

ORDER PINNIPEDIA

Pinnipeds, or "fin-foots", differ most obviously from other groups of aquatic specialists (Sirenia, Mysticeti, Odontoceti) in having flipper-like forelimbs and hindlimbs and in lacking a fluke-like tail. They also spend at least a portion of their life on land or ice. Members of this order can be separated into two groups on the basis of their means of locomotion: "walkers" (sea lions, fur seals, walruses) and "wrigglers" (true seals). Their diet consists primarily of fish, crustaceans, and molluscs.

Pinnipeds possess many physiological and anatomical adaptations that aid survival in sea water. Heat conservation is maximized by the presence of insulating layers of blubber and fur and by vasomotor control of blood flow to the extremities. In addition, special arrangements of small blood vessels in the flippers (retia mirabilia) shunt heat from the outgoing arterial circulation to the cool venous blood returning to the body. Dives are sustained by the high oxygen stores in muscle myoglobin, slowed heart rate (bradycardia), and channeling of blood to metabolically active tissues.

It has long been recognized that pinnipeds have close affinities to terrestrial carnivores, yet there is little consensus about the taxonomic assignment of pinnipeds. They have been given ordinal rank (Scheffer, 1958) or subordinal status in the order Carnivora (Simpson, 1945), although some recent authors (Mitchell and Tedford, 1973; Repenning and Tedford, 1977; Tedford, 1976) accord them no more than superfamily status in the Carnivora. Taxonomic questions center around whether the pinnipeds arose from

one or two carnivore ancestors (McLaren, 1960; Mitchell, 1967, 1975). Pending further clarification, the pinnipeds are here assigned to a separate order.

Recognition Characters:

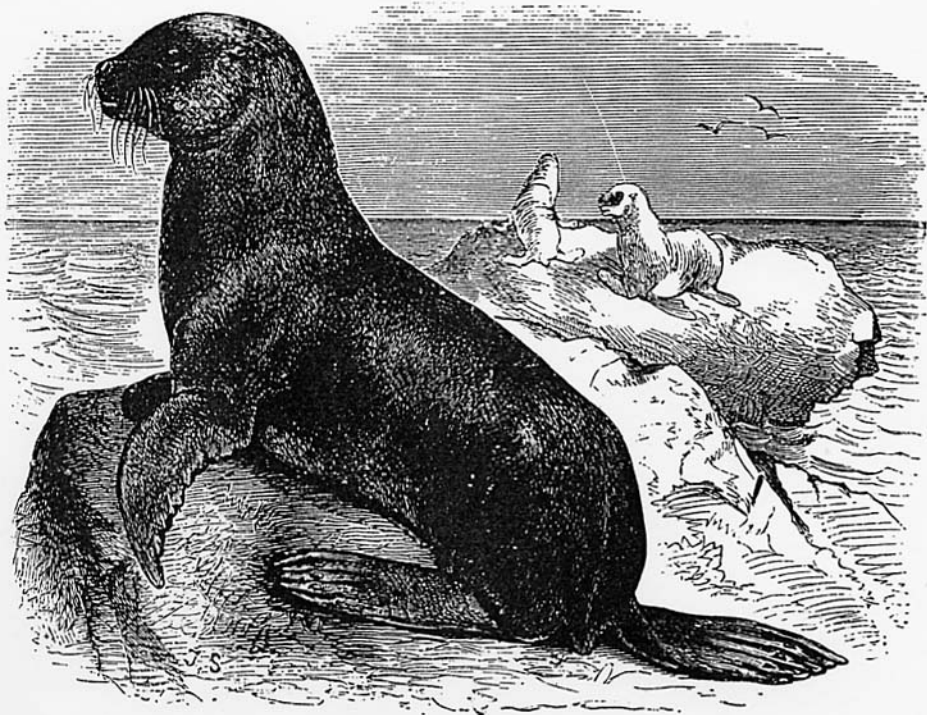
1. size medium to large.
2. **body streamlined, torpedo-shaped; hair very short.**
3. **forelimbs and hindlimbs modified into flippers.**
4. eyes positioned forward on face, close together.
5. pinna reduced or absent.
6. no lacrimal foramen.
7. incisors 1-3/0-2.
8. no carnassials.
9. cheekteeth relatively simple, conical or multi-cusped, without crushing surfaces.

Compare with: Carnivora.

Remarks: Good general references on pinniped biology include King (1964), Ridgway (1972), Ronald and Mansfield (1975), and Scheffer (1958). Behavior and physiology were treated by Harrison et al. (1968). For the most part, generic and species numbers in family accounts are taken from Rice (1977).

KEY TO FAMILIES OF PINNIPEDIA

- 1a. Hind limb permanently extended posteriorly, not capable of being turned forward and used in terrestrial locomotion; body usually spotted or banded; no alisphenoid canal; cheekteeth usually multi-cusped **PHOCIDAE** (p.236)
- 1b. Hind limb capable of being turned forward and used in terrestrial locomotion; body \pm uniform in color, without spots or bands; alisphenoid canal present (see Fig. 102); cheekteeth simple, usually one-cusped or peg-like 2
- 2a (1b). Pinna present; supraorbital process well developed; lower incisors present; upper canine prominent but not tusk-like **OTARIIDAE** (p.232)
- 2b. No pinna; no supraorbital process; no lower incisors; upper canine large, tusk-like **ODOBENIDAE** (p.234)



Sea lion.

Family OTARIIDAE
(Eared seals, sea lions)

Members of this group of pinnipeds are not as specialized for an aquatic existence as their counterparts, the phocids (p.236) Unlike true seals, when on land otariids retain the ability to rotate the hindlimbs to a forward position under the rear of the body. Pinnae are small but present, and the testes are scrotal. Propulsion in water is achieved mostly by undulations of the body and by movements of the oar-like foreflippers.

These animals are gregarious, congregating on sandy beaches, rocks, or reefs. They feed chiefly on fishes and squid. Vocalizations include barks and roars.

Otariids assemble in large herds to breed. Males are much larger than females. Harems, which include one bull and up to several dozen females, are established in the spring. Females are zealously guarded by the bull. After giving birth to a single pup conceived during the previous year's breeding activities, each female is courted by the male. Copulations take place within the confines of the harem group. Bulls generally do not feed during the breeding period. During the non-breeding season, animals often migrate considerable distances to preferred feeding sites.

The California sea lion is displayed as the "trained seal" in zoos and circuses. Fur seals are valued for their pelts.

Five genera, 14 species; coastlines of Pacific, South Atlantic, and Indian oceans.

Recognition Characters:

- **pinna present** (absent in other two pinniped families)

- **supraorbital process well developed** (absent or rudimentary in other two families) (Fig. 110).

1. body relatively uniform in color, never spotted.
2. **hindlimbs capable of being turned forward.**
3. nails prominent on middle three digits of hindfoot, absent or vestigial on forefoot; skin of flipper extending distally beyond nails.
4. testes scrotal.
5. **mastoid process separate from auditory bulla** (Fig. 110).
6. **medial two upper incisors with transverse groove** (Fig. 110).
7. cheekteeth simple, usually with one large cusp (Fig. 110).

Dental formula: $\frac{3 \ 1 \ 4 \ 1-3}{2 \ 1 \ 4 \ 1} = 34-38$

Compare with: Odobenidae, Phocidae.

Representative Genera:

Arctocephalus (including *Zalophus*; see **Remarks**) (9) - Southern fur seals, California sea lion. *A. pusillus*, the giant fur seal, and *A. californianus*, the California sea lion, are common species.

Callorhinus (1) - *C. ursinus* is the northern fur seal.

Eumetopias (1) - *E. jubata* is Steller's sea lion.

Otaria (1) - *O. flavescens* is the South American sea lion.

Remarks: *Zalophus* is placed in *Arctocephalus* following Van Gelder (1977). Treatments of natural history of individual species include Hamilton (1934, 1939), Marlow (1967, 1975), Peterson (1968), and Peterson and Bartholomew (1967).

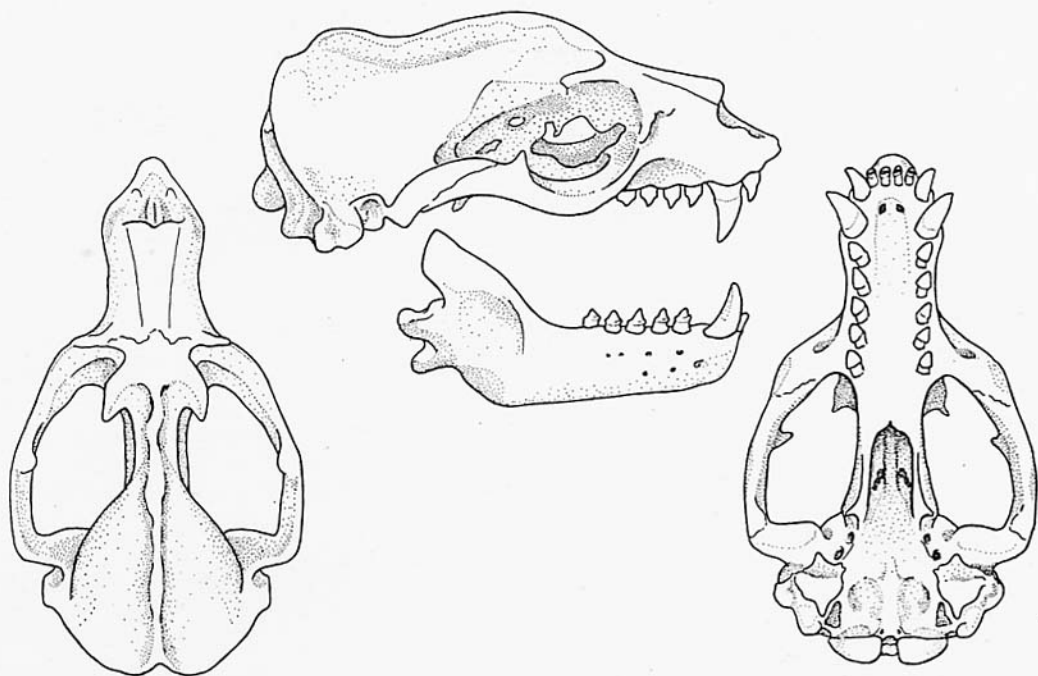


Figure 110. Skull of an otariid (*Arctocephalus*, x 1/4).

Family ODOBENIDAE
(Walrus)

The single species in this family is the largest living pinniped. The most obvious feature is the large tusk-like upper canine (Fig. 111) found in both sexes. Odobenids most closely resemble otariids (p.232) in superficial appearance, behavior, and cranial morphology.

These pinnipeds inhabit shallow waters, rocky shores, and ice in north polar regions, following pack ice during seasonal migrations to and from breeding areas. They associate in herds of mixed sexes and ages. Mating takes place during the northward migration in spring. Breeding is

probably polygynous, but little information is known of mating behavior. Pharyngeal pouches in males produce a spectacular "bell-sound" used in courtship displays (Ray et al., 1975; Schevill et al., 1966). A single pup is produced.

Walruses feed mostly on molluscs and other invertebrates. Feeding behavior is not precisely known, but they probably use their fleshy upper lips and sensory vibrissae on the snout to locate shellfish on the sea floor, and then dislodge the prey with the tusks.

One genus, 1 species; Atlantic and Pacific Oceans in Arctic regions.

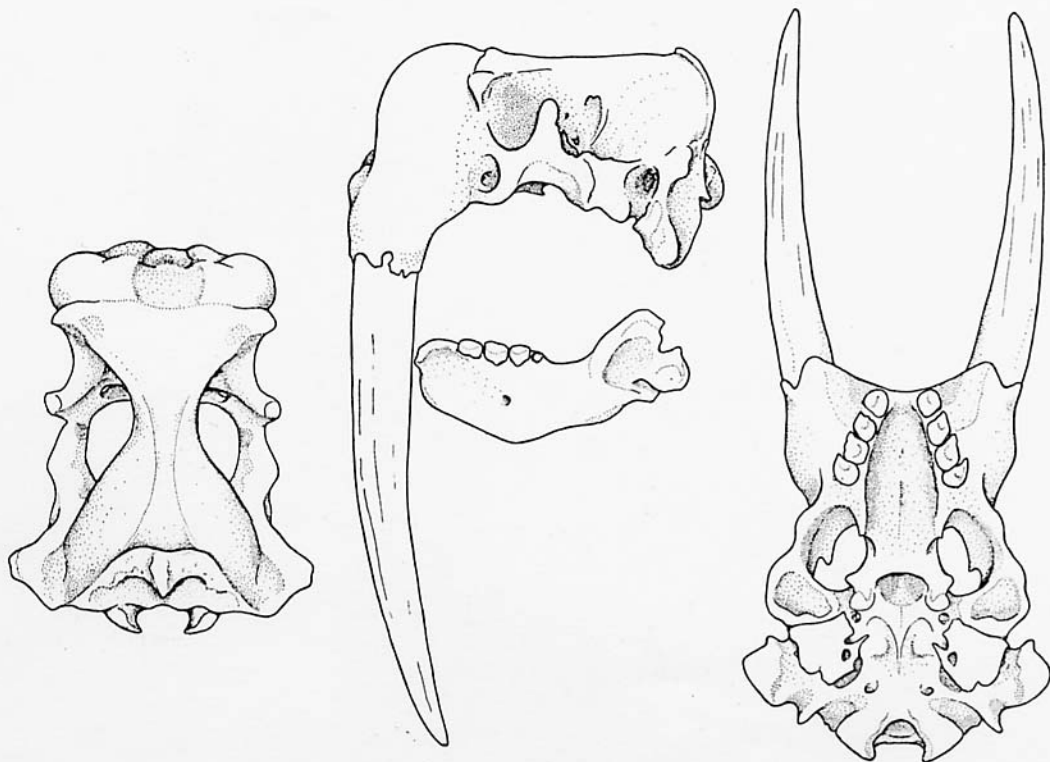


Figure 111. Skull of an odobenid (*Odobenus*, x 1/4).

Recognition Characters:

- **upper canine enormous, tusk-like** (Fig. 111).
- **no lower incisors** (present in other pinniped families) (Fig. 111).
 1. body uniform in color, never spotted.
 2. hindlimbs capable of being turned forward.
 3. nails present on all digits of forefoot and hindfoot; skin of flipper not extending distally beyond nails.
 4. testes abdominal.
 5. **mastoid process enormous, bound to auditory bulla** (Fig. 111).
 6. upper incisors small, conical (Fig. 111).
 7. **cheekteeth simple, peg-like** (Fig. 110).

Dental formula: $\frac{1-2 \ 1 \ 3-4 \ 0}{0 \ 1 \ 3-4 \ 0} = 18-24$

Compare with: Otariidae.

Genus:

Odobenus (1) - *O. rosmarus* is the walrus.

Remark: Ecology and behavior of walruses were treated by Brooks (1954) and Mansfield (1958).

Family PHOCIDAE
(True seals or earless seals)

Representatives of this family are the most aquatically-adapted pinnipeds. Appendages such as pinnae and genitals are absent or located internally. The hindlimbs are functionally modified into a tail which provides the major propulsive force in water. They move by waving the hindflippers from side to side (whales move the tail in an up-and-down fashion). Movements on land or ice are awkward—the forelimbs propel the seal forward while the hindlimbs are generally dragged along behind. For this reason, these pinnipeds are commonly referred to as “wrigglers”. They do not adopt an upright stance like that of sea lions and walruses.

Phocids are also the only pinnipeds that

commonly exhibit spots or bands. Pups are uniformly colored and have a dense woolly underfur that is generally lacking in adults. Adult ribbon and harp seals are sexually dimorphic for banding pattern; the patterns are more prominent in males. Spotted species (e.g., harbor seals) are quite variable in color and spot pattern.

Retreats are located on ice flows and on rocky, muddy, or sandy beaches and flats. Most species are gregarious, but a few are solitary. The diet consists primarily of crustaceans, molluscs, and small fishes. Complexly-cusped cheekteeth in crab-eater seals and leopard seals are used for filtering krill and capturing penguins, respectively.

These animals usually form large associations during the breeding season. Since copulation usually takes place in

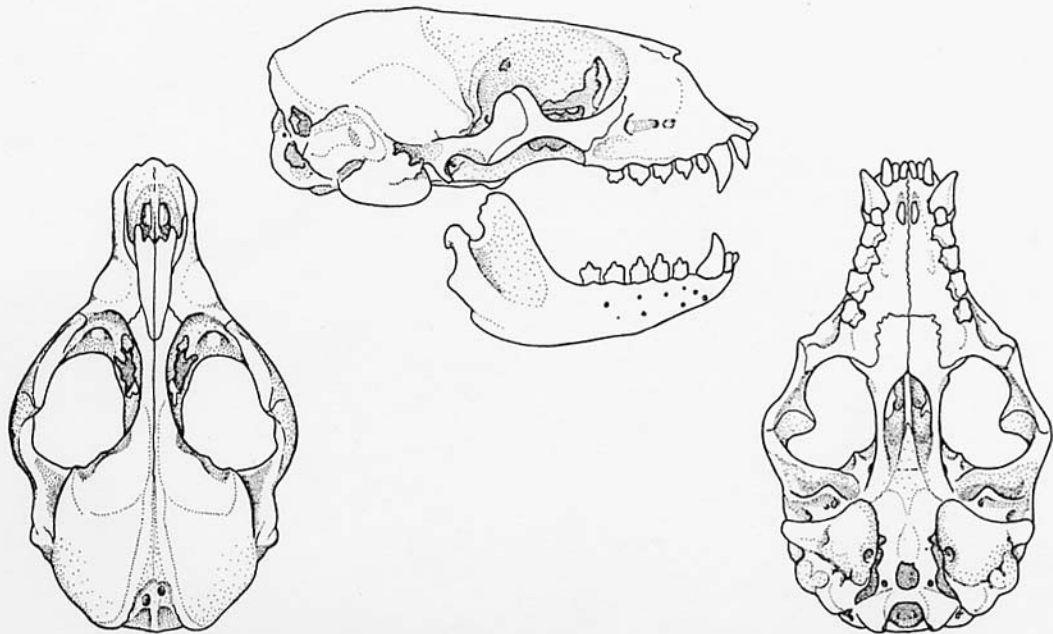


Figure 112. Skull of a phocid (*Phoca*, x 1/4).

water, mating behavior is poorly known even for common species. A single pup is produced.

Ten genera, 19 species; coastlines north of 30° north latitude and south of 50° south latitude, Lake Baikal, Caspian Sea, and scattered locations elsewhere.

Recognition Characters:

- **no alisphenoid canal** (present in other two pinniped families).
- 1. **body usually spotted or banded** (uniformly colored in some).
- 2. **hindlimbs extended posteriorly, incapable of forward rotation.**
- 3. claws present on digits of forefoot and usually on hindfoot; skin on flipper not extending beyond nails.
- 4. testes abdominal.
- 5. mastoid process bound to auditory bulla, the latter inflated (Fig. 112).
- 6. upper incisors not grooved (Fig. 112).
- 7. **cheekteeth usually multi-cusped** (elaborately so in *Lobodon*) (Fig. 112).

Dental formula: $\frac{2-3}{1-2} \frac{1}{1} \frac{4}{4} \frac{0-2}{0-2} = 26-36$

Compare with: Otariidae.

Representative Genera:

Hydrurga (1) - *H. leptonyx* is the leopard seal.

Leptonychotes (1) - *L. weddelli* is the Weddell seal.

Lobodon (1) - *L. carcinophagus* is the crabeater seal.

Monachus(3) - Monk seals.

Mirounga(2) - Elephant seals.

Phoca (including *Pusa* and *Pagophilus*) (7) - Harbor, ringed, spotted, harp, and ribbon seals and allies.

Remarks: Useful references on phocid species include Bertram (1940), Hewer (1974), King (1956), LeBoeuf and Briggs (1977), McLaren (1958), and Sivertsen (1941).