

# Encyclopedia of MARINE MAMMALS

# **Editors**

# William F. Perrin

Southwest Fisheries Science Center, NOAA La Jolla, California

# Bernd Würsig

Texas A&M University
Galveston, Texas

# J. G. M. Thewissen

Northeastern Ohio Universities College of Medicine Rootstown, Ohio



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With so many complications, it is not surprising that the biological stock structure of most marine mammal species (even those that were exploited heavily by commercial harvesting) remains uncertain. However, multidisciplinary techniques, technological advancements, and continued attention should allow us to make rapid progress in identifying biological stocks of marine mammals and to design more effective management programs in the absence of essential biological information.

### See Also the Following Articles

Conservation Biology Genetics for Management Geographic Variation Molecular Ecology Species

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# Stranding

WILLIAM F. PERRIN

Southwest Fisheries Science Center, La Jolla, California

Joseph R. Geraci

National Aquarium in Baltimore, Maryland

tranded whales have fascinated us through history (Fig. 1). Why do marine mammals strand, what can we learn from their misfortune, and what can we do about it?

# I. Why Do Marine Mammals Strand?

Animals that die or become enfeebled at sea of course may be brought passively to shore by wind and wave action. More intriguing are those cases where marine mammals in distress purposely come ashore. A stranded animal when returned to the water may deliberately strand again. This is very frustrating to those who are trying to "rescue" it. It must be understood that an animal may have stranded because it has decided that it cannot keep itself afloat and survive at sea. Thus, deliberate stranding may represent an effort to keep breathing, whatever the ultimate cost. While this may not be adaptive behavior in evolutionary terms because nearly all stranded animals die if unassisted, given the alternative of equally certain but earlier death, the consideration may be moot. A will to survive is adaptive in general, even if not effective in this circumstance.

The natural and unnatural causes of death and disablement leading to single strandings are many: environmental conditions such as anomalously low sea temperature or ice entrapment, parasites, disease, biotoxins, ENTANGLEMENT associated with fisheries, starvation due to decreased food supply, collisions with vessels, contaminants, oil spills, and death or direct injury inflicted by predators, other marine mammals, or at the hands of humans (Geraci and Lounsbury, 1993). Determining the cause of a stranding can be very difficult, even when one is not dealing with a decomposed carcass; symptoms and pathology may be obscure, and two or more factors may be operating simultaneously. Animals that strand in a cluster over a period of a few days may be victims of poisoning, infectious diseases, intensive local fisheries operations, or unusual environmental events. By the time the strandings are investigated, the ultimate cause may no longer be evident.

Certain patterns are exhibited in the strandings of particular species related to their distribution, migrations, and reproduction (Geraci and Lounsbury, 1993). For example, newborn gray whales, *Eschrichtius robustus*, are likely to come ashore in the lagoons of Baja California only during the winter calving season. For all cetaceans, the mother/calf bond is very strong and may continue after lactation ceases. If they come ashore together, it may be impossible to determine who led the way. Young juvenile males of highly social pelagic species may strand after being lost or displaced from bachelor schools; this is



Figure 1 A sei whale (Balaenoptera borealis) stranded in Argentina in 1940. From Leatherwood et al. (1982).

thought to happen to young Atlantic white-sided dolphins, Lagenorhynchus acutus, along the U.S. northeast coast during the fall. Some species follow the migrations of prey. Long-finned pilot whales, Globicephala melas, for example, pursue squid into shallow waters of Cape Cod Bay during the autumn and early winter and can be expected to strand at these times.

Mass strandings have always been the most puzzling. A large number of whales or dolphins of pelagic species such as sperm whales (Physeter macrocephalus), pilot whales (Globicephala spp.), false killer whales (Pseudorca crassidens), or Fraser's dolphins ( $Lagenodelphis\ hosei$ ) may come ashore together for no apparent reason and in seeming good health (Fig. 2). While there undoubtedly is more than one cause of mass stranding in these animals, evidence is accumulating that caregiving behavior engendered by tight social bonds may be involved in at least some cases. For example, a herd of 30 false killer whales that semistranded in very shallow water in the Dry Tortugas in 1977 included a large male that was moribund due to illness or injury (Connor, 2000). The other whales clustered around this male and did not return to deep water until he died 3 days later. The whales became agitated when would-be rescuers tried to separate them and insisted on remaining in a tight group around the large male. Similar behavior has been reported for other mass strandings, with rescued individuals deliberately rejoining a group on the beach containing one or more severely ill or injured animals (Geraci et al., 1999). In most cases, in the absence of human intervention, the entire group perishes, victims of a social cohesion that must be highly adaptive in other circumstances. On a population basis, mass stranding must be a rare event, or it could not persist evolutionarily. Suicidal mass stranding has been suggested as a possible mechanism for population regulation (Sergeant, 1982), but this smacks of the group selection hypothesis of Wynne-Edwards (1962), now largely discredited.

In some other instances of mass stranding, careful investigation has uncovered pathological evidence of widespread disease or parasitism that may have been causal or contributory. For example, about half of the mature females in a large stranded group of Atlantic white-sided dolphins were severely infected with a nematode to the extent that reproductive success was likely affected (Geraci et al., 1978). In a stranding of 33 or more short-finned pilot whales, Globicephala macrorhynchus, in Florida, all live individuals examined were clinically ill, exhibiting an increased respiratory rate, difficulty in breathing, an elevated heart rate, and a wide range of metabolic and hematological abnormalities (Walsh et al., 1991). As Walsh and colleagues noted: "In such a case, the actual etiology of the stranding event may be unknown because the original inciting factor, such as a virus, may have occurred days or even weeks before."

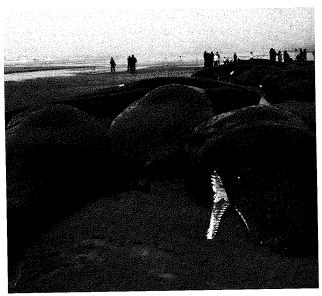


Figure 2 A mass stranding of sperm whales in Oregon in 1979. Photo by Robert L. Pitman.

Several additional causes for mass stranding have been posited (Geraci and Lounsbury, 1999). Areas with broad tidal flats, strong or unusual currents, or extreme tidal volume may lead to errors of navigation or judgment that result in stranding. It has been suggested that pelagic animals may run aground in shallow water because their echolocation is impaired. Others believe that cetaceans use the earth's magnetic field for navigation and are led astray by magnetic anomalies or disturbances. However, the only apparent common factor is strong social cohesion, strong enough that when a single animal comes ashore, for whatever reason, others in the group are likely to follow.

Mass strandings may be increasing in frequency, due possibly to anthropogenic causes. For example, during the period 1981 and 1991, there were 20 mass strandings of long-finned pilot whales, on 32 miles of beach in Cape Cod, Massachusetts, whereas only 1 had been reported in the previous 20 years, and epidemiological evidence suggests a possible link with recent morbillivirus outbreaks affecting a number of marine mammal species in the North Atlantic and Mediterranean (Geraci and Lounsbury, 1999; Duignan *et al.*, 1995). The impact of a viral outbreak may be potentiated by organochlorine pollutants that weaken the immune system.

# II. What Can Be Learned from Strandings?

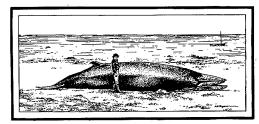
All we know about many species of cetaceans is only what we have learned from strandings. This is true for many of the BEAKED WHALES, the Mesoplodon species, for example. They are not kept in captivity for exhibit, are hunted only rarely and in remote parts of the world, and are relatively rare, elusive, and notoriously difficult to observe at sea. A rotting carcass on the beach can yield invaluable information on such things as anatomy, life history, genetics, disease, parasites, predators, contaminants, and feeding ecology. A live strandling transported to a holding facility can inform us about physiology, behavior, and cognition. A mass stranding offers a population sample (albeit potentially biased), opening to view parameters such as sex ratio, age structure, pregnancy rate, lactation rate, and relatedness within a group. Every stranding event should be considered a potentially unique opportunity to learn something that cannot be learned any other way.

#### III. Stranding Programs

In order to take full advantage of the scientific opportunities offered by stranded marine mammals, formal stranding response programs have started up in many parts of the world. One of the first was begun by Frederick True, the noted cetologist and one of the first curators of the U.S. National Museum of Natural History (Smithsonian Institution) in Washington, DC, and resulted in the beginnings of the largest collection of marine mammal specimens in the world. The stranding program has continued to the present (Fig. 3) and is a world model for stranding-response procedures and data and specimen collection and curation (Geraci and Lounsbury, 1993). Another early stranding program began in Britain when

# Marine Mammal Salvage Program

# WANTED



# INFORMATION CONCERNING STRANDED OF BEACHED

# WEALES, DOLPHINS & SEALS

Smithsonian Institution
Washington D.C.
Scientific Event Alert Network - SEAN

Figure 3 Stranding poster issued by the Smithsonian Institution in the 1970s.

the board of trade instructed receivers of wrecks to send telegraphic reports of the stranding of whales to the British Museum (Harmer, 1914). As "Royal Fishe," stranded cetaceans are property of the Crown and thus receive special attention and care. This has resulted in a long series of detailed data reports on Cetacea stranded on British coasts and basic knowledge of many North Atlantic species, as well as an immense and irreplaceable collection of specimens (Fraser, 1974; Sheldrick et al., 1994). Perhaps the oldest stranding program, although not scientifically based or motivated, is in Vietnam, where cetaceans are revered as sea-going friends and souls, and those washing ashore have been collected and their skeletons preserved in Buddhist temples for centuries; these accumulations are now yielding information on the cetacean fauna of the region (Smith et al., 1997).

In recent years, formal stranding programs have been established in many countries, including Australia, Japan, New Zealand, Canada, France, Italy, Argentina, Brazil, Thailand, the Philippines, and others. In the United States, a national stranding alert network and officially mandated regional stranding programs arose after passage of the Marine Mammal Protection Act in 1972. These new programs around the world are