MAMMALIAN SPECIES No. 683, pp. 1–8, 3 figs.

Stenella attenuata.

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Published 26 December 2001 by the American Society of Mammalogists

Stenella attenuata (Gray, 1846)

Pantropical Spotted Dolphin

Delphinus velox G. Cuvier, 1829:288. Type locality "Ceylon" (Sri Lanka).

Delphinus pseudodelphis Wiegmann in Wagner, 1840:pl. 358 (no text). Type locality not given.

Steno attenuatus Gray, 1846:44, pl. 28. Type locality not given.

Delphinus brevimanus Wagner, 1846:7, pl. 361, fig. 2. Type locality not given.

Delphinus albirostratus Peale, 1848:34, pl. 7, fig. 2. Type locality "Pacific Ocean; latitude 2°47′5″S., longitude 174°13′W. of Greenwich" (near Phoenix Islands).

Delphinus microbrachium Gray, 1850:119. New name for *D. brevimanus* Wagner.

Steno capensis Gray, 1865:522. Type locality "Cape of Good Hope" (South Africa).

Clymene punctata Gray, 1866:738. Type locality "Lat. 16°40′N., long. 21°W." (near Cape Verde, West Africa).

Steno consimilis Malm, 1871:104, pl. 6, figs. 53a and 53b. Type locality "Madagaskar."

Prodelphinus graffmani Lönnberg, 1934:1, pl. 1. Type locality "approximately 20 miles north of the port of Acapulco" (Mexico).

Stenella attenuata Iredale and Troughton, 1934:66. First use of current name combination.

CONTEXT AND CONTENT. Order Cetacea, suborder Odontoceti, family Delphinidae, subfamily Delphininae (LeDuc et al. 1999). Genus *Stenella* contains 5 species (Rice 1998). Two subspecies recognized, 1 offshore and 1 coastal (Perrin et al. 1987):

S. a. attenuata (Gray, 1846:44, pl. 28). Type locality not given.
S. a. graffmani (Lönnberg, 1934:1, pl. 1), see above.

DIAGNOSIS. The pantropical spotted dolphin (Fig. 1) is distinct from the Atlantic spotted dolphin *S. frontalis* in external color. The unspotted calf has a strongly defined cape passing high over the eye, a flipper stripe terminating anteriorly at the angle of gape, and a peduncle divided into dark upper and light lower portions (Perrin 1970), as opposed to a weakly defined cape, a flipper stripe terminating variably between end of gape and eye, and uniform color of the peduncle in *S. frontalis*. *S. attenuata* has no spinal blaze as in *S. frontalis*. Eye stripe is relatively narrow (1–2 cm), as opposed to broad in *S. frontalis*.

In adults several centimeters of the distal ends of rostrum and lower jaw may be white (not present in *S. frontalis*). *S. attenuata* differs from the similarly sized and shaped *Delphinus capensis*, *D. delphis*, *S. longirostris*, *S. clymene*, *S. coeruleoalba*, *Sousa chinensis*, *Sousa plumbea*, *Sousa teuszi*, *Sotalia fluviatilis*, *Tursiops aduncus*, and *T. truncatus* in ground color pattern (shades of gray, cape high over eye, no spinal blaze, no stripes, peduncle divided into light upper and dark lower halves) and in possessing light dorsal spots.

Skull can be confused with that of *S. frontalis*, with which it overlaps in every character (Perrin et al. 1987). In some geographic areas, such as the Caribbean, skulls of the 2 species appear nearly identical. Both have a relatively long and narrow, relatively thick rostrum with no palatal grooves, a large number of small slender teeth (35–48 in each jaw in *S. attenuata* and 30–42 in *S. frontalis*), medially convergent premaxillae, medium-sized rounded temporal fossae, and arcuate rami (Heyning and Perrin 1994; Perrin et al. 1981, 1987). Individual skulls can be identified as *S. attenuata* or *S. frontalis* on a maximum-likelihood basis with stepwise discriminant classification functions incorporating 4 measurements and a tooth count: width of the rostrum at ¾ length, width of the rostrum at ½ length divided by postorbital width, width of the prenarial triangle at 60 mm divided by postorbital width, and highest rostral tooth count (Perrin et al. 1987). The respective coefficients for the variables and constants are: (*S. attenuata*) −0.0984, 1.7263, 0.0158, 14.0818, −494.2775; (*S. frontalis*) 0.0317, 1.8991, −0.3063, 12.7033, −500.8247; to use, add products of variables and coefficients to constants, and classify as *S. attenuata* or *S. frontalis*, depending on which classification function has the higher value. Palatal grooves that are present in *S. clymene*, *S. longirostris*, *Delphinus*, *Lagenodelphis hosei*, and some specimens of *S. coeruleoalba* are lacking in the pantropical spotted dolphin. *S. attenuata* also differs from these species in not possessing a distally flattened and broadened rostrum and sigmoid rami (Perrin et al. 1981). Vertebral count (74–84) does not overlap with that of *S. frontalis* (67–72).

GENERAL CHARACTERS. The pantropical spotted dolphin is a small and slender dolphin; length of sexually mature adults ranged from 162 to 257 cm ($n > 7{,}791$—Perrin and Reilly 1984). Maximum recorded weight was 119 kg (a 257-cm male from the Bay of Panama—Perrin and Hohn 1994). Sex-specific relationships between body length (L) and mass (M) are: $\log M = -4.1576 + 2.6120 \log L$ ($n = 33$ nonpregnant oceanic females from the eastern tropical Pacific), and $\log M = -4.7135 + 2.873 \log L$ ($n = 66$ males—Perrin et al. 1976). Ranges of other external measurements follow (in cm, with parenthetical sample size): tip of upper jaw to apex of melon, 8–13 (139); tip of upper jaw to end of gape, 21–29 (161); tip of upper jaw to umbilical scar, 80–107 (131); tip of upper jaw to tip of dorsal fin, 97–120 (128); girth at axilla, 71–99 (130); anterior length of flipper, 23–30 (27); width of flipper, 8–12 (27); span of flukes, 36–49 (120); width of fluke, 10–15 (17); height of dorsal fin, 12–20 (111—Perrin and Hohn 1994; Perrin et al. 1987).

Eye stripe encloses a black eye spot and extensions of the eye spot as a black line (a few mm wide) occur forward to apex of melon (Perrin 1997). The entire eye stripe may be bordered by a narrow light line. Blowhole stripe is relatively narrow and may be composed of subelements. Intersection of anterior end of flipper stripe and lip mark is demarcated by a narrow light line. Ventral margin of flipper stripe may be bordered by a narrow light line and subtended by a parallel narrow dark line. A light-gray band (4–6 cm) may parallel the ventral margin of the cape. In heavily spotted individuals of the eastern Pacific coastal subspecies, the ground pattern may be nearly obscured dorsally. Spotting may extend to

FIG. 1. Gray's pantropical spotted dolphin (*Stenella attenuata attenuata*) from the eastern tropical Pacific. Photograph courtesy of R. L. Pitman and the U.S. National Marine Fisheries Service.

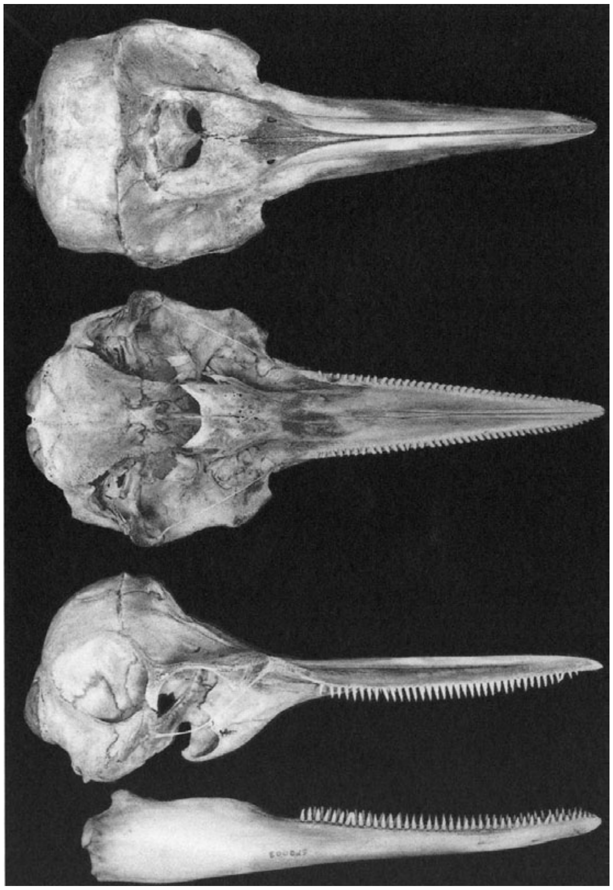

FIG. 2. Dorsal, ventral, and lateral views of cranium, and lateral and dorsal views of mandible of *Stenella attenuata attenuata* from the eastern tropical Pacific (sexually mature female, 181 cm total length, Southwest Fisheries Science Center SWFC 0014; erroneously identified as male in Perrin and Hohn [1994]). Greatest length of skull is 384 mm.

dorsal fin and flippers. Dorsal fin is strongly falcate and relatively narrow.

The pantropical spotted dolphin varies geographically in size as well as in the degree of spotting and is sexually dimorphic in size (Perrin and Hohn 1994; Perrin and Reilly 1984; Perrin et al. 1987). In the eastern Pacific, average lengths of adult males in the coastal and offshore subspecies were 223 cm (n = 47, range 197–246) and 200 cm (n = 1,280, range 166–240), respectively. Average lengths of adult females were 207 cm (n = 87, range 179–227) and 182 cm (n = 3,890, range 163–215), respectively. The length for males in the western North Pacific, southwest Indian Ocean, North Atlantic, and Gulf of Mexico ranged from 193 to 234 cm (n > 307) and for females from 173 to 215 cm (n > 348). In the eastern and western tropical Atlantic, the large coastal form of *S. attenuata* is ecologically replaced by a similar large form of *S. frontalis*.

Skull (Fig. 2) is 356–450 mm long (condylobasal length; n = 315) and 148–198 mm wide (zygomatic width; n = 183), with a relatively long and narrow rostrum (208–287 mm long and 35–60 mm wide at half-length; n = 176 and 185, respectively—Perrin 1975). Rostrum tapers to a relatively sharp and deep tip; distal teeth are not splayed as in some delphinines. Premaxillae and maxillae begin to fuse distally at about the time of sexual maturation, and in an older adult skull the fusion may extend over several centimeters. The tip of the rostrum may become more blunt with age and is more blunt in adult males than in females. Premaxillae may also fuse medially in adults. Palate is flat at midlength. Pterygoid hamuli are usually in contact medially but may be separated by several millimeters. The 2 terminal teeth are very small and may be buried in bone. Ramus is arcuate and symphysis relatively long. Tympano-periotic bones closely resemble those of *S. coeruleoalba* (Kasuya 1973); ventral keel is conspicuously high. Ranges of tooth counts and additional selected measurements (in mm with parenthetical sample size) for specimens from around the world (measurements described in Perrin 1975) are: upper teeth, 35–48 per row (315); lower teeth, 34–47 per row (315); width of rostrum at base, 74–100 (186); width of rostrum at ¾ length, 23–43 (177); preorbital width, 134–178 (184); postorbital width, 151–196 (183); greatest width of premaxillae, 57–76 (186); parietal width, 129–161 (185); length of temporal fossa, 53–97 (184); height of temporal fossa, 33–79 (184); length of ramus, 296–393 (167); tooth diameter (mid-lower row, transverse), 2.6–4.1 (42); width of prenarial triangle at 60 mm, 2.1–15.6 (160—Perrin and Hohn 1994; Perrin et al. 1987). Sexual dimorphism in the skull is slight; percentage differences (females versus males) in 30 measurements of 170 offshore specimens from the eastern tropical Pacific (Perrin et al. 1994b) ranged from −1.3% (length of lower toothrow) to +6.7% (width of rostrum at ¾ length). The number of teeth does not differ between males and females.

Geographical variation in the size of the skull is pronounced (Perrin and Hohn 1994; Perrin et al. 1987, 1994b). Skulls of coastal subspecies of the eastern tropical Pacific are the largest, those of offshore dolphins immediately to the west are the smallest, and skulls from the western Pacific, Indian Ocean, and Atlantic are intermediate. Averages of selected skull measurements adjusted for sexual dimorphism (in cm) for 575 specimens of offshore subspecies and 31 of coastal subspecies in the eastern tropical Pacific, respectively, are as follows: condylobasal length, 396, 437; length of rostrum, 237, 262; width of rostrum at base, 83, 91; width of rostrum at ¾ length, 30, 36; zygomatic width, 165, 181; greatest width of premaxillae, 66, 72; parietal width, 138, 148; length of temporal fossa, 66, 81; height of temporal fossa, 51, 61; length of upper toothrow, 203, 226; length of ramus, 336, 371; height of ramus, 57, 66; diameter of tooth (at midlength of row, transverse), 3.5, 4.7 (Douglas et al. 1984). Skulls of offshore dolphins from the most offshore portion of the Eastern Pacific were more similar to those from south of the equator than to those from immediately to the east; variation was correlated with oceanographic variables: water depth, solar insolation, sea-surface temperature, surface salinity, and thermocline depth (Perrin et al. 1994b).

Although sample sizes are small, postcranial skeleton shows geographical variation parallel to that in skull (Perrin et al. 1987). Vertebral formula is 7 C, 13–17 T, 17–24 L, 32–42 Ca, total 74–84.

DISTRIBUTION. *Stenella attenuata* is pantropical, inhabiting tropical, subtropical, and some warm-temperate waters of the world between about 40°N and about 40°S latitude (Fig. 3). The known distribution within this overall range is scattered (Perrin and Hohn 1994; Perrin et al. 1987), but this more likely reflects lack of knowledge rather than significant gaps in distribution. For some areas, e.g., the eastern tropical Pacific, the detailed distribution is known. For other regions, such as the southeast Atlantic, very little is known. The species ranges "north to Massachusetts, the islands of Cape Verde, Northern Red Sea, Persian Gulf (= Arab Gulf), Arabian Sea, Bay of Bengal, South China Sea, East China Sea, Pacific coast of Northern Honshu, Hawaiian Islands, and Baja California Sur," and "south to Uruguay, Saint Helena, Cape Province, Timor Sea, New South Wales, New Zealand, and about 35°S off Talca, Chile" (Rice 1998:108). Single records from New Zealand (Baker and Stephenson 1972), off temperate Chile (Rice 1998), Southern California (Rice 1998), and Alaska (Perrin et al. 1987) likely represent strays. A record from Victoria, Australia (Dixon 1989), was erroneous, a misidentification of a specimen of *D. delphis*. The species ranks 1st in abundance among cetaceans in the Gulf of Mexico, 2nd in the eastern tropical Pacific and the Sulu Sea, but only 6th in the tropical Indian Ocean (Ballance and Pitman 1998; Dolar 1999; Jefferson and Schiro 1997; Würsig et al. 2000).

FOSSIL RECORD. No fossils of *S. attenuata* are known. The family Delphinidae dates back to the late Miocene in Europe and North America (Barnes et al. 1985).

FORM AND FUNCTION. Average neonatal brain weight is estimated at 311 g; adult brains from the offshore eastern Pacific averaged 726 g (n = 82) and ranged from ca. 500 to 900 g (Perrin and Hohn 1994). Other organ weights of adults were: heart (n = 11) 236–311 g, lungs (n = 6) 1,642–2,275 g, liver (n = 16) 1,281–2,195 g, kidneys (n = 15) 426–968 g, spleen (n = 16) 20–65 g (Perrin and Roberts 1972). Heart and intestine are relatively small-

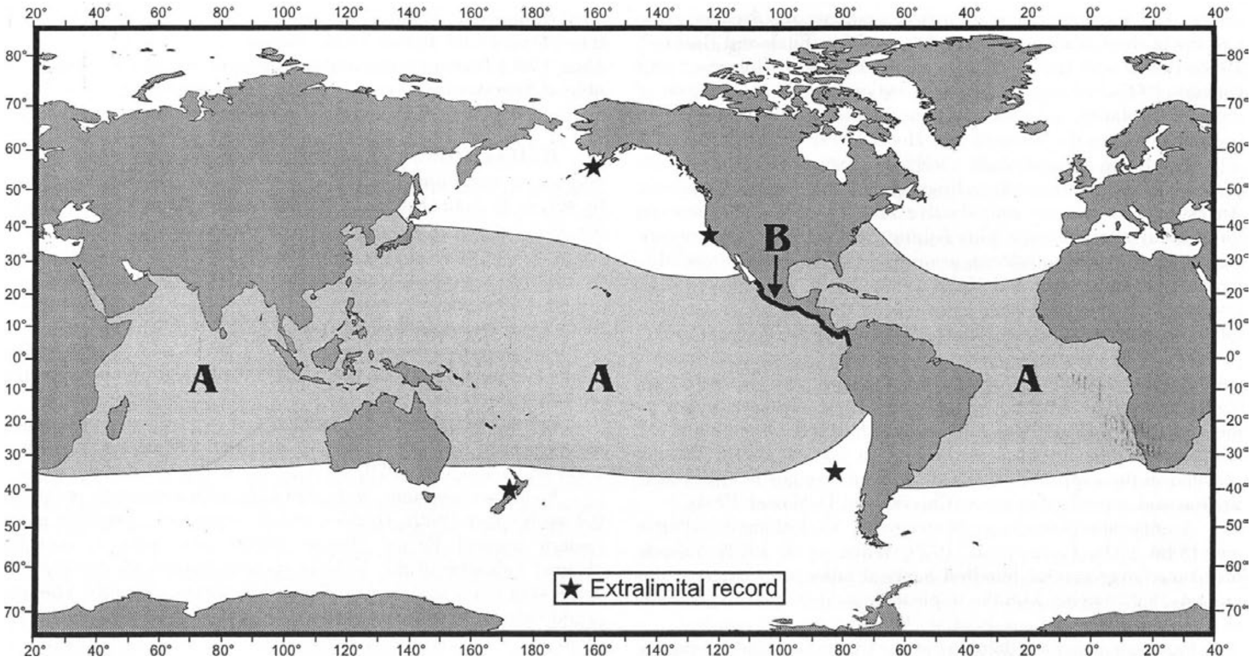

FIG. 3. Geographic distribution of the pantropical spotted dolphin: (a) *S. a. attenuata* and (b) *S. a. graffmani*. Modified from Jefferson et al. (1993).

er than in *S. coeruleoalba* (Miyazaki et al. 1981). Penis is fibroelastic and lacks a baculum (Harrison Matthews 1950).

In the brain a very large nucleus ellipticus may be related to muscular control in the blowhole region (Nieto and Nieto 1984). Islets of Calleja may function with the limbic system in the anosmic pantropical spotted dolphin (Nieto and Nieto 1986). Corpus callosum is relatively small compared with terrestrial mammals (Nieto et al. 1976). Cochlea is typical of species producing broad-spectrum ultrasonic clicks with peak energy below 100 kHz (Ketten and Wartzok 1990).

Milk has a higher concentration of fat (17–32%) than in most dolphins, but not as high as that in baleen whales (Pilson and Waller 1970); chloride concentration (42–51 mEq/kg) is elevated compared with that of cow's milk. Hemoglobin array (of 2 molecular forms S and F) and oxygen dissociation curve are identical or close to those in several other delphinids, *D. delphis*, *Globicephala*, *Orcinus orca*, *S. longirostris*, and *Steno bredanensis*, indicating a biochemical similarity among these species despite great morphological and behavioral differences (Sharp 1975). Myoglobin of *S. attenuata* has been sequenced (Jones et al. 1979). Surface-area-to-mass ratio is lower, and blubber is thinner, than in the cold-water harbor porpoise (*Phocoena phocoena*), reflecting less need to conserve heat in this tropical species (Worthy and Edwards 1990). Ratio of glucose in red blood cells to that in the plasma is relatively high and similar to that in primates (Castellini et al. 1992).

ONTOGENY AND REPRODUCTION. Nervus terminalis ganglion of the brain is relatively small during early development compared with that in *P. phocoena*, but already well separated from the degenerating olfactory bulb (Oelschläger et al. 1988). Development of inner ear and nasal skull is closely similar to that of other odontocetes (Klima 1995, 1999; Solntseva 1983, 1990, 1999). Stripes on the head (the "bridle," made up of eye stripe and blowhole stripe) develop from a single anlage consisting of a band of ca. 100 mm across the back of the head in fetuses (Perrin 1997).

Length at birth is ca. 85 cm (Perrin et al. 1976). Length at 1 year of age in the eastern Pacific is 129 cm (Hohn and Hammond 1985) and 142 cm in the western Pacific (Kasuya 1976, Kasuya et al. 1974); this difference may reflect different analytical approaches (Perrin and Hohn 1994). Growth between males and females does not differ until a secondary growth spurt occurs in males at about the onset of sexual maturation (ca. 160 cm).

Color at birth is dark gray above and ivory below; extremities are dark gray (Perrin 1970). Belly darkens to light gray, then small dark spots appear ventrally, first in the gular and abdominal regions. Next, light dorsal spots appear. Dark ventral spots increase in size and number until they become largely confluent and fade to light pearl-gray in adults. Light dorsal spots also increase in size and number and may become confluent at the ventral margin of the cape over the eye and behind the cape on the upper side of the peduncle. Spots merge and fade in adults to yield a slightly mottled or (from a distance) uniform gray underside.

Females reach sexual maturity at ca. 9–11 years, depending on the population, and males ca. 3 years later (Kasuya 1976; Kasuya et al. 1974; Myrick et al. 1986). Gestation is 11.2–11.5 months. Ovulation rate for adult females is ca. 0.4–0.6 ovulations per year in the eastern Pacific. Annual pregnancy rate is ca. 0.3, varying with population. Calving interval is ca. 2–4 years. Average length of lactation is 1–2 years and varies with population, being shorter in the eastern tropical Pacific than in the western Pacific. Reproduction is seasonal, with 2–3 weakly defined calving seasons in fall, spring, and possibly summer, in the eastern tropical Pacific (Hohn et al. 1985; Perrin et al. 1976). Only a small fraction of females (<1%) were reproductively senescent in the eastern Pacific. A very slight decline in the minimum age of sexual maturation occurred in Japanese waters (Kasuya 1985).

ECOLOGY. The coastal *S. a. graffmani* in the eastern tropical Pacific occurs in shallow water <200 km off the coast. The offshore *S. a. attenuata* occurs in waters typified by unusual conditions of shallow mixed layer, shoal and sharp thermocline, and relatively low annual variation in surface temperature (Au and Perryman 1985). Seasonal shifts occur in the preferred habitat of pantropical spotted dolphins as well as year-to-year variation in habitat distribution (Fiedler and Reilly 1994; Reilly 1990). In other oceans *S. attenuata* is primarily oceanic, although it may occur in deep water close to shore, as in the Philippines (Dolar 1999; Tan 1995).

Prey includes mainly small epipelagic and some mesopelagic organisms, including fishes of the families Acropomatidae, Alepisauridae, Balistidae, Bathylagidae, Bramidae, Bregmacerotidae, Congridae, Evermannellidae, Exocoetidae, Gempylidae, Gonostomatidae, Hemiramphidae, Melamphaidae, Microstomatidae, Myctophidae, Nomeidae, Notosudidae, Opisthoproctidae, Paralepididae, Phosichthyidae, Scombridae, Scopelarchidae, Scopelosauridae, Stromateidae, and Trichiuridae; cephalopods of the families Alloposidae, Architeuthidae, Argonautidae, Chiroteuthidae, Cranchiidae, Ctenopterygidae, Enoploteuthidae (the most numerous), Grimalditeuthidae, Histioteuthidae, Lycoteuthidae, Mastigoteuthidae, Octopoteuthidae, Ommastrephidae, Onychoteuthidae, Pholidoteuthidae, Thysanoteuthidae, and Tremoctopodidae; and decapod crustaceans of the Galatheidae and other families (Fitch and Brownell 1968; Perrin and Hohn 1994; Perrin et al. 1973; Robertson and Chivers 1997). Flying fishes are a major food item in terms of volume. Lactating females consume relatively more squid than pregnant females do (Bernard and Hohn 1989).

Population dynamics are poorly understood because samples provided by fisheries catch or by-catch may not be representative. An estimate of the net reproductive rate (the difference between the natural mortality rate plus fishing mortality rate and the observed gross reproductive rate or crude birth rate) is not available for the species (Perrin and Hohn 1994; Perrin and Reilly 1984). Estimated gross reproductive rates are 11–12% in the eastern Pacific and 10% in Japanese waters. The highest possible net rate is probably 9%, with that upper value based on likely unrealistic assumptions about limits in vital rates (Barlow and Boveng 1991; Reilly and Barlow 1986); a range of 2–6% was used in an assessment of eastern Pacific populations (Smith 1983). Depletion of the northeastern offshore stock in the eastern tropical Pacific has not resulted in the expected density-dependent changes in age at maturation and reproductive rates (Chivers and DeMaster 1994).

Average short-term movements are ca. 50–100 km/day (Perrin and Hohn 1994; Perrin et al. 1979; White et al. 1981). Schools may range over several hundred nautical miles with seasonal migrations, e.g., moving with the tropical Kuroshio Current into coastal Japanese waters (Miyazaki et al. 1974).

Pantropical spotted dolphins in the eastern tropical Pacific are often seen together with spinner dolphins (*S. longirostris*), yellowfin tuna (*Thunnus albacares*), and birds of several species (Au and Pitman 1986; Ballance et al. 1997; Perrin 1969a). Some specialization exists among the participants in species, size, and depth distribution of prey (Perrin et al. 1973). Sharks of the genus *Carcharhinus*, the cookie-cutter shark (*Isistius brasiliensis*), the false killer whale (*Pseudorca crassidens*), the killer whale (*Orcinus orca*), and the pygmy killer whale (*Feresa attenuata*) are predators (Perrin and Hohn 1994).

Levels of Hg, Cd, Cr, Cu, Mn, Ni, Se, Zn, dichlorodiphenyltrichloroethanes (DDTs), and polychlorinated biphenyls (PCBs) changed with location in the body and with age in specimens (n = 30–40, depending on the contaminant) from the eastern tropical Pacific (André 1988; André et al. 1990). Concentration of Hg was extremely high in the liver, Cd was high in the kidneys, Se and Cu were high in the skin, and DDTs were high in the subcutaneous fat. The range of concentration for all contaminants increased with age but with no clear correlation of level with age. Levels of heavy metals were higher in females than in males, but the reverse was true for organochlorines in adults, because of the purging effects of gestation and lactation (Aguilar et al. 1999). Four specimens from inshore waters of Natal, South Africa, contained higher levels of 7 organochlorines than specimens of other species from offshore waters (Cockcroft et al. 1991). Radioactive isotopes of Cs and K were correlated in muscle tissue and liver of specimens from the eastern tropical Pacific (Calmet et al. 1992); levels of Cs, K, and Pb were similar to those in other top-level predators such as tunas.

Naturally occurring pathologies include vertebral fusion (Ross 1984), vaginal calculi (Sawyer and Walker 1977), endometritis and parametrial parasitic granulomata (Benirschke et al. 1980), benign neoplasms, focal interstitial inflammation of the kidneys, glomeruloschlerosis, infarcted renculus, metaplastic ossification of the lungs, myxoid neurofibroma, mucinous edema, pancreatic tumor, pneumonitis, and vascular disease (including arteriosclerosis, basophilic degeneration, focal myocarditis, and scarring of the vessels and heart—Perrin and Hohn 1994).

Parasitism may be a significant cause of natural mortality. High mortality was correlated with infestation by a nematode (*Crassicauda*) in abdominal muscle and pterygoid sinuses in pantropical spotted dolphins in the eastern Pacific (Perrin and Powers 1980). Other endoparasites include (location in host in parentheses) the cestodes *Monorygma delphini* (mesenteries), *Phyllobothrium delphini* (blubber), *Strobicephalus triangularis* (colon), and *Tetrabothrium forsteri* (intestine); the trematodes *Campula rochebruni* (stomachs and pancreatic ducts), *Nasitrema globicephalae* (pterygoid air sinuses), *N. stenosoma* (pterygoid air sinuses), *Orthosplanchnus* (intestine), and *Zalophotrema pacificum* (pancreatic duct); the nematodes *Anisakis alexandri* (forestomach), *A. simplex* (forestomach), *A. typica* (forestomach), *Halocercus delphini* (lungs), and *Mastigonema stenellae* (forestomach); and the acanthocephalans *Bulbosoma balanae* (intestine) and *B. vasculosum* (intestine—Dailey and Perrin 1973; Neiland et al. 1970; Ross 1984; Zhou 1980). Ectoparasites and commensals include a cyamid amphipod *Syncyamus* (Leung 1970) and the barnacles *Conchoderma auritum* (Perrin 1969b) and *Xenobalanus globicipitis* (Ross 1984).

BEHAVIOR. Social organization in the pantropical spotted dolphin is poorly understood. Schools may have segregation by age, by sex, or by both (Kasuya 1995; Perrin and Hohn 1994). Age and sex composition of schools varies (Kasuya 1976; Kasuya et al. 1974; Norris et al. 1978). Schools may have from merely a few individuals to several thousand. Distinct and relatively stable subgroups within schools may contain cow–calf pairs, adult males, or juveniles (Pryor and Shallenberger 1995). Juveniles may also occur in discrete small schools separate from larger schools of breeding adults and nursing calves. Overall school size and composition may vary with the time of day.

Individual dolphins can swim as fast as 11.03 m/s; peak power output occurs 1.5 s after the start (Lang and Pryor 1979; Leatherwood and Ljungblad 1979).

Sound pulses range up to 150 kHz, with a duration of 0.075–0.2 ms (Popper 1980). Thirteen whistle types were identified in the eastern tropical Pacific (Moore 1990); they differed from the "looped" whistles of the Atlantic spotted dolphin (*S. frontalis*) in containing many more upswept and downswept elements. The proposed origin of clicks is in the nasal sac system (Cranford et al. 1996).

GENETICS. G-band karyotypes are nearly identical to those of *S. longirostris* and *S. frontalis* (Stock 1981). However, the C-band karyotype differs sharply from that of *S. longirostris*. Restriction fragment length polymorphism (RFLP) analysis of mitochondrial deoxyribonucleic acid (mtDNA) demonstrated ca. 4% genetic divergence between *S. attenuata* and *S. longirostris* (Dizon et al. 1991). In a cladistic phylogenetic analysis based on cytochrome *b* mtDNA (LeDuc et al. 1999), *S. attenuata* shared a strongly supported polytomic clade with *S. clymene* and *S. coeruleoalba* (sister species), *S. frontalis*, *Delphinus*, and *Tursiops aduncus* (to the exclusion of *T. truncatus*).

CONSERVATION STATUS. A great threat to pelagic small cetaceans, such as the pantropical spotted dolphin, is the incidental catch in fisheries (Northridge 1984, 1991; Reeves and Leatherwood 1994). Tuna fishermen in the eastern tropical Pacific chase and capture pantropical spotted dolphins in order to catch the fish with them. In this way, hundreds of thousands of *S. attenuata* were killed annually in the 1960s and the early 1970s (Gosliner 1999; Joseph 1994; National Research Council 1992; Wade 1995). This has depleted the northeastern offshore population of the pantropical spotted dolphin to 27% of its original size of ca. 270,000 in 1959 (Wade 1994).

Stenella attenuata is divided into several geographical management units in the eastern Pacific, including the northeastern offshore, western–southern offshore, and coastal stocks (Dizon et al. 1994). The northeastern offshore and coastal stocks are listed as "Depleted" under the U.S. Marine Mammal Protection Act.

Pantropical spotted dolphins are also taken as potentially unsustainable by-catch in other fisheries around the world in the tropics: in gillnets in Australasia, central North Pacific, coastal Peru and Ecuador, Japan, northern Indian Ocean, Philippines, Taiwan, western North Pacific, and other areas (Northridge 1984, 1991; Perrin and Hohn 1994; Perrin et al. 1994a, 1996); in purse seines in Philippines and Taiwan (Dolar 1994; Perrin et al. 1996), in trawls in West Africa (Maigret 1994); and on longlines in western Central Atlantic (Northridge 1991). Catches in many other fisheries are suspected but not documented. Small directed catches of unknown impact occur or occurred formerly in French Guiana (Van Waerebeek 1990), Indonesia (Barnes 1991), Japan (Bjørge et al. 1994; Kishiro and Kasuya 1993), Laccadive Islands (Manikfan 1991), Mexico (Zavala-González et al. 1994), Philippines (Dolar et al. 1994), Solomon Islands (Dawbin 1966), St. Helena (Perrin 1985), and St. Vincent (Caldwell et al. 1971).

REMARKS. Taxonomy of the spotted dolphins was confused until a major revision in 1987 (Perrin et al. 1987), and records of the 2 species before that date were confounded with varying permutations of the names *S. attenuata*, *S. dubia*, *S. froenata*, *S. frontalis*, and *S. plagiodon* in broad and often contradictory use.

Sherborn (1892) listed the plate of *D. pseudodelphis* by Wiegmann as having been published by Wagner (1846) with the 7th part of Schreber's Säugethiere, which treated the cetaceans and pinnipeds, and the plate is found in libraries bound with that volume. However, because the plate was cited by Schlegel (1841), Poche (1911) concluded that the plate was first issued with fascicles 95–98 of the series, published in 1840 as part of Wagner's first supplemental volume, even though it had nothing to do with primates, the subject of that volume. Apparently, the various sections and plates of the Schreber series were not published in serial order in conjunction with the relevant text but rather issued, whenever ready, in serial fascicles with whatever text was being published at the time. Poche's conclusion is followed in the synonymy here. Hershkovitz (1966:32) recognized Schlegel's 1841 reference to the plate, but listed the species as authored by "Wiegmann, 1840 (or earlier)."

Gray's 1846 name *Steno attenuatus* (= *S. attenuata*) was ruled to have priority as a nomen conservandum over the older synonyms *D. velox* G. Cuvier and *D. pseudodelphis* Wiegmann because of its currency in the 20th century (International Commission of Zoological Nomenclature 1991; Perrin 1990). Other common names are (English) bridled dolphin, Cape dolphin, Graffman's dolphin (*S. a. graffmani*), Gulf of Panama spotted dolphin, narrow-snouted dolphin, sharp-beaked dolphin, slender dolphin, slender-beaked dolphin, spotted porpoise, spotter, white-spotted dolphin; (French) dauphin à petites pectorales, dauphin véloce, gamin; (Spanish) delfín machado, delfín moteado, delfín pintado, estenela moteado, tonino pintado; (German) dünnschnabel Delphin, pfeilschnelle Delphin, schabracken Delphin, schneller Delphin, unächte Delphin; (Japanese) arari iruka, madara iruka; (Hawaiian) kiko; (Russian) pyatnistyy delfin; (Afrikaans) gevlekte dolfyn; (Indonesian) temu kira (used for spinner dolphin as well); (Cebuano in Negros Oriental, Philippines) balakiki; and (Portuguese) gofinho pintada dos trópicos.

Stenella (originally a subgenus—Gray 1866) is the Latin diminutive form of *Steno*, the genus which Gray (1846) erected for his earlier-listed (1843), but undescribed and unfigured species *D. attenuatus*, a nomen nudum. *Steno* is from Greek and means narrow. The trivial name *attenuata* is Latin and means reduced, slight, or unadorned. Gray called the species "attenuate-beaked dolphin," thus apparently perceiving the holotype skull as narrow and with a reduced, small, or simple rostrum compared with other dolphin skulls in the British Museum. This is not clearly understandable as the rostrum is actually relatively long rather than short. However, he earlier called *D. attenuatus* the "sharp-beaked dolphin." He may have understood the Latin *attenuata* to mean sharp rather than small or reduced; this better fits the appearance of the skull.

L. Ford photographed the skull. Robert L. Pitman contributed the photograph of the live animal. I thank them and T. Jefferson and an anonymous reviewer for helping improve the manuscript.

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