more easily discerned here than in the density tables shown earlier. The period April-June is shown to be the portion of the year supporting the most diverse marine mammal fauna. Also evident is the numerical predominance of sea otter, Steller sea lion, and harbor seal; the latter was numerous only in the summer.

7.5.2 Trophic Relationships

Bivalve molluscs (primarily Mytilus edulis) comprised the largest component of the diet of sea otters (estimated by percent volume of items in scats) during all three sampling periods: 69%, 79%, and 64%, for July, September, and May, respectively (Table. 7.6, Fig. 7.11). Decapod crustaceans (primarily the crab Telmessus sp.), also were important prey during all three sampling periods. Although echinoderms (largely sand dollars) formed the second largest estimated component of the diet during summer and fall 1984, no evidence of this taxon was found in the small sample of scats taken in May 1985.

Kenyon (1978) found that fish comprised over 50% of the diet of sea otters in the Amchitka Island area of the Aleutians, where food may have been limiting sea otter populations that were at equilibrium densities. Most of the dead sea otters found along beaches in the central Aleutians were either very young or very old animals'; Kenyon speculated that these animals may have been unable to catch fish and were forced to eat foods of lower quality (mainly echinoderms), thus causing starvation and death. Estes et al. (1982) similarly found that sea otters in the Amchitka Island area ate fish to supplement a poor quality diet of herbivorous macroinvertebrates. In other areas studied (Attu Island and coastal Oregon), where sea otters were apparently far below equilibrium density, macroinvertebrates made up their entire diet. Based on these findings, and considering (1) the apparent absence of fish bones and scales in the excreta of sea otters that we sampled, and (2) the obvious abundance of fish in the NAS study area, one could speculate that the sea otter

Table 7.5. Rough estimates of total mammal populations within the North Aleutian Shelf, Alaska study area at the time of each aerial survey. Estimates were derived by extrapolating average density on transects within each 10-m depth class to the total area of each depth class in the study area.

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Brown Bear	0	0	0	0	0	0	3	1	0	1	0	0
Sea Otter	1,956	2,548	2,038	6,309	3,825	3,399	1,550	3,349	2,202	12,540	3,977	2,431
Steller Sea Lion	1,093	2,214	503	825	2,391	2,017	94	1,197	108	89	88	1,499
Walrus	0	0	0	100	0	1	0	0	0	0	0	0
Harbor Seal	1	59	0	67	231	2,641	1,147	3,459	1	83	4	108
Pacific While-sided Dolphin	0	0	0	0	0	107	0	0	0	0	0	0
Harbor Porpoise	0	38	0	220	0	0	20	0	0	0	0	0
Dall Porpoise	0	0	0	0	40	40	0	0	0	20	0	0
Gray Whale	0	0	0	215	297	141	0	0	186	0	0	27
small whale	0	0	0	0	0	0	0	0	0	20	0	0
TOTAL	3,050	4,860	2,541	7,736	6,785	8,347	2,814	8,006	2,497	12,753	4,069	4,065

Table 7.6. Estimated mean percent volume of sea otter (*Enhydra lutris*) scats collected In the vicinity of Izembek Lagoon, North Aleutian Shelf, Bering Sea, Alaska.

	July 1984 (n=100)	September 1984 (n-17)	May 1985 (n=2)
	% volume	% volume	% volume
Major Taxa			
Fish	1	0	0
Bivalve	69	79	64
Gastropod	0	1	0
Molluscs	69	80	64
Decapod	13	8	36
Crustaceans	13	8	36
Echinoderm	17	11	0
Other/Unknown*	0	1	0
TOTAL	100	100	100

* Polychaets, sludge.

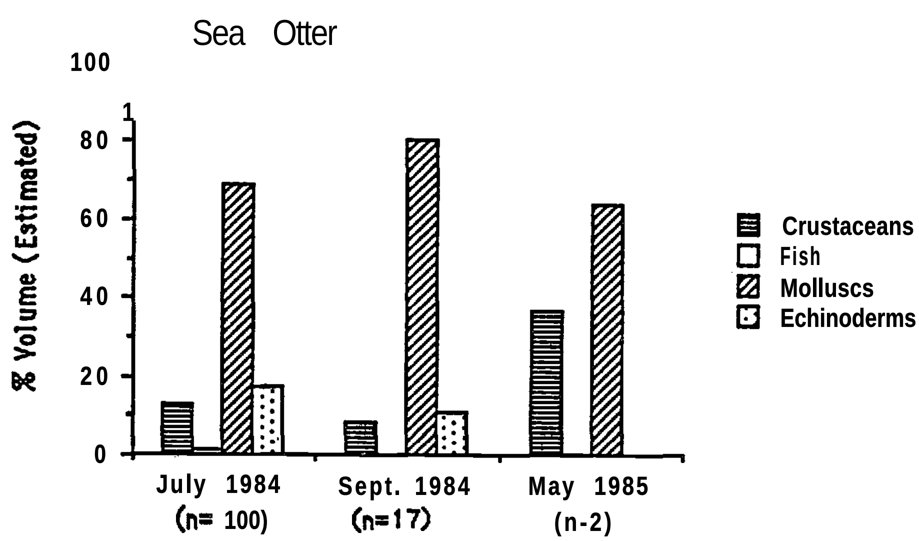

Figure 7.11. Contents of scats of sea otters feeding offshore near Izembek Lagoon, North Aleutian Shelf, Bering Sea, Alaska, July 1984 to May 1985.

population that we sampled was well below equilibrium density and survived almost solely on macroinvertebrates.

7.6 RECOMMENDED FURTHER RESEARCH

1. Replication *of* aerial survey effort is recommended to assess the temporal variability of marine mammal use **of** the area. The presentevaluationrelies on point surveys (2-3 days) to describe each month.

2. Specific attempts to ascertain gray whale use of the area are required if we are to determine the extent to which they are feeding in the area. Although low in numbers their massive size and (when feeding) large daily intake of food makes them potentially important consumers in the area.

3. Our survey efforts did not include censusing the Steller sea lion rookery and haulout areas on Sea Lion Rock and Amak Island. Reliable counts should be obtained In these areas especially considering the apparent decline this species has undergone in the eastern Aleutians.

4. Study effort should be directed at evaluating the role of prey availability in affecting marine bird distribution.

5. Given the apparent ease (at some low tides) In collecting sea otter scats at the haulout location at the southwest entrance to Izembek *Lagoon,* we recommend that further collections be made at this location. We further recommend that a careful survey be made near the entrance to Moffet Lagoon, Bechivan Bay and other lagoon and bay entrances between Nelson Lagoon and Unimak Island to see if sea otters haul out on the beaches there also; collections of scats should be made at several such locations if possible.

7.7 ACKNOWLEDGEMENTS

We thank R.H. Day, P.D. Martin, and G.W. Miller for their help in conducting shipboard censuses. The assistance of the officers and quarter masters and chief scientists of the Miller Freeman in recording the environmental and location data for each transect is greatly appreciated.

D.R. Herter has played a major role in the collection and coding of the aerial survey data and in maintaining our aerial survey equipment for the last minute decisions to take advantage of breaks in the weather. Many pilots from NOAA, ERA, and Seair have taken part in these surveys and we thank them all. We also thank G. LaPiene and M. Meyer of NOAA for managing to arrange for planes at the right times.

The massive job of data entry from both the shipboard and aerial survey programs fell in the hands of Lynn Maritzen and Virginia McCarter who have done a remarkable job in returning clean computer files. Joe C. Truett edited early versions of this report.

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