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The Bearded Seal, *Erignathus barbatus*

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Scientific Nomenclature

Kingdom	-	Animalia, Linnaeus, 1758
Phylum	-	Chordata, Linnaeus, 1758
Class	-	Mammalia, Linnaeus, 1758
Order	-	Carnivora, Bowdich, 1821
Suborder	-	Pinnipedia, Illiger, 1811
Family	-	Phocidae, Gray, 1825
Genus	-	*Erignathus*, Gill, 1866
Species	-	*barbatus*, Gill, 1866
Subspecies	-	*nauticus* (Pallas 1811)
	-	*barbatus* (Erxleben 1777)

The hierarchy presented above recognizes two subspecies of bearded seals, *E. b. nauticus* which is the North Pacific or New World form, and *E. b. barbatus* of the North Atlantic or Old World. There is no clear agreement whether one or two forms (subspecies) in fact exist. Some contemporary investigators, this writer included, are inclined towards recognition of a single, holarctic subspecies.

Common Names

There are probably at least as many common names for the bearded seal as there are different languages spoken by peoples familiar with this seal. Some of the more frequently encountered common names include: *mukluk*, the Upik Eskimo name used in southwest Alaska, St. Lawrence Island, and the southern Chukchi Peninsula; *oogruk*, the Inupiat Eskimo term, a close (dialectal) approximation of which is used from western Alaska to Greenland; *morski zaits*, a Russian name meaning sea hare, commonly used in the western part of the USSR; *laktak*, the name borrowed from the Kamtschatdal people into Russian and generally used throughout the Soviet far east; *square flipper*, the English translation of the Norwegian sealers' term which is used in the North Atlantic region; and *bearded seal*, the most widely used English language name.

The English and Norwegian common names are descriptive of morphological features and the Russian name refers to a characteristic behavioral response. Morphology and behavior will be discussed in another section.

General Description

The scientific name, *Erignathus barbatus*, as well as the English and Norwegian common names for the seal, are descriptive of unique characteristics.

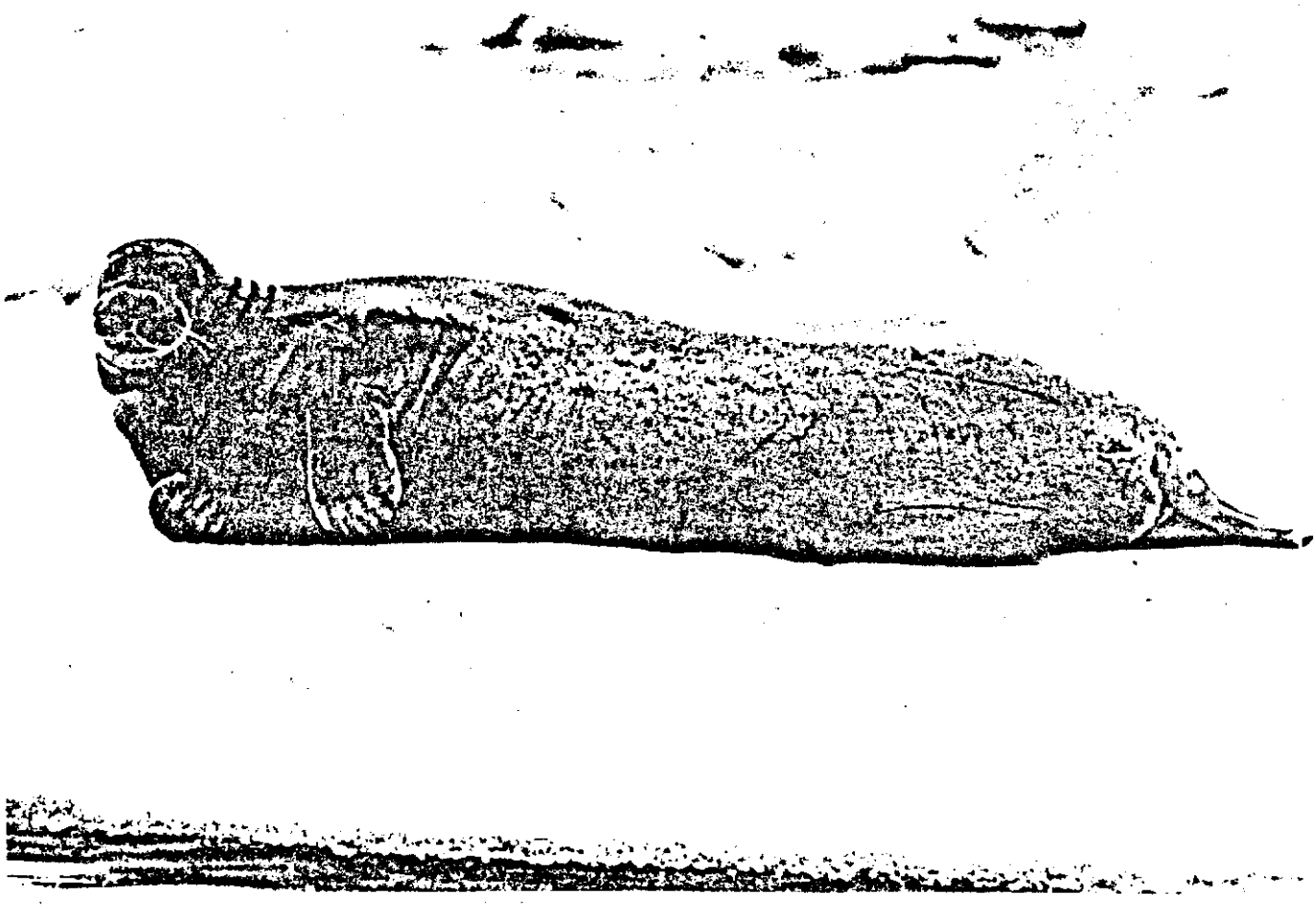

Figure 1. An adult male Pacific bearded seal, *Erignathus barbatus*.

Erignathus, the generic name, is from Greek and refers to the deep jaw. The specific name, *barbatus*, is from Latin and refers to the numerous long moustacial vibrissae. The English common name also refers to these vibrissae. When dry, these whiskers tend to curl. Square flipper, the translated Norwegian common name, describes the distal part of the foreflippers on which the third (middle) digit is longer than the others, giving this appendage a blunt, slightly rounded or squared appearance. These and other general features are illustrated in Figure 1.

Bearded seals are the largest of the northern phocids. However, the head appears disproportionately small. They have four retractable teats whereas the other seals have two. Colar varies among individuals. Adults are usually light to dark gray being slightly darker along the dorsal midline. Some seals are darker, ranging from tawny-brown to dark brown, also being darkest on the dorsal surface. The sexes are similarly colored. Young animals, especially pups, sometimes have faint, irregular shaped blotches unevenly distributed over the body. In general, these seals have none of the distinct and diagnostic color patterns found in other species. The hair is short and straight and on many seals the face and foreflippers have a rust or reddish color.

Term fetuses and newborn pups have dark (usually brown), dense, slightly wavy hair with light coloration on the facial region and one to four broad, transverse light bands on the crown and back. By the time these pups are weaned the pelage resembles that of older seals.

The skull of a bearded seal is wide, comparatively short, and more massive than that of other northern, ice-associated seals. It lacks a sagittal crest. Mandibles are deep (described by the generic name). Teeth are comparatively large, weekly rooted, and, in older animals, they are usually worn down or missing. The number and kinds of teeth are typical of the phocids: incisors 3/2; canines 1/1; postcanines 4/4, and molars 1/1 on each side. Thus, the complement (dental formula indicated X2) includes 34 teeth. Anomalies are not uncommon.

Other major features of the skull include an arched palate, broad and rounded rostrum, deep (wide) zygomatic arch, and wide interorbital region. Characteristics of the skull are illustrated in Figure 2.

Distribution

The worldwide distribution of bearded seals is shown in Figure 3. They occur in regions where ice overlies waters less than 200 m deep. These seals predominantly feed on benthos (prey which lives on and in the sea floor). They are most abundant where ice is in constant motion, and openings (leads, polynyi cracks, etc.) are continuously formed over shallow water. In winter and early spring, when the ice sheet attains its maximum extent and thickness, bearded seals mainly occur in the more labile parts of the seasonal pack.

Off Alaska a shallow intercontinental shelf (less than 200 m) underlies the northeastern half of Bering Sea (the Bering Shelf) and is contiguous, through Bering Strait, with the intercontinental shelf underlying all of the Chukchi Sea. The total area of these shelves approximates 1,725,000 km^2. In the Beaufort Sea the shelf is narrow, lying mostly within 30 km of shore. These shelves are all seasonally ice covered. These shelf regions constitute the largest contiguous area of favorable bearded seal habitat in the world and probably support the greatest number of these seals. The estimated minimum number of bearded seals in the Bering-Chukchi population is 300,000 animals. More rigorous population assessment is certainly in order.

As implied, the distribution of bearded seals coincides with that of the ice cover. These seals are strongly associated with ice and the seasonal advance and retreat of both are broadly synchronous. The late summer and late winter distributions are shown in Figure 4. Annual movements of bearded seals can be viewed as the seasonal expansion from and contraction to the more limited late summer habitat. Some bearded seals remain in favorable areas of the Beaufort and northern Chukchi Seas during winter. Most, however, begin moving southward with the advance and seasonal formation of ice. They begin to appear at progressively more southerly hunting sites immediately prior to the formation and/or arrival of ice. This fall "migration" is a diffuse, general movement which, depending on ice conditions, continues into January or early February in the Bering Strait region.

Most of these seals winter in the Bering Sea where the combination of satisfactory ice conditions overlying water depths suitable for bottom feeding occurs over a broad area. The annual maximum ice extent is obtained as early as February and always by March. Maximum extent of ice is also associated with dynamic stability and maximum differentiation of the ice cover. Dynamic stability refers to the late winter-early spring conditions which result in the influx and formation of new ice in the northern Bering, net southward transport in the face of prevailing winds, and disintegration at or near the Bering Sea shelf break due to warm water and wave action. During transport the ice sheet is shaped by interaction with barriers, constrictions, shoreline configuration, and regional weather and ocean currents.

Bearded seals are widely distributed in favorable areas of the late winter-early spring pack, extending from its southern limits in the Bering Sea to the Beaufort Sea. However, their distribution is neither random nor uniform. They are most abundant in the central and northern Bering where openings in the ice sheet are continuously formed. These conditions extend into the flaw zones of the Chukchi Sea, which mainly occur near and roughly parallel the coast. The greatly restricted flaw zone of the Beaufort Sea supports a relatively small number of bearded seals during seasons of maximum ice cover (January-late April). The northward spring migration in the Bering Sea begins in early April, prior to any appreciable reduction in extent of the ice cover. This northward migration continues throughout the period of ice retreat with the peak being reached in northern Bering Sea during late May-early June. It occurs later at more northerly sites. By late August-September, the extent of ice is at its annual minimum and the majority of bearded seals is associated with the southern parts of the late summer pack

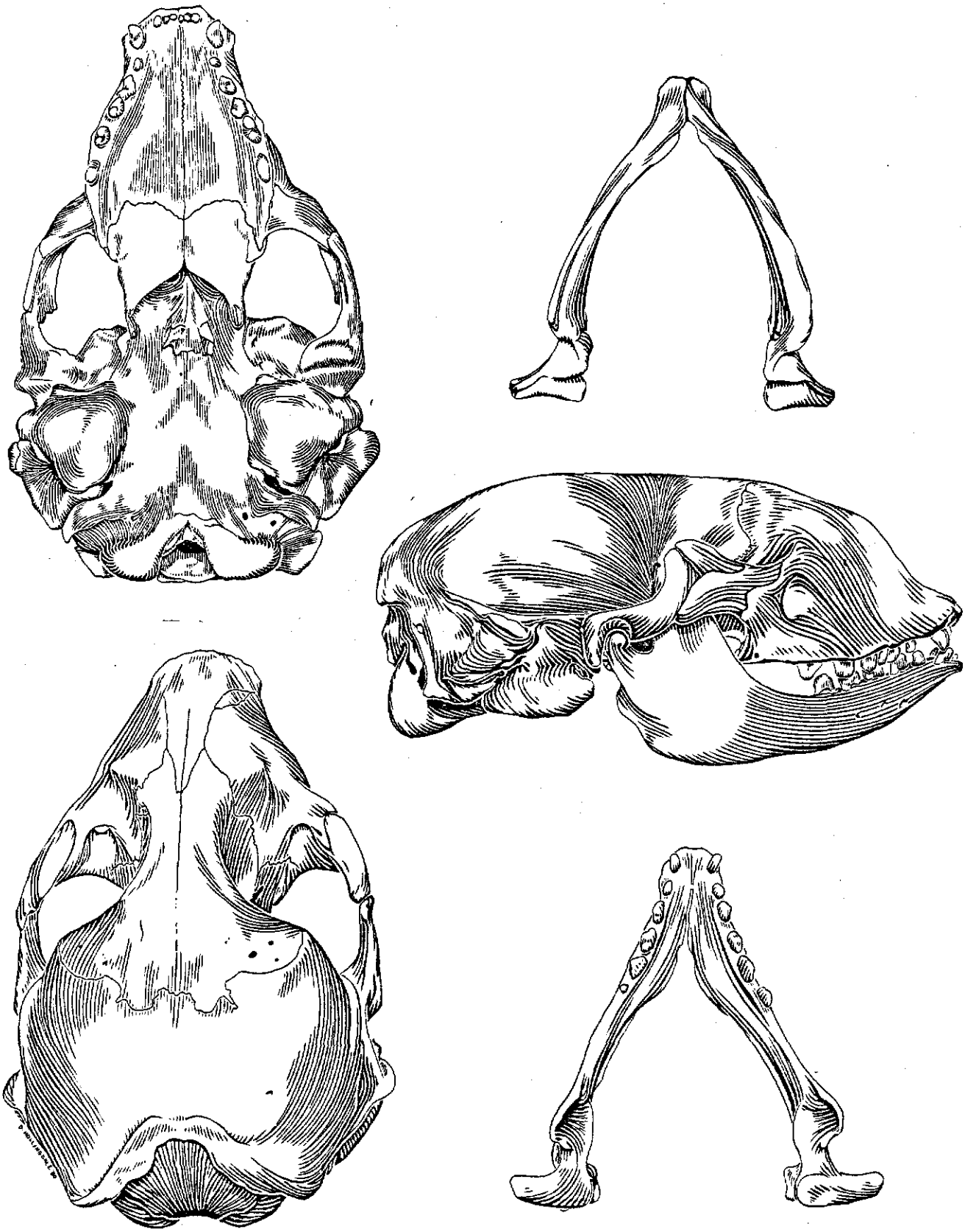

Figure 2: Ventral, lateral, and dorsal views of the skull of a one-year-old male bearded seal. Approximately half actual size.

which overlies the continental shelf. A relatively small proportion of these seals, primarily pups and subadults, remains in the ice-free waters from the Bering Sea north.

In waters adjacent to Alaska bearded seals are not known to haul out on land. It is presumed that individual seals would do so if seriously debilitated and distant from ice.

Natural History

At birth, bearded seals are, on the average, 131.3 cm long (standard length) and weigh 33.6 kg. The nursing period lasts for 12 to 18 days during which time weight is increased to an average of about 91 kg. Physical maturity is obtained by 9 years, at which age the average length is 220 cm and the average weight is about 250 kg.

Maximum recorded lengths and weights for males and females from the Bering-Chukchi population were: males 318 kg and 233 cm; females 360 kg and 243 cm. Bearded seals have a very robust

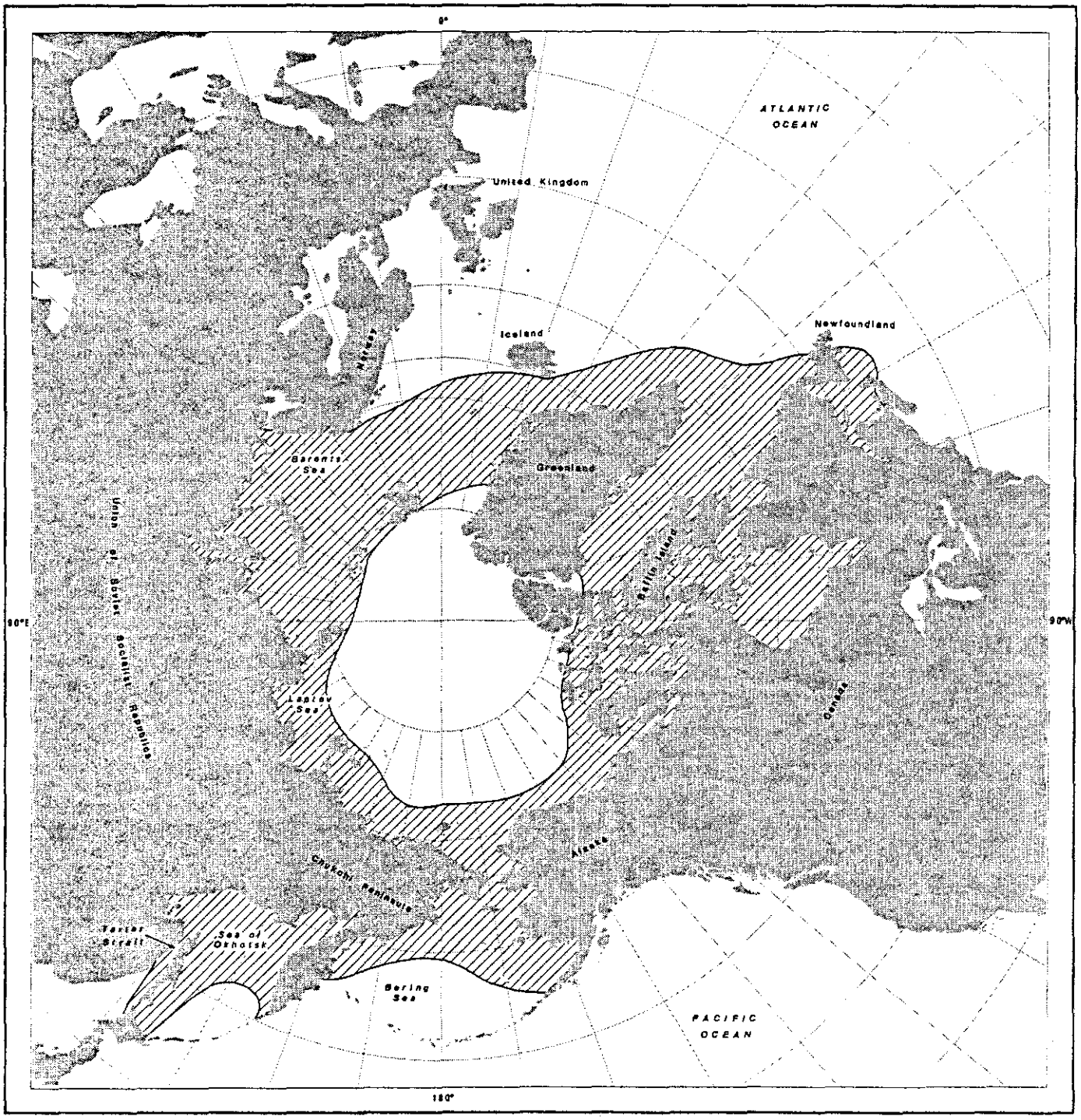

Figure 3. World distribution of the bearded seal, *Erignathus barbatus*.

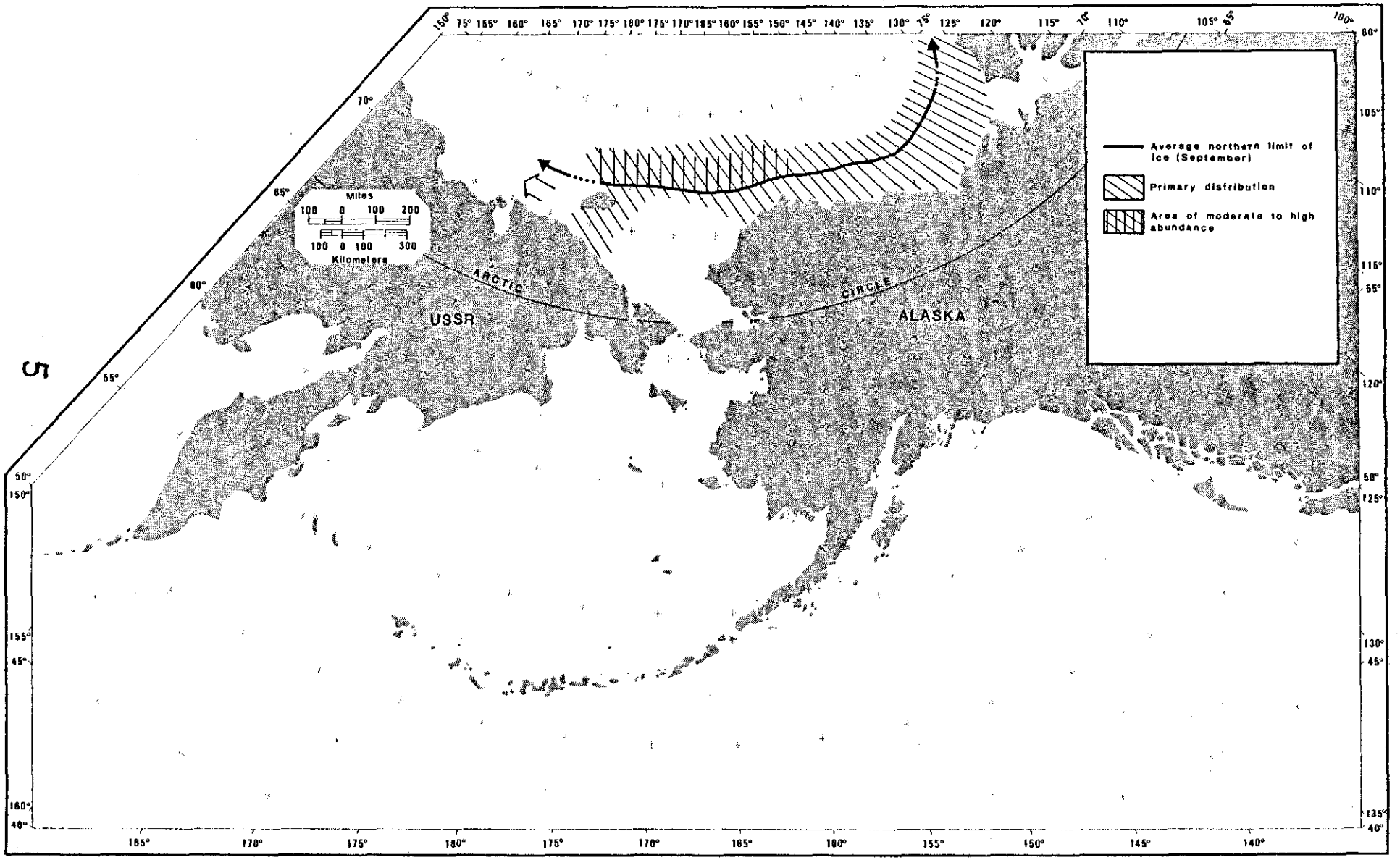

Figure 4a. Average late winter-early spring distribution of bearded seals in waters adjacent to Alaska.

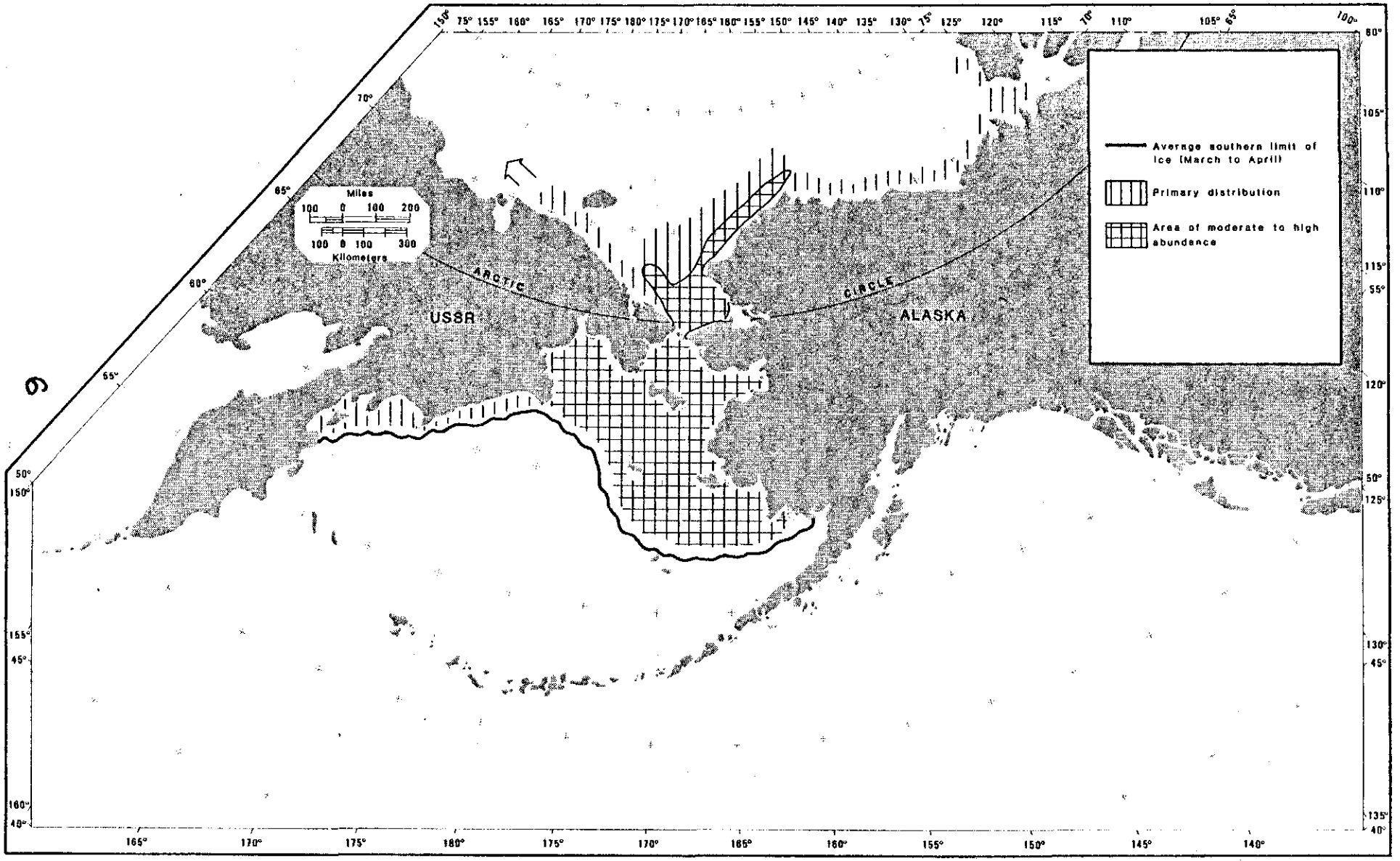

Figure 4b. Average late summer-early autumn distribution of bearded seals in waters adjacent to Alaska.

body shape in which, depending on season, girth immediately behind the foreflippers is 71 to 83 percent of standard body length.

Maximum age of a bearded seal was found to be 31 years. However, based on samples from the subsistence harvests in Alaska, only a small proportion (2.0%) were found to be 20 years or older. The sex ratio at birth is approximately equal. It appears to change in relation to age. Females comprised 55 percent of harvested seals older than pups, indicating a higher mortality rate for males than for females.

Sexual maturity is attained at 6 to 7 years in males and 4 to 7 years in females. The average age of sexual maturity (based on first pregnancy) in females was 6 years, although a small proportion (17%) became pregnant at age 4 and some not until age 8 or 9. Estimated pregnancy rates for the Bering-Chukchi population were found to be 77 percent for age classes 4 and older and 83 percent for females 6 years and older. Thus, breeding can be considered to occur annually in most sexually mature females.

In Alaskan waters the breeding period, based on the time of ovulation, extends from about 25 April to 30 May with most breeding occurring between 5 and 25 May. As in other pinnipeds, there is an extended period of delay between conception and implantation of the embryo (delayed implantation). The period during which implantation occurs extends from the last days of June through early August. Therefore, duration of the phase of delayed implantation is about 2 months. Births occur from late March to about mid-May with the peak period about 20 April. This peak is later than for other ice-associated phocids of the Bering Sea. The reproductive cycle is completed with breeding, again occurring as previously indicated. Major events in the annual cycle of bearded seals are illustrated in Figure 5.

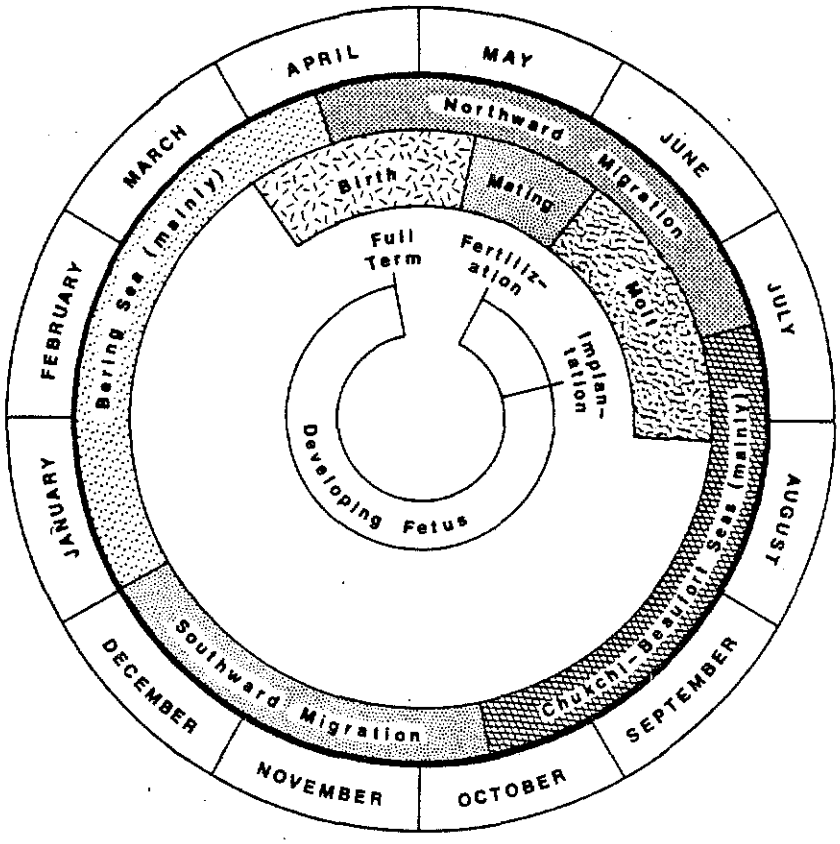

Figure 5. The annual timing of major biological events for the bearded seal.

Behavior

Bearded seals are very vocal and have a distinctive song. It is associated with mating and is thought to be part of the courtship behavior. The long, musical underwater sounds were well known to Eskimo hunters who, in the days when kayaks were extensively used for spring hunting, often located animals by listening for them. Parts of the song are audible at close range in air, but it can easily be heard by placing a paddle in the water and pressing an ear against the butt of the handle. This singing can be heard from March through July. All evidence suggests that breeding is accomplished in the water.

The western Russian common name of this seal, sea hare, is supposedly derived from the initial response when alarmed while resting on ice. They raise themselves abruptly by the simultaneous movement of both foreflippers, appearing to leap forward into the water. Bearded seals are seldom seen on ice more than a few feet from an escape opening. They move with an "inch worm" type wriggling gait which involves simultaneous motion of the foreflippers as they pull themselves forward. When moving across ice the short hindflippers are held directly behind the body. They cannot be rotated forward. However, the highly extendable hindflippers (in the sense that the digits can be widely separated giving these appendages a large surface area) provide propulsion when swimming.

They do not form herds although loose aggregations of animals do occur. They are mostly found as single animals or, during the appropriate season, as mother-pup pairs.

The senses of sight, hearing, and smell are difficult to evaluate as responses to disturbance are highly variable. On a warm, calm spring day when they are basking on the ice they usually exhibit little concern for a low-flying aircraft, or the close presence of men or boats. This is in marked contrast to responses of these seals in winter when the slightest sound-producing movement of a man on the ice will cause a basking seal to flee or a swimming seal to surface and attempt to locate the sound source. When alert it appears that bearded seals have good senses of sight and hearing both in and out of the water. Their sense of smell

is probably poor to fair.

The mother-pup bond is strong during the early nursing period. Females often remained near pups which were being marked, and tried to coax them into the water. On occasion, they defended a pup and attempted to chase the intruder. Towards the end of the lactation period pups are frequently left unattended. Mutual nosing and occasionally gentle scratching are behavioral components of reunions between a mother-pup pair and occur frequently while they are together. Foreflippers are used in play encounters between juvenile seals and in struggles between adults. Scars inflicted by the claws of other bearded seals are common on adults.

Food Habits

As previously stated, bearded seals are primarily benthic feeders. Their diet is diverse, being comprised largely of epifaunal animals (those that live on the sea floor). Infauna (organisms living in the sea floor) is also utilized to a significant degree. Fishes are generally of minor importance except under localized circumstances. In Alaskan waters most bearded seals are in regions where water depth is less than 130 m.

Although the total array of food items utilized is quite large, relatively few types comprise the bulk of the diet. These types include shrimps, crabs, and clams. Some demersal fishes are also taken. Food items representing these general types vary in relation to season, geographical location, and/or relative age of the seals. Young seals, especially pups, eat a higher proportion of shrimps than do older seals. In the Bering Sea the four most important food items, in order of their decreasing importance, were found to be tanner crabs, *Chionocetes opilio*, spider crabs, *Hyas coarctatus*, and the shrimps *Argis lar* and *Crangon dalli*. Greenland cockles, *Serripes groenlandicus*, were third in importance during spring in Norton Sound.

In the southeastern Chukchi Sea the four most important foods during spring and summer were found to be spider crabs, Greenland cockles, and the shrimps *Crangon septemspinosa* and *Argis lar*. Farther north, in the Beaufort Sea, spider crabs were still most important followed by the shrimp *Sabinea septemcarinata* and then by the arctic codfish *Boreogadus saida*. Although the food items indicated above predominated in the diet of bearded seals, a wide variety of other organisms were also consumed. Lists of those prey items of lesser importance are included in appropriate publications indicated in the selected bibliography.

Pathology

This subject is difficult to summarize in general terms. Causes of natural mortality other than predation by polar bears are essentially unknown. However, pathological conditions in living animals are not uncommon. Bearded seals are hosts for a number of helminth parasites, most of which appear to cause no significant harm to the seals. The most commonly occurring helminth parasites in seals from the Bering-Chukchi population were found to include *Diphyllobothrium cordatum, D. lanceolatum, Pryamicocephalus phocarum* and *Corynosoma validum*. Other helminth parasites of these seals included *D.* sp., *Phocanema dicipiens, Orthosplanchnus fraterculus* and *Contracaecum osculatum*. In some instances parasites caused helminthiasis of the liver and associated secondary bacterial infections.

Pesticides and heavy metals have been found in the tissues of bearded seals from Alaskan waters. Based on recent studies of ringed *(Phoca hispida)* harbor *(Phoca vitulima)* and grey seals *(Halichoerus grypus)* in the Baltic Sea, these and other environmental contaminant loads can be expected to increase commensurate with increased industrial development. At the present time tissue contaminant burdens in bearded seals from waters adjacent to Alaska are low. Pesticide residues reported included DDT, DDD, DDE, dieldrin and polyclorinated biphenols (PCS's).

Heavy metals identified in tissue samples from bearded seals taken in waters adjacent to Alaska have included mercury, cadmium, nickel, copper, and zinc. These seals had the highest heavy metal loads of the pinnipeds examined (including walrus, spotted, ribbon, and bearded seals), perhaps because of their food habits. Tissue levels of petrochemical contaminants have, as yet, not been determined.

Very limited data indicate that death of term fetuses and newborn pups, induced by trauma (probably during birth) may occur more frequently in bearded seals than in the smaller seals of the Bering-Chukchi region.

The Impact of Man

Bearded seals have been harvested by aboriginal hunters of Alaska and Siberia for perhaps several thousand years. At present, United States law (the Marine Mammal Protection Act of 1972) restricts hunting to that done by Eskimos, Indians, and Aleuts. In 1977, the last year for which records were available, the American take was estimated at about 4,750. The Soviet harvest including both the commercial sealing fleet and coastal based hunters was reported to have been 1,204 in 1977. This level of harvest is considerably below the 5,000-7,000 bearded seals taken each year by Soviet hunters in the early 1960's. This difference reflects the change from small sealing vessels which sought mainly hides and oil, to large modern vessels which process meat, oil, and hides. Because of their large size and high yield, walruses are now more important to the Soviets than are the smaller seals.

Commercial fishing for tanner crabs and clams, both important foods of bearded seals, could eventually result in competition between fisherman and the seals. At present, this is probably not a problem. Although not a direct effect of mans' impact, it appears that there is increasing competition for certain foods, mainly clams, between walruses and bearded seals. The population level of the former has become very large and is currently estimated to number about 250,000 animals.

Since bearded seals do not utilize hauling areas on shore, there is little direct impact or displacement of these seals due to onshore installations. To the present time it appears that man has not significantly altered the condition of bearded seal habitat in the Bering-

Chukchi-Beaufort regions. However, development of petroleum reserves in the offshore regions of these seas poses the first real possibility that man-induced changes could occur. Significant direct mortality to bearded seals is probably not likely. Indirect effects resulting from pollution are more probable, especially if major oil spills occur. In the fact of pollution it is anticipated that recruitment and survival of the immature stages of bearded seal food species and other components of the supporting food webs will be lowered, thus affecting carrying capacity of the habitat. Some localized displacement from the immediate vicinity of development sites is anticipated. The extent and therefore significance of such displacement will depend on the number and distribution of offshore installations.

From a management perspective it appears that current levels of harvest are within limits of the biological productivity of this species. Significant expansion of shrimp, crab, and clam fisheries in the central and northern Bering Sea are potential threats and must be closely monitored. Offshore petroleum development, which will constitute the first real possibilities of man-induced changes in the habitat of bearded seals, is an unknown factor which must be approached with the utmost care and caution.

SELECTED REFERENCES

Benjaminsen, T. 1973. Age determination and the growth and age distribution from cementum layers of bearded seals at Svalbard. Fisk Dir. Skr. Serv. Hav Unders, 16:159-170.

Burns, J. J. 1967. The Pacific bearded seal. Alaska Dept. of Fish and Game, Juneau, 66 pp.

Burns, J. J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi Seas. J. Mammal, 51:445-454.

Burns, J. J. In press. The bearded seal, *Erignathus barbatus*. *In* R. J. Harrison and S. H. Ridgway, eds., Handbook of Marine Mammals, Academic Press, London.

Burns, J. J., and K. J. Frost. 1979. The natural history and ecology of the bearded seal, *Erignathus barbatus*. Final Report OCSEAP contract 02-5-022-53, Alaska Dept. of Fish and Game, Fairbanks, 77 pp.

Chapskii, K. K. 1938. The bearded seal (*Erignathus barbatus* Fabr.) of the Kara and Barents Seas. Trans. Arctic Inst., Leningrad, 123:7-70 (Transl. Dept. Sec. State of Canada).

Delyamure, S. L. 1955. Helminthofauna of marine mammals: (Ecology and Phylogeny). Izd. Akad. Nauk SSSR, Moscow, 517 pp. (Transl. Israel Prog. Sci.)

Fay, F. H. 1974. The role of ice in the ecology of marine mammals of the Bering Sea. Pages 383-389, *In* D. W. Hood and E. J. Kelley, eds., Oceanography of the Bering Sea. Inst. Mar. Sci., University of Alaska, Fairbanks.

Fay, F. H., R. A. Dieterich, and L. M. Shults. 1979. Morbidity and mortality of marine mammals. Annual Report OCSEAP Contract 03-5-022-56, 37 pp.

Fedoseev, G. A., and Yu A. Bukhtiyarov. 1972. The diet of seals of the Okhotsk Sea. Fifth All-Union Conf. Studies of Marine Mammals (USSR), Part 1:110-112 (Transl. F. H. Fay).

Glaster, W. R. 1971. Accumulation of mercury in Alaskan pinnipeds. Page 76, *In* Proc. 22nd Alaska Sci. Conf., Fairbanks, (abstract).

Galster, W. R., and J. J. Burns, 1972. Accumulation of pesticides in Alaskan marine mammals. Proc. 23rd Alaska Sci. Conf., Fairbanks, (abstract).

Kosygin, G. M. 1966a. Some data on the feeding of the bearded seals in the Bering Sea during the spring-summer months. Izv. TINRO 58:153-157, (Transl. U. S. Bureau Comm. Fish.).

Kosygin, G. M. 1966b. Distribution of bearded seals in the Bering Sea in the spring period 1962-1964. Izv. TINRO 58:125-128.

Kosygin, G. M. 1971. Feeding of the bearded seal *Erignathus barbatus nauticus* (Pallas) in the Bering Sea during the spring-summer period. Izv. TINRO 75:144-151 (in Russian).

Kosygin, G. M., and V. A. Potelov. 1971. Age, sex and population variability of the craniological characters of bearded seals. Izv. TINRO 80:266-288.

Sampiro, T., and O. Stenman (eds.). 1978. Proceedings from the symposium on the conservation of Baltic seals, April 26-28, 1977, Haikko, Finland. Finnish Game Res. 37: 1-56.

Lowry, L. F., K. J. Frost, and J. J. Burns. 1979a. Trophic relationships among ice inhabiting phocid seals. Annual Report OCSEAP Contract 03-5-022-53, 71 pp.

Lowry, L. F., K. J. Frost, and J. J. Burns. 1979b. Trophic relationships among ice inhabiting phocid seals. Final Report of Beaufort Sea activities, OCSEAP Contract 03-5-022-53, 55 pp.

Manning, T. H. 1974. Variations in the skull of the bearded seal. Biol. Pap., Univ. of Alaska, Fairbanks, 16: 1-21.

McLaren, I. A. 1958. Some aspects of growth and reproduction of the bearded seal, *Erignathus barbatus* (Erxleben). Journal of Fisheries Research Board, Canada. 15:219-227.

Pikharev, G. A. 1940. Some data on the feeding of the Pacific bearded seal. Izv. TINRO 20:101-120 (in Russian).

Potelov, V. A. 1975. Reproduction of the bearded seal *Erignathus barbatus* in the Barents Sea. Rapp. P.-v. Reun. Cons. Int. Explor. Mer. 169-554.

Ray, C., W. A. Watkins, and J. J. Burns. 1969. The underwater song of *Erignathus* (bearded seal). Zoologica 54:79-83, three plates.

Smith, T. G., and F. A. J. Armstrong. 1978. Mercury and selenium in ringed and bearded seal tissues from arctic Canada. *Arctic* 31:75-84.

Tikhomirov, E. A. 1966. On the reproduction of seals belonging to the family phocidae in the North Pacific. Zool. Zhur. 45:275-281. (Transl. Fisheries Resource Board, Canada).