

productive season is short. In many cases, animals must consume a yearlong supply of food over the course of a few months because reproductive periods necessitate fasting, especially for species that haul-out on land, and those large whales that feed in high latitude waters and migrate to lower latitudes to mate/calve. The effects of climate warming on polar bears is a clear case where access to prey such as ringed seals (*Pusa hispida*) has been disrupted by earlier breakup and later formation of sea ice in some areas of the eastern Canadian Arctic. Long-term records show declines in population size and body condition for bears in Western Hudson Bay and Baffin Bay due to the extended fasting imposed on the bears by longer ice-free periods. There is no other species of marine mammal for which such a long-term record exists to investigate the potential effects of climate change on feeding opportunities. However, anecdotal observations suggest that rapid diminution of seasonal sea ice in the Arctic could also be affecting feeding opportunities and recruitment in Pacific walrus. In summer, female walrus and their calves ride the retreating sea ice north from the Bering Sea to the northern Chukchi Sea. In the recent past, at maximum recession the sea ice edge as approximately at the edge of the Chukchi Sea continental shelf and adult female walrus could make easy forays there to feed, then return to suckle calves while hauled out on sea ice. However, in recent years, sea ice has retreated rapidly and far into the deep water of the Canadian Basin. Adult walrus must undertake long swims (ca. 100+ km) between sea ice haul-outs and shallow-water feeding areas, at considerable energetic cost. In addition, the report of at least nine walrus pups separated from adult females in deep water habitat suggests that young may become separated from their mothers before they are weaned. Without the food or protection of their mothers, these pups would almost certainly die. Whether this situation is having a measurable effect on the Pacific walrus population is unknown, as population size and trend for these pagophilic (ice-associated) animals have not been accurately determined.

III. Disease and Toxins

Infectious diseases can cause rapid declines in wildlife populations. Rates of pathogen development, disease transmission, and host susceptibility are all influenced by climate, with a greater incidence of disease anticipated with warming. Marine mammal health and reproductive success are also adversely affected by toxins associated with harmful algal blooms (HABs). Marine mammal deaths associated with HABs appear to have increased over the past three decades, as have the frequency and geographic distribution of the events. Although coincident with climate warming, these apparent increases in HABs may also reflect improvements in the ability to detect HABs and in the capability to identify algal toxins in marine mammal tissues. While marine mammals may face greater risk of mortality due to disease outbreak or exposure to toxins in a warming ocean, the magnitude of these threats and their relationships to climate are difficult to judge. Fortunately, diagnostic tools to monitor and measure the effects of disease and HABs on marine mammal populations are in rapid development, and combined with access to satellite imagery of the oceans and geo-spatial modeling, there is some hope for rapid advances in this field.

See Also the Following Articles

Biogeography ■ Ecology, Overview ■ Ocean Environment

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Clymene Dolphin

Stenella clymene

THOMAS A. JEFFERSON

I. Characteristics and Taxonomy

The Clymene dolphin is a small, but rather stocky dolphin with a moderately long beak, separated from the melon by a distinct crease (Fig. 1). The dorsal fin is tall and nearly triangular to slightly falcate, and the flippers and flukes are typical of dolphins of the genera *Stenella* and *Delphinus*. The body shape is probably most similar to that of the striped dolphin, but coloration is very different. The color pattern is distinctly tripartite, with a white belly, light gray flanks, and dark gray cape (Fig. 1). The cape dips below the dorsal fin, somewhat lower than in the spinner dolphin. There is an eye stripe that runs forward to the upper beak and connects with a dark gray stripe running down the length of the top of the beak. The most distinctive feature is a black “mustache” marking of variable extent and intensity on the top of the beak. The lips are dark. Often there is a dark, indistinct band between the white belly and gray sides. With the exception of the mustache, most of the species’ external characters are very similar to those of the spinner dolphin. This is one of the reasons why the Clymene dolphin was not fully recognized as a distinct species until 1981 (Perrin *et al.*, 1981).

Not many individuals of this species have been examined in detail and measured, so data are limited. These small dolphins probably do not reach much over 2.0 m in length, with males somewhat larger and heavier than females (Jefferson, 1996). Adult-sized females have been between 171 and 190 cm, and males between 176 and 197 cm (Perrin and Mead, 1994; Jefferson, 1996). The maximum



Figure 1 A *Clymene* dolphin leaps at the bow wave of a research vessel in the northern Gulf of Mexico, showing the species' diagnostic characteristics. The dark vertical streak on the tail stock is not typical coloration. Photo by R. L. Pitman.



Figure 2 Three *Clymene* dolphins ride the waves produced by a research vessel in the offshore Gulf of Mexico. These dolphins are avid bowriders and are very active, often leaping and breaching alongside vessels. Photo by T. Pusser.

known weight is about 80 kg, but considering the few specimens that have been weighed, they probably reach somewhat greater weights than this.

The skull of this species is very similar to that of *Stenella longirostris* and *S. coeruleoalba* (especially the latter). It can be distinguished by its small size (CBL <415 mm), combined with a short, broad rostrum. Tooth counts range from 39–52 (upper) and 39–48 (lower) (Jefferson and Curry, 2003). Total vertebral counts for the small number of specimens examined so far have been 70–76.

The species was named after the Greek sea nymph, Clymene (daughter of Oceanus and Tethys), and therefore Clymene should always be capitalized in the common name (Jefferson and Curry, 2003). Other English common names include short-snouted spinner dolphin and helmet dolphin. Taxonomically, *S. clymene* is considered to be most closely related to *S. longirostris* and *S. coeruleoalba* (Perrin *et al.*, 1981; Perrin and Mead, 1994). However, genetic studies indicate that its cytochrome *b* sequence is actually closer to that of *S. coeruleoalba* (LeDuc *et al.*, 1999). Specimens thought to be hybrids between *S. clymene* and *S. longirostris* have been observed in the southwestern Atlantic (Silva *et al.*, 2005).

II. Distribution and Abundance

The Clymene dolphin is found only in the Atlantic Ocean, in tropical to warm-temperate waters (Fertl *et al.*, 2003). The exact range is not well documented, especially in South Atlantic, mid-Atlantic, and West African waters. Presumably it occurs continuously across the Atlantic Ocean. Recently, the known range off the coast of West Africa has been extended south to Angola (Weir, 2006). Most sightings have been in deep, offshore waters, although Clymene dolphins are sometimes observed very close to shore where deep water approaches the coast (such as around some islands of the Caribbean). It is present year-round in at least the northern Gulf of Mexico and probably throughout much of its tropical range.

No estimates of overall abundance exist, although there are estimated to be over 17,000 Clymene dolphins in the northern Gulf of Mexico (Mullin and Fulling, 2004). Considering this, it seems likely that the global abundance of the species is over 100,000 dolphins, and the species is not considered to be in danger of extinction. However, despite this, little is actually known about the status of any stock.

III. Ecology

There is very little known about the feeding ecology of this species, as very few stomachs have been examined. It apparently feeds mostly on mesopelagic fishes and squids, including some species that are vertical migrators (Jefferson and Curry, 2003).

External parasites include barnacles on appendages and whale lice in lesions and body grooves. Internal parasites have not been well studied but include various worms and flukes in the blubber and muscle, respiratory system, digestive system and brain and in the mammary glands of females. They can cause disease and have been implicated in the deaths of some animals.

Clymene dolphins associate with dolphins of other species on occasion, in particular spinner dolphins. Associations with tuna are known to occur off the West African coast (Cadenat and Doutre, 1958). Many Clymene dolphins bear bite marks and scars from cookie-cutter sharks on their bodies, and large sharks and killer whale are probable predators (although actual predation events have not been documented).

IV. Behavior and Physiology

Schools of this species are often moderately large, although most appear to consist of less than a few hundred individuals. In the Gulf of Mexico, where most information on school size comes from, the average group size is 42 dolphins (Mullin *et al.*, 1994). Schools may be segregated by age and sex class, as evidenced by several mass stranded herds that were composed largely of individuals of one or the other sex (Jefferson *et al.*, 1995).

Clymene dolphins are active bow riders, sometimes approaching ships from a distance for a free ride (Fig. 2). They are also often aerially active and they do spin on their long axes like spinner dolphins (something that only a few species of dolphins do), although apparently not as frequently or as elaborately as the spinner dolphin. Cooperative foraging techniques have been observed in the Gulf of Mexico (Fertl *et al.*, 1997).

Although there has been little work done on acoustic behavior (Mullin *et al.*, 1994), these animals often appear to be quite vocal, with whistles in the frequency range of 6–19 kHz (Wang, 1993). Virtually nothing is known about the species' physiology.

V. Life History

There have been no published studies on the life history of this species based on large samples of specimens. Most of what we know is based on scant information from strandings, mostly from the Gulf of Mexico. Both males and females appear to reach sexual maturity by a length of 180 cm (Jefferson and Curry, 2003). Nothing is known of other life history parameters, but they are thought to be broadly similar to those of other members of the genus *Stenella*.

VI. Interactions with Humans

Clymene dolphins have not been held captive, except for occasional animals that were kept temporarily after stranding alive. No major conservation problems are known for this species, but it is likely that some undocumented problems exist. Some dolphins are known to be killed in directed fisheries in the Caribbean, and others incidentally in nets throughout most parts of the range. This may be one of the species involved in the tuna purse seine fishery in the Gulf of Guinea area of West Africa (Maigret, 1981). It is possible that large, but undocumented, incidental catches may occur there, as they have in the eastern tropical Pacific. There has been almost no work on environmental contaminants in this species (Jefferson and Curry, 2003).

See Also the Following Articles

Spinner Dolphin ■ Striped Dolphin ■ Bow-riding

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Coloration

WILLIAM F. PERRIN

Marine mammals are not as colorful as birds or fishes or reptiles, but many have striking and distinctive coloration patterns that are useful in their taxonomy, presumably have function and adaptive value, and can vary individually and with age, sex, geographic region, and even time of the year.

I. Terminology

A number of schemes have been proposed for naming the elements of color patterns in cetaceans; the usage here follows Perrin (1973, Perrin, 1997) and Perrin *et al.* (1991). In delphinids and phocoenids (Fig. 1), the *bridle* is composed of the *blowhole stripe* running from the blowhole to the apex of melon and the *eye stripe* from the eye to the apex of melon. Both stripes may have complex internal structure. An *eye spot* may be visible, and there may also be a small *ear stripe* or *spot*. The *eye-to-anus stripe* runs from the eye to the anal/genital region and may have *accessory stripes*. The *flipper stripe* runs forward from the base of the flipper variously to the eye (e.g., in spinner dolphin, *Stenella longirostris*), corner of the mouth (e.g., pantropical spotted dolphin, *S. attenuata*), or forward along the rostrum to join the *lip mark* ventrolaterally (common dolphins, *Delphinus* spp.).

The overall color pattern in at least some delphinids can be analyzed in terms of interacting independent components (Fig. 2). A basic *cape* is covered with a *dorsal overlay* of varying extent and intensity and may not be visible except in fetal or anomalously pigmented specimens. A crisscross of the boundaries of these two elements in *Delphinus* spp. yields a complex four-part pattern of a dark-gray *dorsal field* (cape and overlay combined), buff or yellowish *thoracic patch* (cape alone), light-gray *flank patch* (overlay alone), and white *ventral field* (outside both cape and overlay). In some anomalous individuals, the overlay may be absent, yielding a simplified pattern of cape only [e.g., in *Delphinus delphis* (Perrin *et al.*, 1995) and *Stenella longirostris* (Perrin, 1973)]. Spotting appears to be yet another independent component that develops with maturation in some species.

In pinnipeds, coloration can be a property of different *pelages* or pelage elements, through a range from white to silver, gray or bluish gray, brown, and black. The *lanugo* is a fetal pelage that develops and can be lost before birth, although in many species it is shed a few days or weeks after birth. Juveniles may undergo additional *molts* and changes of color. The coarse *guard hairs* can differ in color from