

Sotalia fluviatilis. By Vera M. F. da Silva and R. C. Best

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Sotalia Gray, 1866

Sotalia Gray, 1866a:401. Type species is *Delphinus guianensis* van Bénédén, 1864.

Tucuxa Gray, 1866b:213. Type species is *Steno tucuxi* Gray, 1856 (= *Sotalia fluviatilis*).

CONTEXT AND CONTENT. Order Cetacea, Suborder Odontoceti, Superfamily Delphinoidea, Family Delphinidae, although considered by some authors to be Family Stenidae (Fraser, 1966), Subfamily Steninae (Mead, 1975). The genus *Sotalia* is monotypic.

Sotalia fluviatilis Gervais, 1853

Tucuxi

Delphinus fluviatilis Gervais, 1853:148. Type locality Marañon River above Pebas, Loreto, Peru.

Delphinus pallidus Gervais, 1855:94. Type locality Loreto, Peru, "... ce dauphin a été pris á Nauta, dans la région de l'Amazonne qu'on nomme le Marañon."

Steno tucuxi Gray, 1856:158. Type locality upper parts of the Amazon River near Santarém, Pará, Brazil.

Delphinus guianensis P. J. van Bénédén, 1864:27. Type locality mouth of the Surinam River, Surinam.

Sotalia brasiliensis E. van Bénédén, 1875:8. Type locality Bafa de Guanabara, Rio de Janeiro, Brazil.

Sotalia fluviatilis van Bénédén and Gervais, 1880:596. First use of current name combination.

CONTEXT AND CONTENT. Context as for the genus. Some authors (e.g., Nowak and Paradiso, 1983) accept two subspecies (as follows). However, others consider that populations of *Sotalia fluviatilis* are not subspecifically distinct, but exhibit different ecotypes in marine and riverine habitats (Borobia et al., 1991; da Silva, 1994; da Silva and Best, 1994; Mitchell, 1975).

S. f. fluviatilis Gervais, 1853:148 (riverine).

S. f. guianensis E. van Bénédén, 1875:8 (marine).

DIAGNOSIS. The skull of *Sotalia fluviatilis* differs from that of other dolphins in the shape of the well-separated pterygoid hamuli and by having fewer small teeth in each mandibular row. In the Amazon drainage area, the only sympatric dolphin is *Inia geoffrensis*, which is easily distinguished from *S. fluviatilis* by its low dorsal keel and its surfacing behavior. In its marine range, *S. fluviatilis* is smaller than all other dolphins except *Pontoporia blainvillei*. However, it can be distinguished from *P. blainvillei* by the length of the mandible, which is only slightly longer than the upper jaw in *S. fluviatilis*, but is extremely long and narrow in *P. blainvillei* (da Silva and Best, 1994). Other co-occurring marine forms differ in various bodily features. For example, *Tursiops* has a larger hooked dorsal fin; *Steno* has a conical-shaped head, longer gape, larger eye, and a broad-based, tall dorsal fin; and *Stenella* has a long beak and triangular dorsal fin. *Delphinus* and *Stenella* are also distinguishable from *S. fluviatilis* by body coloration (Best et al., 1986; Martin, 1990; Pinedo et al., 1992). The tucuxi is gray on the sides and dorsum, but *Delphinus* has yellowish-ochre patches on the sides of the body and *Stenella* has stripes and spots that vary in pattern among species (Martin, 1990).

GENERAL CHARACTERS. *Sotalia fluviatilis* is a small delphinid with a moderately long, slender beak that is triangular at the base, 26-36 teeth in each mandibular ramus, and a small rounded melon (Fig. 1). The dorsal fin is triangular, short, high, and has a posteriorly curved hook (Best et al., 1986; Bittencourt,

1984; da Silva, 1994; de Carvalho, 1961; van Bree, 1975). Flippers are slightly broader than in other coastal oceanic dolphins, but flukes are similar in shape. The eyes are about 18 mm in diameter and have black countershading around the eyelids. The iris is brown and the pupil is a longitudinal ellipsoid (de Carvalho, 1963). Length of the rostrum is 55-60% of condylobasal length in specimens from the central Amazon ($n = 15$ —da Silva and Best, 1994), Lake Maracaibo ($n = 3$ —Casinos et al., 1981), and Surinam ($n = 4$ —Husson, 1978; Williams, 1928). The skull has a typically delphinid degree of asymmetry (Ness, 1967).

The tucuxi is dark gray on the dorsum and rosy pink to light gray on the ventral side, with the two colors separated by a distinct line that originates on the rostrum at the gape of the mouth and passes below the eye to the leading edge of the flippers. A lateral area of light gray occurs behind the pectoral fin and another extends from approximately mid-body to the level of the anus. The pectoral fin and flukes are dark gray underneath. After death, the body color changes; the gray parts of the body become very pale and the pink belly becomes yellowish. In some marine-dwelling individuals there is another light streak that slopes anteriorly and ventrally from the upper edge of the caudal peduncle for 10-15 cm. Marine *S. fluviatilis* is larger than the river-dwelling ecotype. Mean body length ($\pm SD$) for the marine ecotype is 1.7 ± 0.2 m ($n = 17$ —Husson, 1978; Lodi and Capistrano, 1990; Perrin and Reilly, 1984), with the largest recorded adults being a 1.87-m male and a 2.06-m female (Barros, 1991). Mean body length ($\pm SD$) for the riverine ecotype is 1.4 ± 0.2 m, with the largest recorded adults being a 1.49-m male and a 1.52-m female ($n = 27$ —Best and da Silva, 1984; da Silva, 1983, 1994; da Silva and Best, 1994). Mean body measurements (cm $\pm SD$) for the marine ($n = 4$ or 5) and riverine ($n = 8$) ecotypes, respectively are: from tip of jaw to blowhole, 25.9 ± 1.5 , 26.4 ± 3.0 ; from tip of jaw to insertion of flippers, 41.2 ± 3.7 , 39.0 ± 18.3 ; from tip of jaw to angle of gape of mouth, 22.9 ± 2.7 , 22.7 ± 0.9 ; maximum length of flippers, 29.2 ± 2.2 , 24.8 ± 1.7 ; and length of flukes tip to tip, 42.2 ± 2.8 , 39.4 ± 2.8 . Additional measurements are: marine ecotype, maximum width of pectoral fin, 11.4 ± 0.6 ; and riverine ecotype, length of dorsal fin 23.0 ± 1.7 , height of dorsal fin, 10.3 ± 0.7 , and maximum depth of flukes, 13.1 ± 0.6 .

Marine and riverine ecotypes also differ slightly in coloration, dimensions of the orbital region, and numbers of teeth (Borobia, 1989; da Silva and Best, 1994). For example, marine *S. fluviatilis* has significantly more upper teeth (30-36; $n = 38$) than the riv-



FIG. 1. Live adult female *Sotalia fluviatilis*, from Lago Tefé, Amazon River, Brazil. Length of body is 139.5 cm.

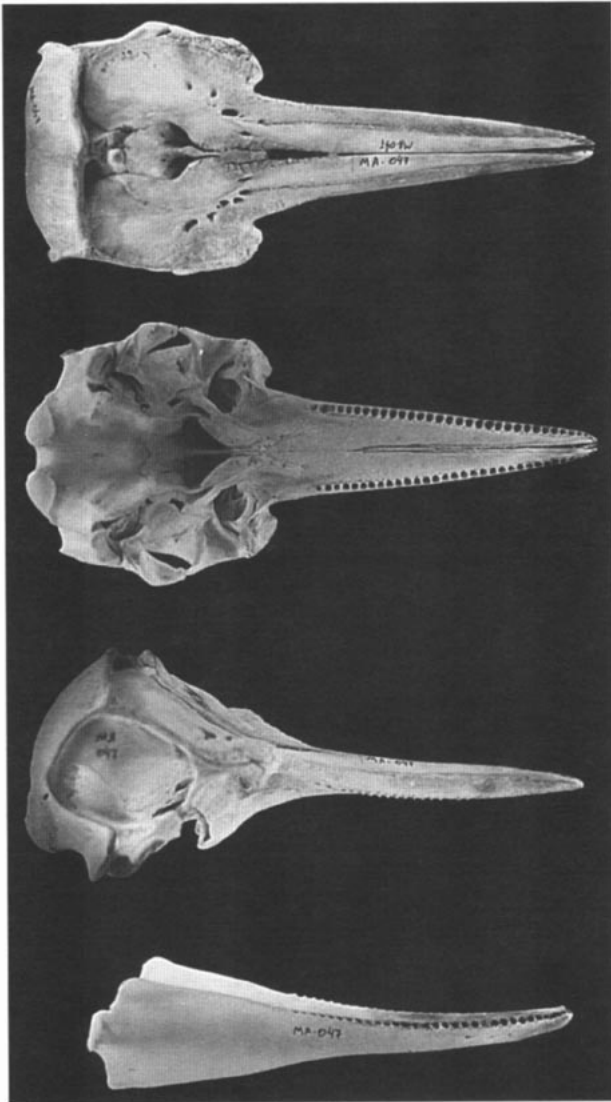


FIG. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of adult male *Sotalia fluviatilis* (Divisão de mamíferos aquáticos No. 047). Maximum length of cranium is 33.7 cm.

erine ecotype (28–35, $n = 38$; $t = 3.35$, $P < 0.05$ —Borobia, 1989).

DISTRIBUTION. The tucuxi is endemic to the Amazon River drainage (Fig. 3). Records exist from Belém through main tributaries of the Amazon Basin in Brazil to Peru in the Ucayali and Putumayo Rivers and their tributaries, such as the Marañon and Samira Rivers to the south and the Napo and Tigre Rivers to the north (Best and da Silva, 1984; Borobia et al., 1991; da Silva and Best, 1994; de Carvalho, 1961; Grimwood, 1969; Kasuya and Kajihara, 1974; Layne, 1958; Neville et al., 1976; Zam et al., 1970). The tucuxi occurs as far upriver as Ecuador in the Napo, Coca, Pastaza, Bobonaza and Lagarto Cocha Rivers (Best, 1984; E. Asanza, pers. comm.; L. von Fersen, pers. comm.). It does not pass the rapids at São Gabriel da Cachoeira on the upper Rio Negro and thus does not occur in the upper Orinoco River (da Silva, 1994; da Silva and Best, 1994; Meade and Koehnken, 1991). A single sighting of *Sotalia fluviatilis* has been recorded in the Orinoco River, between Cabruta and Caicara, <50 km from the Cassiquiare canal (Borobia et al., 1991), but the report is questionable because the species was not sighted by other biologists working in the middle and upper Orinoco Rivers (Kasuya and Kajihara, 1974; Meade and Koehnken, 1991; O'Shea et al., 1986; Trebbau and van Bree, 1974). The species may have been confused with *Inia geoffrensis* which, in the upper Rio Negro, is smaller and darker than in the

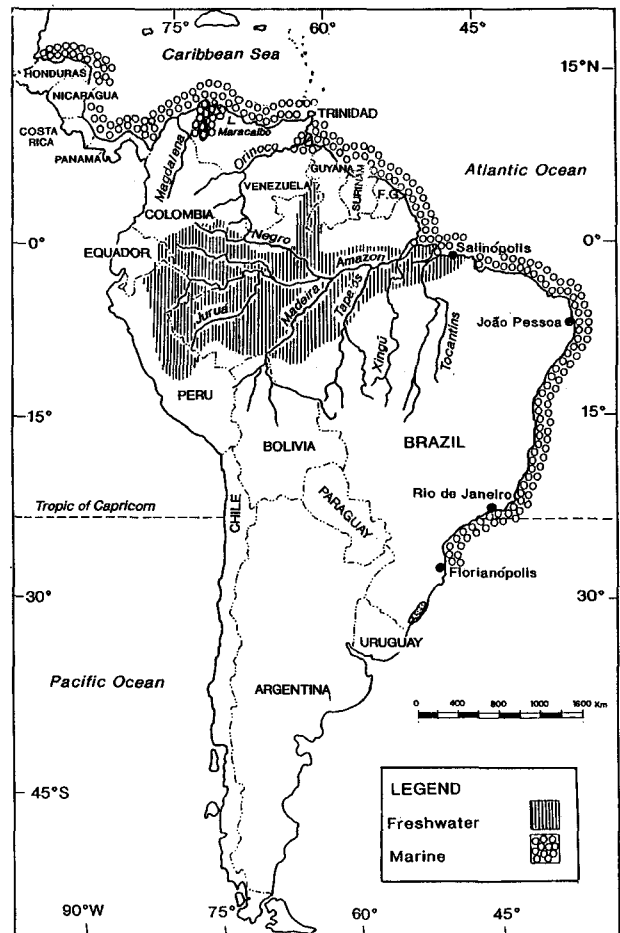


FIG. 3. Distribution of *Sotalia fluviatilis*.

Amazon river (R. Barthen, in litt.; R. Best, in litt.). The tucuxi also occurs in Colombia in the Amazon, Putumayo and Caquetá Rivers (Layne, 1958; Obregon et al., 1988; Vidal, 1990), but not in the Orinoquia River drainage (S. Kendal and F. Trujillo, pers. comm.).

Marine *Sotalia fluviatilis* is distributed along the tropical and sub-tropical Atlantic coastlines of South and Central America. Northern records include Honduras (15°58'N, 85°42'W), where the species has been seen ≥ 1 km upriver (H. Edwards, in litt.); Nicaragua; Panamá (~9°22'N, 79°54'W); and Colombia (Bössenecker, 1978). Lake Maracaibo in Venezuela is considered a principal area of occurrence (Casinos et al., 1981; Hershkovitz, 1963; Osgood, 1912). The species occurs as far as 130 km from the mouth of the Orinoco River (Pilleri, 1979; Trebbau and van Bree, 1974) and possibly also as far as Ciudad Bolívar, about 300 km upriver (Kasuya and Kajihara, 1974). Similar observations have been made in rivers of Ceará and Paraná states in Brazil, where the marine tucuxi penetrates several kilometers upriver, although no correlation with salinity has been found (R. Almeida, pers. comm.; R. Zanelatto, pers. comm.). In Trinidad (van Bree, 1975) and Guyana, the species is known from the Demerara, Cuyuni, Mazaruni, and Essequibo Rivers (Herald, 1967; van Bénédén, 1864; Williams, 1928). In Surinam, this species is common near Paramaribo and as far upriver as Domburg and Paranam (Husson, 1978). Along the coast of Brazil, *Sotalia fluviatilis* was recorded by several authors as having an extensive and continuous distribution (Borobia et al., 1991; Pinedo et al., 1992) with the southern limit in Florianópolis (27°35'S, 48°34'W; Simões-Lopes, 1988). The principal limiting factor for the riverine ecotype is the presence of rapids and small channels in the Amazon River drainage (da Silva, 1983, 1986; da Silva and Best, 1994; Layne, 1958) and for the marine ecotype low water surface temperatures (Borobia et al., 1991; Simões-Lopes, 1988). There are no fossil records of *Sotalia fluviatilis*, although this species may have had an Atlantic origin and subsequently invaded the Amazon system (Brooks et al., 1981).

FORM AND FUNCTION. The vertebral formula is 7 C (atlas and axis fused in adults), 12 T, 12 L, and 22–25 Ca, total 53–56 ($n = 19$). The thoracic and lumbar vertebrae have a well developed oblique process that secures one vertebra firmly to the other, eliminating lateral torsion of the body (da Silva and Best, 1994).

Mean hematological values ($n = 30$) for marine *Sotalia fluviatilis* in captivity ($n = 9$) are: hemoglobin, 13.4g/dl (range 11.0–15.5); Na^+ , 150 Meq/l (range 143–160); K^+ , 3.9 Meq/l (range 3.4–4.4); white blood cell count, 9.163 Nu/ μl (range 4,000–16,600); neutrophils, 56.5% (26–93); lymphocytes 27% (6–61); monocytes 2.5% (0–7); eosinophils 13.5% (1–25); and basophils, 0% (0–3—van Forest, 1980).

Selected organ masses (in g) from adult animals (35–53 kg body mass) from the central Amazon Basin are: left kidney, 105–174 ($n = 8$); left lung, 293–685 ($n = 8$); adrenal (one), 2.2–5.0 ($n = 6$); heart, 125–264 ($n = 7$); and liver, 920–1,600 ($n = 7$). The following organs comprise a constant percentage of the body mass: kidney (0.6%); heart (0.5%), liver (2.5%), and lungs (2.4%). Cranial volume is 546–627 ml ($n = 8$); da Silva, 1994; da Silva and Best, 1994). Brain:body mass ratio in one animal was 0.0163 (688g/42.2 kg—Morgane and Jacobs, 1972).

The optic nerve of *Sotalia fluviatilis* has about 19,500 optical fibers and a tapetum is present (Morgane and Jacobs, 1972). The eye is large, but vision may not be acute (Pilleri, 1982). However, visual stimuli play an important part in courtship display in captive animals (Terry, 1983). Acoustic fatty tissue in the melon of *Sotalia fluviatilis* contains short-chain (C_n) isovaleric acids typical of Delphinidae, in contrast with long-chain triglycerides in the blubber (Ackman et al., 1975; Litchfield et al., 1975).

Sotalia fluviatilis has a large non-glandular forestomach and smaller true stomach leading to a non-differentiated intestine, which lacks a caecum and obvious colon. Anal tonsils are found in the rectal portion of the intestine (Chaves and da Silva, 1988). Mean intestinal lengths ($\pm SD$) are 6.1 ± 0.26 times that of the body (range 6.0 to 9.6 m; da Silva, 1983; da Silva and Best, 1994).

ONTOGENY AND REPRODUCTION. The body length at which marine *S. fluviatilis* reaches sexual maturity is between 160–170 cm (Bössenecker, 1978), and adult size is attained when there are five or more growth layer groups (GLG's) in the dentine (Borobia, 1989). Using testis weight as an index, males of the riverine ecotype reach sexual maturity at a body length >139 cm. Adult males may have active or inactive testes. When active, testes are >5% of body mass and average tubule diameter ranges from 106 to 232 μ (da Silva, 1994). The breeding system is polyandrous and involves sperm competition (Best and da Silva, 1984). Females mature at a body length between 132 and 137 cm (Best and da Silva, 1984). Females of the marine ecotype have been recorded lactating at body lengths of 167 cm, 172 cm, and 180 cm (Bössenecker, 1978; de Carvalho, 1963), and a 182-cm female had a 60-cm fetus. The birth size of *S. fluviatilis* was estimated to be from 60 to 65 cm for the marine ecotype (Bössenecker, 1978) and from 71 to 83 cm for the riverine ecotype (Best and da Silva, 1984). Ovulation occurs only from the left ovary (Best and da Silva, 1984; Harrison and Brownell, 1971). The gestation time of marine *S. fluviatilis* is estimated at 11 to 12 months (Perrin and Reilly, 1984), with birth occurring during the winter on the Guyanan coast (Bössenecker, 1978) and throughout the year in southern Brazil (Schmiegelow, 1990). The estimated fetal growth rate of riverine *S. fluviatilis* is 8.5 cm/month and post-natal growth 2.5 cm/month. Birth occurs during the season of low water (October–November) after a gestation of 10.2 months (Best and da Silva, 1984). Although there is no hair on the rostrum of the adults, four to seven pairs of thick hairs were found on the rostrum of two fetuses collected in the central Amazon Basin (da Silva and Best, 1994).

ECOLOGY. In freshwater, the only possible predator of tucuxi is the bull shark (*Carcharhinus leucas*), which occurs in the Amazon River system (Werder and Alhanti, 1981). Along the coast many potential predators exist, such as several species of shark and the killer whale (*Orcinus orca*). A killer whale has been recorded with remains that are probably of this species in its stomach (Castello and Pinedo, 1986).

S. fluviatilis has been intentionally caught to be used as bait for sharks in Marajó Bay, northern Brazil (Pinedo, 1985) and along the Brazilian coast (Barros, 1991; Lodi and Capistrano, 1990). In-

cidental capture in fisheries occurs throughout most of their distribution (Bittencourt, 1984; Borobia and Barros, 1989; Geise and Borobia, 1987, 1988). Natural mortality rates are unknown.

In southeast Brazil, *S. fluviatilis* feeds upon pelagic clupeids (*Trichurus lepturus* and *Pellona barroweri*), demersal sciaenids (*Cynoscion jamaicense*, *C. striatus*, and *Porichthys porosissimus*), and neritic cephalopods (*Loligo* spp. and *Lolligunculla brevis*—Borobia and Barros, 1989). *Sotalia fluviatilis* feeds on anchovies in southern Brazil (Simões-Lopes, 1988), and on fish and shrimps in Surinam (Husson, 1978). In Guyana, one specimen had the remains of 32 small herring-like fish, four small catfish, and several crystalline lenses in its stomach (Williams, 1928). In the Amazon region, a total of 28 species of fish comprising 11 families were identified in stomachs, with Curimatidae occurring in 52%, Sciaenidae in 39%, and siluriforms in 54% of the animals analyzed ($n = 29$). The maximum body length of fish eaten was 37 cm. The greatest diversity in diet occurred during periods of receding and lowest river levels when fish are more concentrated (da Silva, 1983, 1986; da Silva and Best, 1994).

Parasitic trematodes include: *Amphimeris lancea*, found in bile ducts of the liver of *Sotalia fluviatilis* from the Amazon region, and *Nasitrema attenuata*, found in the respiratory tract of *S. fluviatilis* from the coast (Gibson and Harris, 1979; Greenwood et al., 1979). The occurrence of trematodes in pancreatic ducts was also noted, as was an unidentified cyst in a glandular stomach (Grafton, 1968). The three types of nematodes recorded for *Sotalia fluviatilis* are *Halocercus brasiliensis*, from lungs of individuals from the Colombian and Brazilian coasts, and *Anisakis typica* and *A. alexandri*, from the forestomach of a young specimen from the Napo River in Peru. One case of lobomycosis disease caused by a pathological fungus *Loboa lobo* was reported in an adult female from the estuary of the Surinam river. The other forms of mycosis found were caused by *Glenospora graphii* and *Turulopsis haemalonii*; neither was considered pathological (de Vries and Laarman, 1974). A possible case of toxoplasmosis in wild specimens (Bandoli, 1968), the death of two captive individuals with septicaemia caused by *Proteus morgani* (Greenwood and Taylor, 1979), and the presence of an erysipelothria-type organism have been reported (Grafton, 1968).

The abundance and status of *Sotalia fluviatilis* populations is unknown or based on mostly qualitative assessments of small geographic areas (da Silva and Best, 1994). In Colombia, the number of individuals at the mouth of the Magdalena River was estimated at between 100–400, and the species was abundant in the Gulf of Cispatá (Bössenecker, 1978). It is fairly common at the mouth of large rivers of Surinam, (Husson, 1978) and is frequently seen in the lower reaches and mouth of the Essequibo River in Guyana (Williams, 1928). On the Brazilian coast, the species was reported to be extremely common in the Baía de Guanabara (Goeldi, 1899; Lins de Almeida, 1933; van Bénédén, 1875) with a population of 100 to 400 individuals and a mean density ($\pm SD$) of $5.1 \pm 4.4/\text{km}^2$ ($n = 57$ observations—Geise, 1984). In the Santos and Cananéia regions of São Paulo State (Brazil) it is common, with an estimate of mean density ($\pm SD$) for the area around Cananéia Island of $2,829 \pm 565$ animals (Geise, 1989). In about 500 km of the Solimões River, between Manaus and Tefé, the average density ($\pm SD$) was 1.1 ± 0.4 tucuxi/km of river (Magnusson et al., 1980). Four boat surveys from Manaus to Leticia (about 1,525 km each) gave a mean total ($\pm SD$) of $768 \pm 104.7/\text{trip}$ or 1.02 individuals/ km^2 (da Silva and Best, 1994). Near Iquitos (Peru), 62 tucuxis were counted during 36 h of observation (Kasuya and Kajihara, 1974). The species is also common in Colombia in the Loretoyacu River, the Tarapoto river at the El Correo Lake system, and in the lower reaches of the Orinoco river in Venezuela (Meade and Koehnken, 1991).

Marine *S. fluviatilis* is found in shallow and protected estuarine waters, bays, and the mouth of large rivers, sometimes ascending as far as the limit of tidal influence (Bössenecker, 1978; Duplaix, 1980; Hershkovitz, 1963; Husson, 1978). In Baía de Guanabara, it prefers deep channels (>25 m) and avoids areas <6 m deep (Geise, 1984). Riverine *S. fluviatilis* is found in the main channel of all tributaries as well as in large lakes, but does not enter the flooded forest and avoids rapids (da Silva, 1983, 1986, 1994). It shows a distinct preference for the junction of rivers and channels (Magnusson et al., 1980).

In captivity, *Sotalia fluviatilis* suffers from lung problems and hepatic degeneration (Bössenecker, 1978), shock (Caldwell and

Caldwell, 1970), bronchial pneumonia, acute infective pharyngitis, tracheo-bronchitis (Grafton, 1968), bacterial septicaemia, necrotic intestine, botulism, and gastric ulcers (Greenwood and Taylor, 1979; Spotte, 1967). These animals are very nervous and die easily from shock and capture stress. Many of the 45 individuals captured alive in the Amazon and Colombia during the 1960s and 1970s died during capture, during transport, or after being held in captivity (Collet, 1984). A few animals caught in Colombia in 1977 have survived in captivity and two were still alive in the Nurnberg Zoo, Germany in August 1993 (L. Fersen, pers. comm.). In Colombia, an adult female has been on exhibition since 1986 (S. Kendall, pers. comm.). Two adults and one female calf were introduced into a lagoon in the city of Sete Lagoas, in Minas Gerais State (Brazil), as a tourist attraction in 1985. The two adults died in July 1993, but the calf was still alive in August 1995 (F. Colares, pers. comm.).

Sotalia fluviatilis is protected by legends and myths from Colombia (Bössenecker, 1978) to southern Brazil (van Bénédén, 1875), as well as in the Amazon region (da Silva, 1990). No commercial fisheries have been reported in the past (Mitchell, 1975). On the coast of Brazil, *S. fluviatilis* may occasionally be killed for use as bait for sharks, in shrimp traps, or for human consumption (Barros, 1991; Geise and Borobia, 1987; Perrin, 1989). The greatest direct threats to the species are modern fishing practices, as *S. fluviatilis* is extremely vulnerable to monofilament gill nets. Commercial fishing has increased greatly in recent years, although local fisheries also play an important role in this respect (Lodi and Capistrano, 1990).

Another threat to the tucuxi in the Amazon River basin is development of hydroelectric power facilities that reduce fish fauna abundance (Ferreira, 1984) and fragment the populations by isolating small groups in individual reservoirs (Best and da Silva, 1989). Mercury used in refining fluvial gold has been found in high concentrations in fish identified as part of the tucuxi's diet in the Amazon region and may pose a threat (da Silva, 1983, 1986; Pfeiffer and de Lacerda, 1988), as does pollution from industrial and agricultural areas that destroys the habitat and contaminates the food chain. Large harbors like the Baía de Guanabara (Rio de Janeiro) and Santos (São Paulo) are extremely polluted with effluent, including heavy metals (Amador, 1989; Diegues, 1975) and pose a serious potential threat (Geise, 1989). Mercury and selenium were found in the livers of two specimens from Surinam (Koeman et al., 1973). Exploration for oil in offshore regions of Brazil, Venezuela, and Colombia may directly threaten the marine ecotype because an oil spill could affect the food chain (da Silva and Best, 1994) or impact the tucuxi directly.

BEHAVIOR. Behaviors reported in wild populations include aerial displays such as vertical and lateral full jumps, somersaults, spy-hopping, surfing in waves made by a passing boat (but not bow-riding), tail-lob, lying on the surface belly up and hitting the water with flippers and flukes, rolling on the surface of the water, and diving with tail clear of the water (Borobia, 1984; da Silva, 1983; da Silva and Best, 1994; Geise, 1984, 1989). In contrast, captive specimens rarely show voluntary aerial displays (Terry, 1983, 1986). Other behaviors are slow directional movements, higher travelling speeds, porpoising in a fixed direction, and very slow resting-type movements at the surface (Borobia, 1984; Geise, 1984, 1989).

The two ecotypes of *Sotalia fluviatilis* appear to have very similar social structure that is characterized by small social groups of 1–30 individuals, with a modal number of two per group in the marine tucuxi (Bössenecker, 1978; de Carvalho, 1963; Geise, 1984, 1989; Simões-Lopes, 1988; van Bénédén, 1875; Williams, 1928) and one to six individuals in the riverine ecotype (Magnusson et al., 1980). Groups with more than nine individuals are rarely seen (Best, 1984; da Silva, 1994; Kasuya and Kajihara, 1974; Layne, 1958). The composition of groups is unknown, although there is some evidence that groups of three consist of two adults and one calf and groups of four consist of two calves and two adults (Borobia, 1984; da Silva and Best, 1994; Geise, 1984, 1989). The size and structure of groups varies according to time of day and type of activity (Geise, 1989). *S. fluviatilis* is relatively sedentary and apparently not territorial. It can occur throughout the year in the same area (Andrade et al., 1987; Borobia, 1984; da Silva, 1983; Geise, 1984, 1989; Magnusson et al., 1980; Simões-Lopes, 1988).

Sotalia fluviatilis has a distinct diurnal rhythm; in Baía de Guanabara and Cananéia regions, 90% of tucuxis entered the bay

around 0600–0800 h and all left between 1300 and 1900 h (Borobia, 1984; Geise, 1984, 1989). In the Amazon River drainage, tucuxi seem more active than usual between 0900 and 1000 h, and there is a marked movement into lakes from rivers before about 0900 h and from lakes to rivers from 1600 to 1800 h (da Silva and Best, 1994; Layne, 1958).

Sotalia fluviatilis produces echolocation clicks at 8–15 kHz, 30 kHz, and 95 kHz. Clicks may be single or twin pulses, called paired clicks (Norris et al., 1972), and are produced at rates between 600/s and 960/s (Nakasai and Takemura, 1975; Norris et al., 1972; Wiersmsa, 1982). Repetition rates are usually in the range of 10–70/s when cruising. Short pulses and high repetition rates allow discrimination of objects at distances <15 cm. Simple whistles have been reported in the wild riverine ecotype (Norris et al., 1972) and, in captivity, short, pure tone whistles rising in frequency have been recorded when the animals were agitated (Terry, 1983). Simultaneous clicks having different frequencies (kHz \pm SD) and duration (ms \pm SD) have been recorded (frequencies 94.7 ± 1.4 and 29.2 ± 0.7 ; durations 27.7 ± 0.7 and 98.7 ± 3.7 ; Wiersmsa, 1982). Dissimilar sonar signals were found between the two ecotypes of *S. fluviatilis*; clicks of both forms are characterized by a larger band width with the same dominant frequency, but no paired clicks were recorded (Kammimga et al., 1993).

Compared to *Tursiops truncatus*, *Sotalia fluviatilis* exhibit less curiosity, manipulation and play, leaping/surface behavior, and care-giving behavior. The only behavior that *Sotalia fluviatilis* exhibits with greater frequency than *T. truncatus* is aggression towards other cetacean species (Defran and Pryor, 1980; Terry, 1986).

Aggressive behavior is common between males during the breeding season. When excited, they may flex the body and glide in an inverted-U posture. Copulation is belly to belly and is often preceded by tactile contact and masturbation. Homosexual behavior in captivity is rarely seen in this species (Terry, 1983). In the Amazon River basin, reproduction is synchronized with annual flood cycles (Best and da Silva, 1984).

In captivity, intergeneric behavior between male *Inia geoffrensis* and *Sotalia fluviatilis*, and between *S. fluviatilis* and *T. truncatus*, has been reported (Spotte, 1967). Although wild tucuxi do not interact often with the Amazon River dolphin *Inia geoffrensis*, they have been seen in close proximity to feeding groups (da Silva, 1983). A group of tucuxi has been seen to expel *I. geoffrensis* from a particular location (Layne, 1958), although an adult tucuxi was seen playing with a calf of this species (da Silva and Best, 1994). Tucuxi feed in association with terns (*Phaetusa simplex*) in the Amazon (da Silva, 1983) and with two species of seabirds (*Sula leucogaster* and *Sterna* sp.) in Santa Catarina State (Simões-Lopes, 1988).

Fishing behavior may consist of random slow movements with occasional high bursts of speed as tucuxi chase fish along the surface. A coordinated group may consist of several subgroups working in conjunction and may involve other species of dolphins. They may herd a school of fish against a steep mud bank and then attack in unison, or circle a school of fish and converge simultaneously towards the center (Borobia, 1984; da Silva, 1983; Geise, 1984, 1989). Riverine *Sotalia fluviatilis* sometimes feed in areas of great turbulence, such as mouths of rivers or steep river banks, and may even use gillnets as a wall to force the pursued fish schools to scatter (da Silva, 1983, 1986).

REMARKS. The most common name of *Sotalia fluviatilis* in the Amazon region is tucuxi. This name originates from the Tupi language of the Mayanas indians (*tucuchi-una*). In Peru, it is called bufeo negro or bufeo gris (Gray, 1856; Neville et al., 1976), in Venezuela tonina (Osgood, 1912), in Nicaragua local fishermen call them lam (T. Carr and R. K. Bond, in litt.), and Guyana dolphin or Surinam dolphin in Surinam (Bössenecker, 1978; Husson, 1978; van Bree, 1975). Along the coast of Brazil, it is referred as boto or boto comum (da Silva and Best, 1994; Pinedo et al., 1992).

The species has been listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Appendix I) since 1982 as *Sotalia* spp., and considered as "insufficiently known" by the World Conservation Union—IUCN (Klinowska, 1991). In Brazil, it is protected by the Federal Fisheries Law (Decreto Lei N° 73.632 de Fevereiro de 1967). The freshwater population is also protected by Fauna Protection Law No. 5197 of March 1967.

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