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# Handbook of Marine Mammals

edited by

Sam H. Ridgway and Richard J. Harrison F.R.S



Volume 1: The Walrus, Sea Lions,  
Fur Seals and Sea Otter

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Fur Seals and Sea Otter*

*Edited by*

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# Preface to the Series

The idea of producing a Handbook of Marine Mammals of this type was the result of many discussions between the authors and the late Mr John Cruise of Academic Press during his visits to Cambridge over ten years ago. It would be, it was hoped, a comprehensive account of all marine mammal species with each chapter written by someone who had actually worked on a particular form. We felt that this would give a more personal flavour to each chapter, provide opportunity to include original observations, and increase accuracy. Some species of marine mammal are worldwide in their distribution and known to many investigators, others are restricted to certain rivers, lakes, seas and even to relatively short ranges along a coast. We know of no one person who claims to have seen every extant species alive in its environment. We hoped that such a series of chapters written by experts on each species would naturally draw attention to subtle differences in form, coloration, behaviour and many other characteristics, many of which might not be known to an ordinary reviewer.

There are obvious difficulties and problems to vex the editors of multi-author works and they all affected this one. We knew it would take time; active marine mammalogists spend long periods away from home on expeditions and at conferences. The majority of contributors have remained loyal to the project but a few have had to withdraw with inevitable difficulties over replacement and with continual postponement of completion dates. New information has become available about many species over the last ten years, due mainly to efforts by countries to find out more about their local species but also to enterprising attempts to display little-known species in captivity. These last ten years have also seen a much increased interest in conservation of

marine mammals and an awareness by the public of their importance as interesting animals from many points of view. There has been much debate about whether a moratorium should be introduced by international agreement over the taking of large or even any cetaceans. The arguments have affected many of the classical views held on harvesting, culling, controlling or managing stocks of all marine mammal species. They have exposed our ignorance on many basic facts concerning reproduction, school competition and behaviour, and even what is really meant by many of the terms and concepts used so glibly in marine mammalogy in the past.

The last decade has seen much burgeoning in scientific investigation of marine mammals, though not always in a direction leading to important results. For example, the delightfully satisfying construction of mathematical models has occupied many folk. The results give joy to the constructor, the administrator, the politician and this whole game is not only fun but really quite cheap. What the computer tells us is only as good as the data put into it which are often incomplete or inadequate for detailed analysis. At the very best the results are always based on past events. What is happening now in the seas is still as mysterious as it always was.

Many advances have been made in our knowledge of how to keep marine mammals in captivity, about their diseases and the associated pathological changes, and on treatment. The life styles, life history, expectation of life, growth rates, vulnerability and responses to adverse effects of disease and pollution are becoming better known and understood. Formulae have been constructed to provide the optimum size of pool for holding marine mammals of varying number and size. Codes of practice have been issued to ensure the welfare of marine mammals during transport and in captivity. This concern has increased life expectation of captive animals, and has improved their lot from being mere objects of curiosity and participants in circus acts. The list of different species displayed to the public has steadily lengthened; to an extent that many countries demand permits to be issued for taking of rare and even not so rare animals from local stocks, and records must be kept about captive animals.

Film and television companies have realized the increasing popularity of productions involving marine mammals, and this has spread knowledge more than any other factor, and unfortunately in some cases misinformation, about the various species. Conservationists have also promoted public awareness of which nations still hunt whales and the purposes to which the carcasses are put. These groups have put pressure on national and international bodies to provide more accurate

information about endangered species and the state of stocks generally. Again and again it has had to be confessed that many species are still little known, their habits obscure, and assessment of their numbers mere guesswork.

Problems of nomenclature are bound to arise in presenting any group as diverse and widely dispersed as marine mammals. We have avoided strict rules and have left decisions as to the use of particular names to each expert author. Authors were asked to summarize the scientific and common nomenclature of the genera and species about which they have written. As a guide to the various genera and species Dale W. Rice's "A List of Marine Mammals of the World" (NOAA Technical Report NMFS SSRF-711, US Department of Commerce, Washington, D.C., 1977, 15p) is especially useful.

This Handbook is intended as a guide to marine mammal types and is all about them as animal forms. It is meant for use in the field and laboratory as a practical aid to identification and to provide useful basic information. It is not concerned with management, husbandry or treatment of disease, stock levels or whether there should be a moratorium on the taking of certain marine mammals. We have both worked for many years on various aspects of the biology of what we have found an entirely fascinating group of mammals. We know that all contributors have an interest equal to ours and far more expertise, so we have tried to keep editorial intervention to a minimum. We dare to hope that only marine mammals will know about themselves what is not in this Handbook, or that it is the editors' fault that useful information has been overlooked.

We thank Academic Press for their patience and guidance.

Sam H. Ridgway  
Richard J. Harrison

# Preface to Volume 1

We start this series on marine mammals with chapters on those genera most easily seen by man—animals which come out of the water to rest, to breed and to bear young. The three families represented in this volume are closely related to more familiar land mammals such as dogs, bears, raccoons and weasels.

We introduce these genera with an account of the walrus, the only living member of the family *Odobenidae*. This giant northern seahorse congregates in colossal heaving masses of its kind on ice floes or on rocky islands. The whiskered, brown creatures, with protruding tusks, have from ancient times greatly interested humans.

The next seven chapters deal with sea lions and fur seals, members of the family *Otariidae* (the eared seals), readily differentiated from other seals by their tiny cone-like external ears and by their powerful forelimbs which enable them to run on land. Eared seals inhabit rocky beaches and sandy shores from Alaska to subantarctic islands of the South Atlantic and Indian oceans. In their densely populated colonies, huge males—sometimes ten times the size of females—control territories and dominate harems, creating an interesting social structure that has aroused the curiosity of ethologists and behavioural scientists.

Around the world, the best-known eared seal is probably the California sea lion, the trained “seal” of zoos and circuses. These bright, agile animals, are especially adaptable to contact with man, and are easily trained as performers. Perhaps their most familiar trick is to balance a ball on the tip of the nose.

Concluding the volume, Chapter 9 treats the only marine member of the family *Mustelidae*, the sea otter. Our sea otter expert, like most of



the authors discussing species in this handbook, is the world's leading authority: Karl W. Kenyon, a retired biologist, has spent more time observing marine mammals in their natural habitat than probably any other researcher.

We are grateful to Denis A. McBrearty for much assistance with proof reading and indexing.

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February, 1981

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# 1

## Walrus

### *Odobenus rosmarus* (Linnaeus, 1758)

Francis H. Fay

#### *Genus and Species*

Walruses (Family Odobenidae, genus *Odobenus* Brisson, 1762) occur around the Northern Hemisphere (Fig. 1). Those inhabiting the North Atlantic region are regarded as the subspecies *Odobenus rosmarus rosmarus* (Linnaeus, 1758); those of the North Pacific region are distinguished as *O. r. divergens* (Illiger, 1815). They differ principally in size. Pacific walruses from the Bering and Chukchi Seas tend to be the largest in body size, dimensions of the skull, and length of the tusks; Atlantic walruses of the eastern Canadian Arctic tend to be the smallest (Mansfield, 1958; Heptner, 1976). There are no type specimens of either form. A third subspecies, *O. r. laptevi*, was described tentatively by Chapskii (1940) from a few specimens taken in the Laptev Sea, but its status as a distinct taxon is doubtful. Though intermediate in size between the Bering-Chukchi and the North Atlantic forms (Heptner, 1976), it is craniologically most like the former (Fay, unpublished).

The English name "walrus" probably was borrowed from the Dutch "walrus" or "walros". The terms "sea horse" and "sea cow" also have been used by English speaking people in the past. The Russian name for this animal is "morzh"; the Danish (Greenland) is "hvalros". To the Eskimo, it is known as "aivuk" (Yupik) or "aivik" (Inuit), and to the Aleut as "amak" or "amaghak". Numerous additional names applied by native people of the coastal regions of the northern and far-eastern parts of the Soviet Union are given by Ognev (1935).

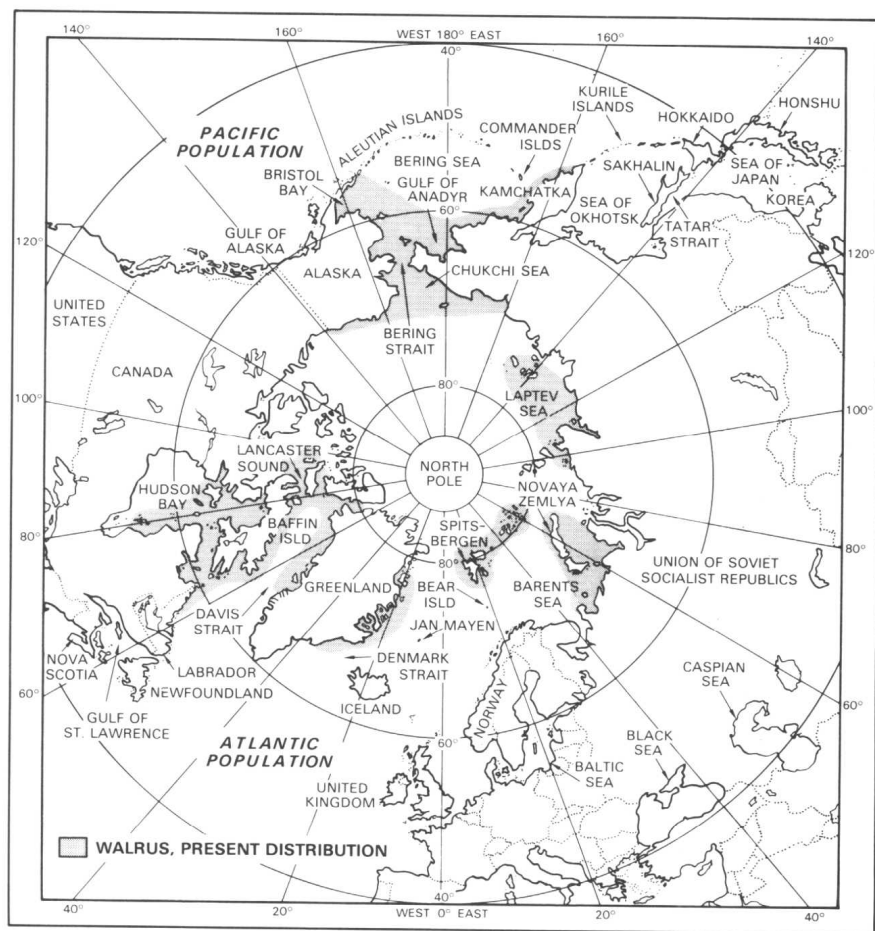


FIG. 1 Approximate normal limits of present distribution of walruses.

## *External Characteristics and Morphology*

Walruses are among the largest and most robust of the pinnipeds. The adults are sexually dimorphic, the males being about 20% longer and 50% heavier than the females (Table 1). Adults of the Atlantic form are about 3% shorter and 10% lighter than those of the Pacific. In both, the maximal girth of the body, midway between the fore limbs and the umbilicus, is about the same as the standard length.

TABLE 1. Standard body length and live weight of Pacific walruses<sup>a</sup>

	No.	Males Measurement		No.	Females Measurement	
		Range	Mean		Range	Mean
<i>Newborn calves</i>						
Standard length (cm)	18	112-137	122.4	30	102-133	121.4
Total weight (kg)	5	45-77	63.8	15	33-85	63.3
<i>Adults<sup>b</sup></i>						
Standard length (cm)	30	270-356	315.2	18	225-297	260.6
Total weight (kg)	30	880-1557	1215.1	18	580-1039	811.5

<sup>a</sup>Length in straight line from tip of snout to tip of tail, with animal lying flat on its back, spine straight and fully extended (= about 90% of curvilinear length); weight includes all body fluids

<sup>b</sup>Males 15 yrs old and older; females 10 yrs old and older

The skin on the neck and shoulders is very thick (2-4 cm) and tends to be thrown into folds with the animal's movements (Fig. 2). On the palms and soles of the flippers, it is highly cornified and rough. The fore flippers are squarish and about as wide as long; the hind flippers are more triangular, similar to those of the Phocidae. Each flipper has five subequal digits, the first being longest and the fifth shortest on the fore limbs; on the hind limbs, the fifth is slightly longer than the first, and the third is shortest. Each digit bears a weakly developed claw and a short (compared to the Otariidae) cartilaginous extension beyond the claw. In the water, the hind limbs are used for propulsion and the fore limbs mainly for steering; on land or ice, the fore flippers are rotated back and the hind flippers forward for support of the body in quadrupedal locomotion. There is no distinct tail.

The head appears small, relative to the size of the ponderous body. The eyes also are small and situated dorsolaterally; the anterior nares are positioned centrally on the dorsal edge of the snout. The external ears have no pinnae. The unusually broad snout is remarkably hirsute, having some hundreds of stiff bristles (mystacial vibrissae) on its anterior surface; those on the ventrolateral parts of it are the longest. Extending downward from the corners of the mouth are the tusks, which are enlarged upper canine teeth. Tusks are present in both sexes; they are straighter, longer and stouter in the males. Those of the males also tend to be more elliptical in cross-section and more divergent distally, though these characteristics are by no means reliably diagnostic of the sex of individuals.

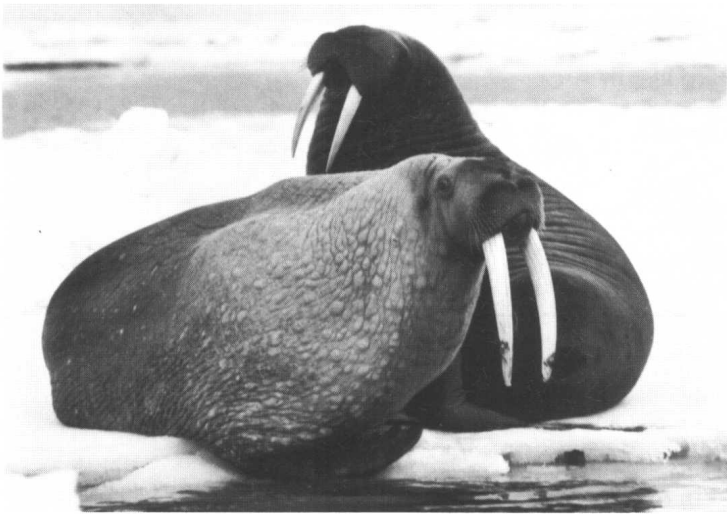


FIG. 2 An adult (left) and subadult male on an ice floe in the Bering Sea. The paler colouration and “warty” skin of the animal on the left is typical of adult males of the Pacific population—less so of those in the Atlantic. (Photo: L. M. Shults)

In basic colour, walrus are cinnamon-brown overall, but there is some variation with age and sex. In general, the younger individuals tend to be the darkest, their hair being most intensely pigmented and their skin nearly black. The palest are the old males, in some of which the skin and hair are so light that they appear to be albinistic. The pallor of these individuals is accentuated by immersion in cold water,

wherein their skin becomes ischaemic (deprived of blood) and appears to be nearly white. Under warmer conditions, their lightly pigmented skin becomes congested with blood, which imparts a distinctive rosy colour, often mistaken for "sunburn" (Fay and Ray, 1968). Males of all ages also tend to have many depigmented scars on the neck and body. Typically, the older males also have numerous raised nodules (Russian = "shishki") in the skin of, especially, the neck and shoulders (Fig. 2). These nodules, mostly 3-4 cm in diameter and 1 cm high, are often hairless and contain some scar tissue. Since they first appear at about the time of puberty and are absent in females, they are presumed by some workers (e.g. Chapskii, 1936) to be a secondary sexual character, the development of which is hormonally induced during sexual maturation. Others have regarded them simply as scars (e.g. Loughrey, 1959).

The body is covered with short, coarse hair, usually no more than 1 cm in length (Scheffer, 1964). Only the appendages, the nostrils, and the lips tend to be hairless. Hair populations are most dense on the youngest animals and least dense on the large, old males. For the most part, the hair of the males is shed during June and July, at which time the animals may appear to be naked; it is replaced mainly in July and August. Apparently, the females moult somewhat later or over a more prolonged period (Mansfield, 1958). The calves undergo a prenatal moult, about two to three months before birth, shedding a fine, white lanugo while *in utero* and replacing it with a coarser, natal coat (Fay, 1981). They moult again in July of their first year (Nikulin, 1941). At birth, they appear ashen gray to gray-brown overall, becoming tawny-brown with distinctively black flippers within one to two weeks. A remnant of the umbilical cord usually is retained for two weeks to a month after birth.

### *Distribution and Migration*

Walruses are inhabitants principally of the moving pack ice over the shallow waters of the continental shelf, where they feed on benthic invertebrates at depths to 80 m (Vibe, 1950). They seem to prefer ice as a substrate on which to haul out for resting, moulting, and bearing their young. They also will haul out on land, principally on small, rocky islands, when there is no ice available in the vicinity (Tsalkin, 1937; Nikulin, 1947; Popov, 1958; Loughrey, 1959).

Most of the populations appear to be migratory, moving southward with the advancing ice in autumn and northward as the ice recedes in



spring. The seasonal migrations of the Pacific walrus are the best understood; there, some individuals may travel more than 3000 km per year (Nikulin, 1941; Brooks, 1953; Fay, 1957). These animals inhabit mainly the pack ice of the north-central and south-eastern Bering Sea in winter (December-March), migrate northward through Bering Strait in spring (April-June), spend the summer along the ice edge in the Chukchi Sea (July-September), and return to the Bering Sea again in autumn. Several thousand males do not participate in the northward migration but remain in the Bering Sea throughout the summer, utilizing small islands in Bristol Bay and the Gulf of Anadyr as hauling grounds. During the autumn migration, the south-bound animals mostly swim ahead of the advancing ice and utilize as intermediate resting places several traditional hauling grounds on the coast of Chukotka and on the islands in Bering Strait and northern Bering Sea.

The migrations of other populations are not yet well understood. Some seasonal movements have been inferred by the information available on each of them (Reeves, 1978), but the details of routes and timing remain largely unknown.

Extralimital records are numerous, indicating either that walruses tend to be wanderers or that they frequently become confused. In the North Pacific, recent extremes have been recorded as far south as Honshu Island, Japan (Scheffer, 1958) and from the Okhotsk Sea (Moiseev, 1951, *In* Kosygin and Sobolevskii, 1971); in Alaska, a few have reached the southern-most Aleutian Islands, while others have penetrated eastward to Kodiak Island, Cook Inlet, and Yakutat Bay (Fay, 1981). In the North Atlantic, individuals have been reported in the south-west from Nova Scotia and Newfoundland (Wright, 1951; Mercer, 1967) and, in the south-east, from the Netherlands and Belgium (Bree, 1977).

### *Abundance and Life History*

The present world population of walruses probably does not exceed 250 000 individuals, at least four-fifths of which are in the North Pacific (Bering-Chukchi) region (Reeves, 1978; Estes and Gol'tsev, 1981). The Laptev population is believed to comprise about 4000-5000 animals (Tavrovskii *et al.*, 1971). In the North Atlantic, the largest population or group of populations, estimated to number about 25 000 individuals, exists in the eastern Canadian Arctic and West Greenland (Mansfield, 1966); each of the others evidently comprises no more than