

Distribution, Status, and Biology of the Atlantic Humpback Dolphin, *Sousa teuszii* (Kükenthal, 1892)

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Abstract

The distribution, status, and biology of the Atlantic humpback dolphin (*Sousa teuszii*) is critically reviewed, and results of recent research are discussed. The species' known distribution limits are, in the north, Dahkla Bay (23°50'N), Western Sahara, and in the south, Tombua (15°47'S), southern Angola. Its habitat is predominantly inshore coastal and estuarine, over soft-sediment bottoms. There is no evidence that it might occur beyond the brackish waters of estuaries into a riverine, fresh-water habitat. There are no records for the Senegal, Casamance, and Niger Rivers.

A total of eight stocks are provisionally discerned for management purposes. Six of these are confirmed-contemporary (based on recent records), including Dahkla Bay, Banc d'Arguin, Saloum-Niumi, Canal do Gêba-Bijagos, South Guinea, and Angola. Two stocks, the Cameroon Estuary and Gabon, are historical, and new field-work needs to confirm their current presence. No inference is made on degree of reproductive isolation and biological population status of any named stock. The potential existence of a western Togo stock is currently under study. Nine coastal states, including Morocco (Western Sahara), Mauritania, Senegal, The Gambia, Guinea-Bissau, Guinea-Conakry, Cameroon, Gabon, and Angola are confirmed range states.

While historically distribution may have been quasi-continuous over the species' range, indications of contemporary distribution gaps are emerging. Ongoing monitoring of cetacean takes

in coastal fisheries off western Ghana, and experimental whale-watching sorties in Bénin have not yielded a single record. The species has either become rare through human-related pressures or, less likely, it never lived there. For most other areas there is little, if any, information due to the lack of research.

No abundance estimates are available for any stock. The smallest extant stock may be the northernmost, Dahkla Bay. The aggregated number of individuals seen in four sightings was 28 individuals. The healthiest known stock seems to be Canal do Gêba-Bijagos (in Guinea-Bissau), which may number at least several hundred, if not more. How extensively humpback dolphins range in-between core areas is unclear, but only a few individuals have been encountered.

There is no evidence for seasonality in presence, nor for seasonal movements. Regular cross-border movements between the Saloum Delta (Senegal) and Niumi National Park (The Gambia) technically qualifies *S. teuszii* as a "migratory species" under the Conservation of Migratory Species (CMS) Convention. Fisheries-related mortality is thought to be significantly higher than the few recorded takes suggest because it is very rarely reported. Combined with habitat encroachment, such losses may threaten the long-term survival of some stocks.

Key Words: Atlantic humpback dolphin, *Sousa*, West Africa, status, management, distribution, movements, general biology

Introduction

The Atlantic humpback dolphin (*Sousa teuszii*) (Kükenthal, 1892) is a small delphinid regionally endemic to the tropical and subtropical eastern Atlantic nearshore waters of West Africa, an area concordant with the Food and Agriculture Organization (FAO) fishing area No. 34 (see Northridge, 1984). The species was described in 1892 by a German zoology professor, Dr. Willy Kükenthal, based in Jena, from a shark-damaged carcass found floating in the Bay of Warships in present-day Cameroon. A description in French and some additional information was published almost simultaneously by Van Beneden (1892). The type specimen is at the Natural History Museum, London. A second specimen was collected in 1925 at the port of Dakar, Senegal, by Mr. Papot (van Bree & Duguay, 1965).¹ This skull, first deposited at the Museum d'Histoire Naturelle de La Rochelle, France, remained largely forgotten. The species was rediscovered in Senegal in 1943 (Cadenat, 1956a; Fraser, 1949) and then sighted south of Conakry, Guinea's capital, in January 1953 (Cadenat, 1956a). Over the next half-century it was encountered in at least six other West African nations as detailed below, but has never been considered a common species. Earlier names included "Cameroon (or Camerun) River Dolphin" and "Dauphin de Rivière" (Dupuy, 1983; Mörzer Bruyns, 1971), but considering that *S. teuszii* is not known to occupy true riverine habitats (see below), these names are misnomers. The Imragen² people of Mauritania call the humpback dolphin "owdenne," distinguishing it from the bottlenose dolphin (*Tursiops truncatus*) "ajanna" (Maigret, 1980). For relative scarcity of data and specimens³ and unclarity of taxonomy, the biology of *S. teuszii* has only a few times been the subject of a brief dedicated review (e.g., Jefferson et al., 1993; Klinowska, 1991; Reeves et al., 2003) and has otherwise been discussed in conjunction with other nominal species of the genus *Sousa* (e.g., Ross, 2002; Ross et al., 1994).

The species is listed in Appendix I of Convention on International Trade of Endangered Species (CITES). The International Union for Conservation of Nature and Natural Resources (IUCN) Cetacean Specialist Group has long accorded it a high priority for studies in view of its restricted range, narrow ecological niche, and presumed low population size (Perrin, 1988; Reeves & Leatherwood, 1994; Reeves et al., 2003). In 1991, the Pakistan delegation to the CMS Convention successfully proposed including *S. teuszii* in Appendix II. New insights originating from the United Nations Environmental Programme (UNEP)/CMS West African Cetacean

Research and Conservation Project 2's project in 1999-2001 warned about the possibility that *S. teuszii* could become an endangered species in the foreseeable future (Van Waerebeek et al., 2002, 2003). This led the authors to review all available information in a working document presented to the 2002 International Whaling Commission (IWC) meeting in Shimonoseki, Japan (Van Waerebeek et al., 2002), which was the precursor of the present paper.

Taxonomy

Genus: *Sousa* Gray, 1866: 213. Type species *Steno (Sousa) lentiginosus* Gray

Species: *Sousa teuszii* (Kükenthal, 1892)

Atlantic humpback dolphin, Teusz's dolphin
Dauphin du Cameroun, dauphin à bosse de l'Atlantique (French)
Delfín jorobado del Atlántico (Spanish)

Synonymy:

Sotalia teuszii Kükenthal, 1892: 442. Skull holotype originally deposited in the Jena Natural History Museum, Germany, by Professor Pechuel-Lösche after it was collected by Mr. Eduard Tëusz in the Bay of Warships, Douala, Cameroon. The type is currently at the British Museum (Natural History)⁴ under catalogue number 1893.8.1.1 (Jefferson & Van Waerebeek, 2004; Pilleri & Gihir, 1972).

Sotalia Teuszii Van Beneden, 1892: 351. Alternate spelling. This paper may have been published before Kükenthal's species description was available; nonetheless, credits for the discovery were properly referred to Kükenthal.

The species epithet has frequently been misspelled or unwarrantedly renamed—for example,

¹ Olivier Van Canneyt, curator at the Centre de Recherche sur les Mammifères Marins (CRMM), Institut de la Mer et du Littoral, Port des Minimes, La Rochelle (France), confirmed details (e-mail, 13 March 2002) as listed in Table 8. Specimen was received on loan from the Muséum d'Histoire Naturelle de La Rochelle.

² Also spelled "Imraguen"

³ Through December 2002, only 43 specimens of *Sousa teuszii* have been properly documented for the whole of West Africa; several for which no voucher material is available (see Table 1). Vague or dubious records were excluded.

⁴ Presently named the Natural History Museum, London

Sotalia teuszii {sic} (Cadenat, 1956a), *S. teuzi* (Hershkovitz, 1966; Marcuzzi & Pilleri, 1971; Ross, 2002; Scheffer & Rice, 1963). Rice (1998) cited both *Sousa teuzi* (p. 103) and *Sousa teuszii* (p. 102) in the same paper, adding to the confusion.⁵

The taxonomy of the genus *Sousa* remains unresolved, largely for lack of specimen material (see also Ross, 2002). Briefly, three main theories compete on how three geographic units and nominal species (i.e., West African *S. teuszii*, Indian Ocean *S. plumbea*, and Pacific *S. chinensis*) are assigned to different taxonomic levels. One conservative opinion, supported by the IWC, proposes two species, *S. teuszii* and *S. chinensis*, the latter combining all Indo-Pacific populations (Jefferson & Karczmarski, 2001; Mitchell, 1975a; Rice, 1977). Another view, which we believe is the most plausible, recognizes three nominal species identifiable with the three main allopatric geographical units as cited above (Rice, 1998; Ross et al., 1994; Zhou et al., 1980). Pilleri & Gühr (1972) supported recognition of *S. plumbea*, but added two other nominal species (*S. lentiginosa* and *S. borneensis*), both of highly dubious validity due to wide sympatry. Rice (1977) suggested *S. teuszii* could perhaps be regarded as a subspecies of *S. chinensis*, from which it differs mainly in tooth count. Ross (1984) supported the separation between *S. chinensis* and *S. plumbea*, but proposed *S. teuszii* as a subspecies of *S. plumbea*. Finally, Ross (2002) argued for a “single, variable species for which the name *S. chinensis* has priority,” citing “recent morphological studies, supported somewhat equivocally by genetic analyses.” Currently, no morphologic or genetic analyses have been published that are sufficiently comprehensive to be convincing. In fact, *S. teuszii* was missing from a phylogenetic cytochrome b sequences study by LeDuc et al. (1999) and a recent mtDNA variation study (Rosenbaum et al., 2002). Cockcroft et al. (1997) included tissue samples of two *S. teuszii* skulls from the British Museum (Natural History) in their genetic study; these yielded no amplifiable mtDNA. No karyotype of *S. teuszii* has been described.

Jefferson & Van Waerebeek (2004), analysing morphologic variation in 222 skulls of humpback dolphins worldwide, concluded that the distinctness of *S. teuszii* is clearcut. Further, marked differences in colouration, dorsal fin shape (Jefferson & Karczmarski, 2001), and some cranial characteristics (Jefferson & Van Waerebeek, 2004) suggest that the *plumbea* stock from the western Indian Ocean (although eastern distribution boundaries are unclear) is an evolutionary significant unit (ESU) distinct from the *chinensis* stock from Southeast Asia. In other words, *plumbea* is a

nomen conservandum, most likely as a species, if not, as a subspecies. Nonetheless, for the sake of consistency in nomenclature within this volume, and while awaiting results of further, confirmatory studies, the authors pragmatically utilized the conservative hypothesis of a bispecific genus, as recommended by the IWC.

Distribution

Besides Heaviside's dolphin (*Cephalorhynchus heavisidii*), the Atlantic humpback dolphin is one of only two cetacean species endemic to the Atlantic African subregion. A few authors have argued for a largely discontinuous distribution of *S. teuszii* (Maigret, 1980; Ross et al., 1994; Van Waerebeek et al., 2000), while most indicate a more or less continuous coastal range from Morocco or Senegal to Cameroon (Dupuy, 1983; Hershkovitz, 1966; Klinowska, 1991; Marcuzzi & Pilleri, 1971; Mörzer Bruyns, 1971; Pilleri & Gühr, 1972; Rice, 1977, 1998; Ross, 2002; Scheffer & Rice, 1963), or suggested it may extend south to Angola (Evans, 1987; Jefferson et al., 1993; Mitchell, 1975a).

Here, we critically review distribution, fishery interactions, and status, including indicators of relative abundance for all known and potential range states, from Dahkla Bay, Western Sahara, to southern Angola (Figures 1 & 2). The available information on the presence, or absence, of Atlantic humpback dolphins is largely incomplete in many areas due to a paucity of field survey effort. Nonetheless, it is deemed useful to designate here a number of nominal “management stocks” (*sensu* Donovan, 1991) as part of a progressive working hypothesis. No doubt other stocks will be discovered as field research intensifies. Some of these “stocks,” especially in the northwestern part of the species' range, may indeed represent discrete biological populations, segregated by stretches of coast of very low density or even virtual absence.

The Atlantic humpback dolphin appears to be separated spatially from Indian Ocean *plumbea* populations by ca. 2,200 km coastline off southwest Africa, washed by the cold Benguela Current. The latter acts as an ecological barrier for (sub)tropical *Sousa*, as was first suggested by Mörzer Bruyns (1971). According to Ross (1984), the western limit of the *plumbea* form is uncertain, and except for a vagrant specimen found at Muizenberg (34°07'S, 18°28'W), South

⁵ However, encyclopedia editor, W. F. Perrin, indicated these were typographical errors (E-mail to KVW, 13 November 2003). The correct ending—ii—was used in the list of Marine Mammal Species on p. 1337.

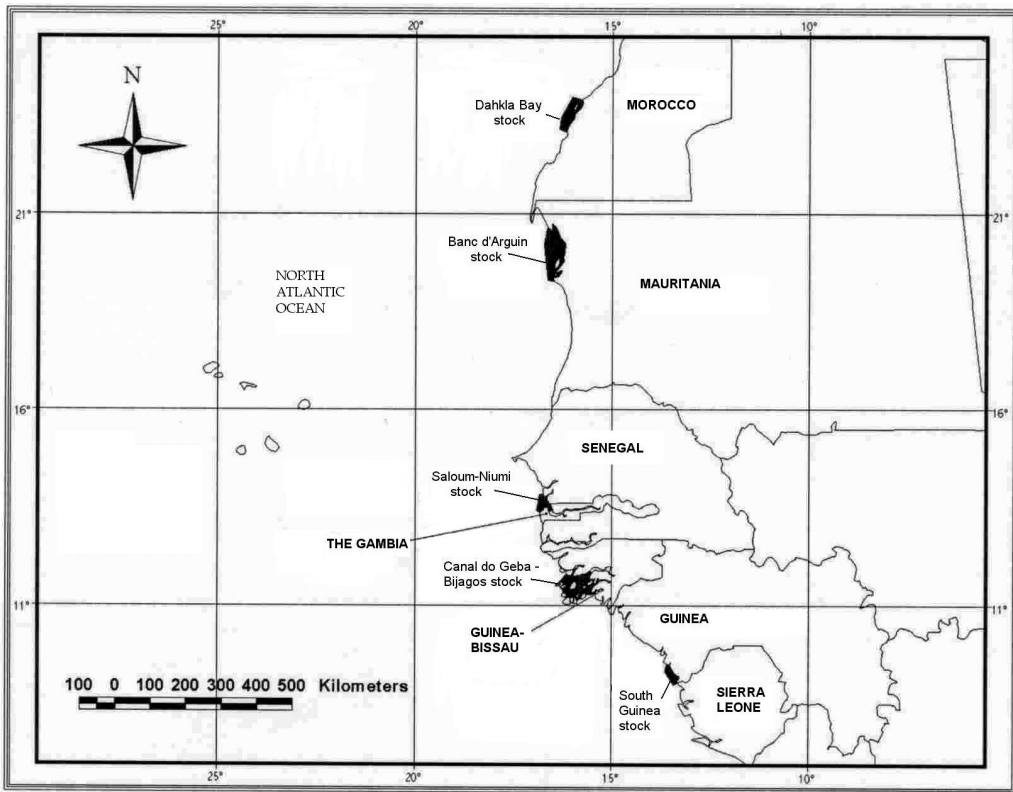


Figure 1. Known distribution areas of five proposed management stocks (Dahkla Bay, Banc d'Arguin, Saloum-Niumi, Canal do Gêba-Bijagos, and South Guinea) of Atlantic humpback dolphin in Northwest Africa, based on recent sightings; actual range for the two southern stocks is thought to be larger, but is undocumented.

Africa, no records existed previously west of the Gouritz River mouth at 21°53'E. Findlay et al. (1992) identified three sightings beyond this point, the westernmost off De Hoop at 20°30'E. Recent observations have established False Bay (18°30'E) in southwestern South Africa as the western range limit of *S. plumbea* (Victor Peddemors, pers. comm.; Ross, 2002).

Discussing the extra-limital sighting of a humpback dolphin off Israel's Mediterranean coast, Kerem et al. (2001) stated "one cannot completely exclude the identification of the West African humpback dolphin (*Sousa teuszii*), although the fact that it has never been reported from the western Mediterranean [...] makes this possibility highly unlikely" (p. 170). Indian Ocean humpback dolphins inhabiting the Red Sea have long been known to penetrate into the Suez Canal, and small groups have been reported to occur near both Port Said and Port Suez, Egypt (Beadon, 1991; Hershkovitz, 1966; Marcuzzi & Pilleri, 1971; Mörzer Bruyns, 1960). The

humpback dolphin sighted off Israel is thought to represent a good example of "Lessepsian migration" from the Red Sea, via the Suez Canal, towards the Mediterranean Sea, and was most probably a specimen of *S. plumbea*.

Morocco and Western Sahara

Distribution—Beaubrun (1990) first reported a *S. teuszii* sighting from Western Sahara (formerly Rio de Oro) in Dahkla Bay at 23°54'30"N, 15°46'30"W on 14-15 January 1989. A small group of three mixed with three *T. truncatus*. *Sousa* was identified from "... the very characteristic morphology of their dorsal fin." These humpback dolphins seem confined to the shallows of the extreme northern end of Dahkla Bay (Beaubrun, 1990; Notarbartolo di Sciarra et al., 1998). The northern Bight of Dahkla Bay, at 23°50'N, is the northernmost known distribution limit for the species (contra 20°N, cited by Klinowska, 1991). Presumed additional records from Western Sahara attributed to Martin et al.

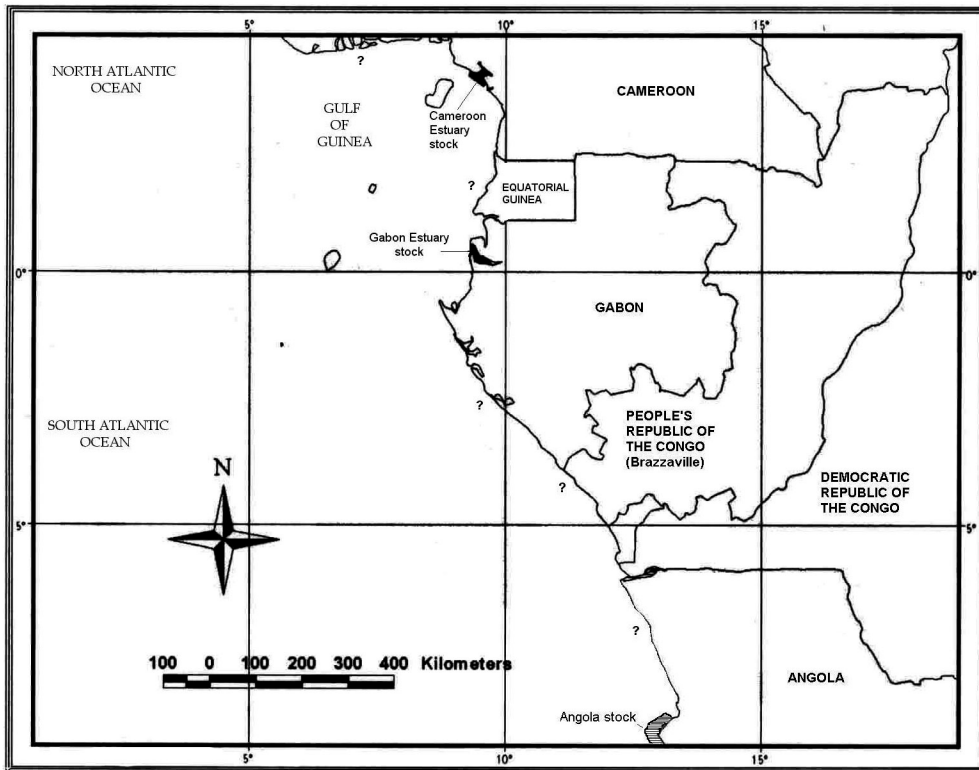


Figure 2. Locations of Atlantic humpback dolphins management stocks. Two management stocks of Atlantic Humpback Dolphin are provisionally proposed in Equatorial West Africa, each based on a single historical specimen record: Cameroon Estuary (anno 1892) and Gabon (*ca* 1940-1945). The Angola stock is based on recent sightings off southern Angola.

(1992), and cited by several authors (Jefferson et al., 1997; Powell et al., 1996), refer to the same sighting by Beaubrun (1990).

Fisheries Interactions—Suspected. A single stranded fresh specimen was examined (Notarbartolo di Sciarra et al., 1998), but was not collected (Abdellatif Bayed, in litt. to KVV, 5 October 2001); the cause of its death is unknown.

Status—The Dahkla Bay stock (Figure 1) appears to be very small (Notarbartolo di Sciarra et al., 1998) and may be a remnant of a once stronger northern foothold; however, the area has not been subject to extensive surveys or long-term monitoring. No records exist over the approximate 360 km open coastline between Dahkla Bay and Cap Blanc (20°46'N, 17°03'W at northern end of Banc d'Arguin).

Morocco has ratified several relevant environmental conventions like Convention on Biological Diversity (CBD), CITES, CMS, and Ramsar, but is nonparty to United Nations Convention on the Law of the Sea (UNCLOS).

Canary Islands and Cape Verde

Atlantic humpback dolphins are absent from the Canary Islands (see Martín et al., 1992; Vonk & Martel, 1988). The mostly rocky archipelago surrounded by deep oceanic waters offers no suitable habitat; however, Reiner et al. (1996), who reviewed cetaceans from the Cape Verde Archipelago, listed *S. teuszii* among a batch of species for which “some of them are likely to occur also in the Cape Verde Archipelago.” This is highly unlikely given 620 km of deep oceanic water separates the Cape Verde Archipelago from the African continent (see also Hazevoet & Wenzel, 2000), while *S. teuszii* has exclusively been found in a shallow, neritic environment, with mostly sandy or muddy bottoms (Maigret, 1980).

Spain (Canary Islands) is party to all the major relevant environmental conventions (CBD, CITES, CMS, Ramsar, UNCLOS), while Cape Verde is party only to CBD.

Mauritania

Distribution—René Guy Busnel first reported free-ranging *S. teuszii* from Cap Timiris, Parc National du Banc d'Arguin (PNBA), in 1972–1973 when he observed one individual among a group of 10–15 bottlenose dolphins while interacting with Imragen fishers beach-seining for mullet (*Mugil cephalus aschentiis*) (Busnel, 1973, Figures 4 & 10). One of Busnel's photographs was reproduced in Leatherwood et al. (1983, p. 189). Photos documenting an Imragen-dolphin fishing interaction event during the winter of an unspecified year, likely early 1970s (Cousteau & Diolé, 1975), and another presented in Pelletier (1975), depicted only bottlenose dolphins. The first humpback dolphin specimen known from Mauritania was a stranded female dolphin in a picture from Mr. James, taken in 1967 (Busnel, 1973; Figures 6 & 7), in which a relatively fresh carcass is shown being cut up; however, the first specimen collected was a damaged skull picked up from a beach near Cap Timiris by Busnel in 1970 (Fraser, 1973).

The Banc d'Arguin is the main area of regular occurrence of *S. teuszii* in Mauritania (Duguy, 1976; Maigret, 1980; Maigret et al., 1976; Robineau & Vely, 1998). Maigret (1980) identified two hotspots of occurrence in the PNBA park, based on 18 sightings made in 1972–1980: the Baie d'Arguin in the north and the shallow waters off Iwick in the south. Robineau & Vely (1998) reported 15 strandings and 15 sightings, with 12 and 10 of these, respectively, within the boundaries of PNBA. Strandings occurred on the southern tip of Arguin Island (n=1), on the Iwick Peninsula (n=2), on Tidra Island and facing Thila Peninsula (n=3), and along the shorelines of Cap Timiris (n=6). Sightings were made inside the Baie d'Arguin (n=2), north of Cap Tagarit (n=1), west of Tidra Island (n=1), and off Cap Timiris (n=5). No records are known for Baie du Lévrier and Cap Blanc, located just north of the PNBA. Along la Grande Plage south of Nouamghar, five sightings are registered, but only one stranded specimen is on record south of Nouakchott.

Fisheries Interactions—*Sousa teuszii* is often named in the symbiotic fishing relationship between coastal dolphins and Imragen people (e.g., Busnel, 1973; Pelletier, 1975), but photographic records suggest that, almost exclusively, bottlenose dolphins are involved.

One of us (A. Samba Ould Bilal) collected five new cranial specimens of *S. teuszii* from Mauritania (Table 1). Specimen BLM16/95 confirms that by-catch is a cause of mortality in Mauritania. Nieri, Grau, Lamarche, & Aguilar (1999) documented mass mortality of Atlantic

spotted dolphins (*Stenella frontalis*) and one *T. truncatus* as a result of purse-seine fisheries off la Grande Plage. In their original report, Nieri et al. (1996) indicated that one male *S. teuszii* was among the dolphins found in the western lagoon of Cape Timiris, but it is unclear why this was not repeated in the published paper (Nieri et al., 1999). Samba Ould Bilal confirms the contention by Nieri et al. (1996, 1999) that some Mauritians consume dolphin meat, at least occasionally.

Status—The Banc d'Arguin stock (Figure 1) is apparently fairly small. Maigret (1980) thought it did not exceed 100 animals in 1980, but apparently this number was a guess. The largest group seen numbered 20 individuals. In fact, no scientific assessment of abundance has been made. Apart from photos near Cap Timiris mentioned above, the only other photographic evidence of this stock published is from Maigret (1986, Figure 3), depicting five Atlantic humpback dolphins speeding at the surface.

Mauritania is party to CBD, CITES, CMS, Ramsar, and UNCLOS.

Senegal

Distribution—Senegal is the species range state for which most information is available (Cadenat, 1956a; Cadenat & Paraiso, 1957; Fraser, 1949; Maigret, 1980; van Bree & Duguy, 1965; Van Waerebeek et al., 1997, 2000, 2003, 2004). *Sousa teuszii* has been sighted in the three main channels of the Siné-Saloum Delta (Saloum, Diombos, and Bandiala), but it appears to be most common in the south. The main part of the 180,000 hectare Siné-Saloum Biosphere reserve consists of a swampy delta with *Avicennia* spp. mangrove, lagoons, dunes, sand banks, and sandy islands. Waters around Sangomar Island, and especially its southern tip, appear to be a feeding area for *S. teuszii* (e.g., Dupuy & Maigret, 1976; Maigret, 1980; Van Waerebeek et al., 1997).

Dupuy (1983) claimed that Atlantic humpback dolphins frequent the lower third of the Casamance, Gambia, and Senegal Rivers, but this was not substantiated (also see below). There is a single sighting “registered with certainty” from the outer estuary of the Casamance River and another probable sighting from the Casamance region near the Presqu'île aux Oiseaux, just north of the Casamance River Estuary, which is coastal habitat (Dupuy & Maigret, 1979; Maigret, 1980). Two of us (KVV and AD) rediscovered a presumably semiresident community of bottlenose dolphins, but no Atlantic humpback dolphins, in the lower stretch of the Casamance River near Carabane Island, based on sightings from the ill-fated ferry Djoola and interviews with locals

Table 1. Confirmed specimen records (n=43) of *Sousa teuszii*, 1892-2002, arranged in chronological order within each range state

Specimen no.	Collection	Area, specific site	Date	Specimen encountered	Voucher material collected	Details	Reference
Morocco							
s/n	Not collected	Dahkla Bay, western Sahara	January 1996	Carcass [2]	None	Juvenile entangled in octopus line; northern end of bay	Notarbartolo-di-Sciara (1998); A. Bayed, in litt. to KVVW
Mauritania							
s/h	Indeterminate	Mauritania	1967	Carcass [2]	Photos	Stranded female; photos by Mr. James; cut-up by Imragen	Busnel (1973); Figures 6 & 7
1981-32	MNHN	Cap Timiris, 19.23°N, 16.32°W	Indeterminate	Skull	Skull		Busnel (1970)
1983-107	MNHN	Mauritania				Beach-cast, collected by R.-G. Busnel; cranially immature	Fraser (1973)
1992.138	BMNH	Cap Timiris, 19.23°N, 16.32°W	1970	Skull [5]	Skull	Adult specimen found stranded	Duguy (1976)
?	MHNLR	Ile de Zera, Banc d'Arguin Mauritania	June 1973	Carcass	Skull	Examined by T. Jefferson on 8 September 1999	Jefferson & Van Waerebeek (2004)
1982.132	MNHN	Mauritania	Indeterminate	Indeterminate	Skull		
VST1	PNBA	Grand Plage	2 December 1993	Skull [5]	Skull	Subadult	This paper (legit A. Samba Ould Bilal)
VST2	PNBA	Rigueiba, Banc d'Arguin	27 December 1993	Skull [5]	Skull	Subadult	This paper (legit A. Samba Ould Bilal)
BLM09/95	PNBA	Teichet, Banc d'Arguin	25 January 1995	Calvaria [5]	Calvaria	Juvenile; position N 19.30', E 16.25'	This paper (legit A. Samba Ould Bilal)
BLM11/95	PNBA	Iwik, Banc d'Arguin	27 January 1995	Head [4]	Skull	Subadult; position N 19.53', E 16.19'	This paper (legit A. Samba Ould Bilal)
BLM16/95	PNBA	Ile Arguin, Banc d'Arguin	27 January 1995	Carcass [2]	Skull	Adult male killed in gill net; eaten by fishermen; N 20.34; E 16.28'	This paper (legit A. Samba Ould Bilal)
s/n	Indeterminate	Banc d'Arguin	February 2001	Carcass	Indeterminate	Carcass brought to Iwik, PNBA	This paper (Wim Wolff, pers. comm. to KVVW)
Senegal							
M.564	MHNLR	In port of Dakar	1925	Indeterminate	Skull		"Dakar, (Mr. Papot, 1925) M.564" van Bree & Duguy (1965)
93-4	IFAN	Off M'Bour, Petite Côte	Summer 1943	Carcass [2]	Skull	Cranially imm.; indet. sex; caught in shark net close to shore	Cadenat (1947); Fraser (1949)

Table 1 (cont.)

24785	NSMT	Joal (landed), Petite Côte	10 August 1955	Live-capture [1]	Skull (ex-IFAN 72)	191 cm (77 kg) cranially immat. female taken alive in beach seine	Cadenat (1956a, 1957); Kasuya (1973); Miyazaki (1986)
13.319	ZMA	Joal (landed), Petite Côte	29 June 1956	Carcass [2]	Photos	248 cm (166 kg) adult male, taken in shark gill net	Cadenat (1957); Jefferson & Waerebeek (2004)
114	IFAN Gorée	Joal (landed), Petite Côte	14 July 1956	Carcass [2]	Calvaria, teeth	186.5 cm (70.5 kg) subadult male, taken in shark gill net	Cadenat (1957); Van Waerebeek et al. (2000)
13.324	ZMA	Joal (landed), Petite Côte	18 August 1956	Carcass [2]	Indeterminate	240 cm (141 kg) adult male, taken in shark gill net	Cadenat (1957); Jefferson & Van Waerebeek (2004)
13.323	ZMA	Joal (landed), Petite Côte	1955?	Carcass [2]	Skull	Taken in shark gill net off Joal; former number "IFAN 43"	Cadenat (1956a); Jefferson & Van Waerebeek (2004)
115	IFAN	Joal (landed), Petite Côte	1958?	Carcass [2]	Calvaria + R mandible	Indeterminate	Van Waerebeek et al. (2000)
116	IFAN Gorée	Pointe Jacksonsa, Saloum Delta	Feb./March 1959	Indeterminate	Calvaria, teeth	Subadult "no. II"	Van Waerebeek et al. (2000)
117	IFAN Gorée	Pointe Jacksonsa, Saloum Delta	Feb./March 1959	Indeterminate	Calvaria, teeth (n=7)	Subadult "no. I"	Van Waerebeek et al. (2000)
118	IFAN Gorée	Yene Kao, Petite Côte	15 August 1958	Indeterminate	Calvaria; Mor	Adult, good condition	Van Waerebeek et al. (2000)
SN 29	IFAN	Senegal	Indeterminate	Indeterminate	Head mummified	Teeth: LL 26, LR 28, UL 30, UR 29	Van Waerebeek et al. (2000)
SN 62	IFAN	Senegal	Indeterminate	(Skull?)	Mandibula, some teeth	Few teeth available	Van Waerebeek et al. (2000)
SN 65	IFAN	Senegal	Indeterminate	(Skull?)	Mandibula, some teeth	Few teeth available	Van Waerebeek et al. (2000)
SN 67	IFAN	Senegal	Indeterminate	(Skull?)	Left mandible	Hole in ramus; no teeth	Van Waerebeek et al. (2000)
SN 68	IFAN	Senegal	Indeterminate	(Skull?)	Right mandible	No teeth	Van Waerebeek et al. (2000)
SN 83	IFAN	Joal, Petite Côte	Indeterminate	Indeterminate	Vertebral column	Some vertebrae broken	Van Waerebeek et al. (2000)
SN 88	IFAN	Senegal	Indeterminate	Indeterminate	Teeth only	Mistakenly referred to <i>Tursiops</i> "26"	Van Waerebeek et al. (2000)
SN 44	IFAN	Joal, Petite Côte	Indeterminate	Indeterminate	Calvaria	Rostrum damaged; all teeth lost; cranially subadult	Van Waerebeek et al. (2000)
s/n	-	Ile aux Oiseaux, Saloum Delta	15 March 1978	Carcass	None	Stranded on beach (PNdS); reported by Y. Prevost	Dupuy & Maigret (1979)

Table 1 (cont.)

KVW 3001	COREWAM	Djiffere, Saloum delta	26 April 1996	Occipital, mand. [5]	Occipital	Beach cast	Van Waerebeek et al. (2000)
KVW 3017	COREWAM	Sangomar Island, Saloum Delta	22 November 1996	Carcass [4]	Photo, skull	ca 222 cm, sex indet.; fisheries victim remains on beach	Van Waerebeek et al. (1997, 2000)
KVW 3018	COREWAM	Sangomar Island, Saloum Delta	22 November 1996	Carcass [4]	Photo, tissue	261 cm, sex indet.; fisheries victim remains on beach	Van Waerebeek et al. (1997, 2000)
KVW 3019	COREWAM	Sangomar Island, Saloum Delta	22 November 1996	Carcass [4]	Photo, skull	250 cm, sex indet.; fisheries victim remains on beach	Van Waerebeek et al. (1997, 2000)
KVW 3045	COREWAM	Ile l'Eba, Saloum Delta	19 November 1999	Carcass [4]	Skull, post-cranials	Incomplete specimen; physically and cranially immature	This paper
The Gambia							
PFM 005	DPWM	Sanyang Point	1 September 1996	Skull [5]	Skull	Beach pick-up	Van Waerebeek et al. (2000)
Guinea-Bissau							
89.03.01	Museu Bocage pers. collection	Canhabaque Island, Bijagos	March 1989	Carcass [2]	Skeleton	190 cm male died in fishing trap at 11.13°N, 13.47°W	Sequeira & Reiner (1992); Hazevoet (1999)
s/n		Bubaque Island, Bijagos	13 July 1997	Carcass [4]	Two teeth	Small specimen; found by ornithologist Rafael Matias	This paper
Cameroon							
1893.8.1.1	BMNH	Bay of Warships, Douala	1891?	Carcass	Skull	Carcass partially eaten by sharks; found floating by M. Teusz	Kükenthal (1892); Van Beneden (1892)
Gabon							
120268	AMNH	Kango, E. side of Gabon Estuary	1940s	Unknown	Skull	Maclatchy-Malbrant expedition	Mammal dept. files, H. Rosenbaum (pers. comm.)

American Museum of Natural History (AMNH), New York; Conservation and Research of West African Aquatic Mammals (COREWAM), Dakar; Department of Parks and Wildlife Management (DPWM), Abuko, The Gambia; Institut Fondamental d'Afrique Noire (IFAN), Dakar; Musee d'Histoire Naturelle de La Rochelle, France (MHNLR); Musee Nationale d'Histoire Naturelle, Paris (MNHN); Parc National du Banc d'Arguin, Mauritania (PNBA); Zoological Museum Amsterdam (ZMA). Specimen condition codes (1-5) according to Geraci & Lounsbury (1993); s/n = *sine nomine* (without name); ? = unknown.

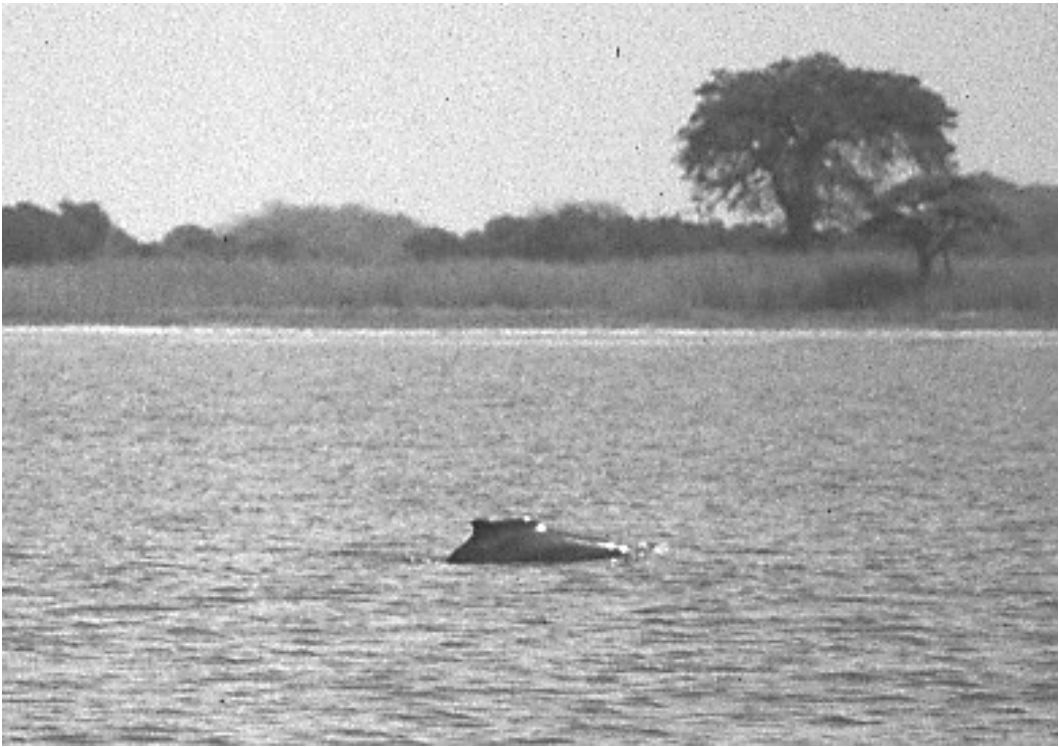


Figure 3. After feeding in a large group at Djinack Creek, Atlantic humpback dolphins of the Saloum-Niumi stock dispersed in smaller groups. One member is here seen crossing the Senegal–The Gambia international border off Djinack Island on 28 October 2000. (Photo: K. Van Waerebeek)

(Van Waerebeek et al., 1997, 2000). Sightings in 1984–1986 in the same area had also revealed *T. truncatus* (Cornelius J. Hazevoet, in litt. to KVV, 19 August 1997; cited in Van Waerebeek et al., 1997). Maigret (1980) noted that *S. teuszii* has never been observed in the Delta of the Senegal River (which borders with Mauritania), despite high observer effort in and around the Parc National de la Langue de Barbarie, and concluded that it is absent there. A few isolated reports exist of specimens caught and landed at ports (Dakar, Yène Kao, and M'Bour) along the Petite Côte, north of the Saloum Delta, but it is entirely possible that these dolphins were taken further south. Significantly, no documented records exist of Atlantic humpback dolphins from Senegal's coastline north of Dakar, nor from by-catches at the major artisanal fishing town of St.-Louis, suggesting a very low density.

Fisheries Interactions—Fishers' communities of Joal and Fadiouth, located at the northern edge of the Saloum Delta, have long been known to harpoon small cetaceans for food (e.g., Cadenat,

1956b; Van Waerebeek et al., 1997), and this would most likely include *S. teuszii* of what we define as the Saloum-Niumi stock (see further). By-catches in shark gill nets are also well-documented (Table 1). In November 1996, three carcasses with fishing rope tied around tailstocks were found together on Sangomar Island, Saloum Delta (Van Waerebeek et al., 1997, 2000).

In the few weeks before a visit on 2 June 1997, fishers from Fadiouth, home village of one of us (END), reportedly caught a humpback dolphin, sold the meat, and discarded the remains offshore to avoid detection. By-catches in artisanal gill net fisheries, as well as habitat degradation and overfishing (e.g., Deme, 1996), are thought to be the main threats to the species' survival in Senegal (Van Waerebeek et al., 1997, 2000).

Status—The large majority of records are from the Saloum Delta (Figure 1), but Maigret (1980) guessed the size of even this population at no more than 100 animals. Group size of *S. teuszii* in the Saloum Delta, recorded in the period 1999–2000, ranged from 10–37 individuals (median

Table 2. New sightings (n=15) of Atlantic humpback dolphins *Sousa teuszii* in Senegal and the Gambia, 1996-2001; all sightings are from Saloum Delta waters. Observers include the authors and trained rangers of the Parc National du Saloum and the Department of Parks and Wildlife Management. Average group size was 20.75 dolphins (SD=11.78, n=13). Notice that apparent seasonality is an artifact due to the absence of boat surveys in the rainy season (June-September). NA=Not available; "bolon" means creek in Wolof language.

Date	Time (start)	Locality	Group size	Platform	Observers	Comments
2 October 1996	NA	Off Djinaek Island (The Gambia)	8	Small boat	P. F. Murphy	Murphy et al. (1997)
10 November 1996	NA	Off Djinaek Island (The Gambia)	15	Small boat	P. F. Murphy	Murphy et al. (1997)
17 December 1996	NA	Off Djinaek Island (The Gambia)	20	Small boat	P. F. Murphy	Murphy et al. (1997)
23 March 1997	NA	Barra Point, North bank Gambia	3	NA	John High	Murphy et al. (1997)
19 November 1999	8:30	Entrance to Djinaek Bolon	26 (22-32)	Small boat	AD, END, KVVW, Colly	Feeding; dispersed in small subgroups (see text)
20 November 1999	9:14	1.5 km off Ile l'Eba	30 (25-40)	Small boat	AD, END, KVVW, Colly	Widely scattered group, milling; subgroups (see text)
9 January 2000	9:10	Entrance to Djinaek Bolon	NA	Small boat	V. Mansaly	Milling movements; apparently feeding jumps seen; dorsal humps reported
10 January 2000	11:30	Djinaek Bolon	NA	Small boat	V. Mansaly	Moved parallel to boat direction of Ile Terema
1 January 2000	8:28	Entrance to Djinaek Bolon	ca 10	Small boat	V. Mansaly	Apparently feeding; dorsal humps reported
20 January 2000	9:50	Diombos	> 20	Small boat	E. Manga, V. Mansaly	Feeding during rising tide; indifferent to boat
22 January 2000	14:30	Entrance to Bassoul Bolon	ca 30	Small boat	E. Manga, V. Mansaly	Several subgroups of 2-4 animals; no jumps
27 January 2000	12:50	Diombos, entrance to Toubakouta	ca 15	Small boat	E. Manga, V. Mansaly	Approached boat; no jumps seen
7 February 2000	NA	Diombos	ca 15	Small boat	E. Manga, V. Mansaly	Apparently feeding with rising tide; deep water
28 October 2000	10:52	Entrance to Djinaek Bolon	37 (32-42)	Small boat	AD, END, KVVW, MD	Two subgroups; moved into The Gambia (see text)
26 December 2001	7:30	Off Djinaek Island	ca 40	Shore	LB, Craig Emms	Moving from N to S, passing Madiyana camp and Senegal—The Gambia border; feeding

23; $n=8$) (Table 2). In small boat surveys, not more than one group a day was encountered, and often none, and we believe that sightings near the mouth of Djinack Creek on separate days involved a single community (Figure 3), displaying a high site-fidelity. Our observations cover the cool, dry season from November through February, but residents of Djinack (village) and park rangers claim the species is present year-round. In the absence of scientific abundance data, a low relative encounter rate suggests a low population size for the Saloum-Niumi stock.

Senegal has ratified all the major environmental conventions pertaining to marine mammals (CMS, CITES, CBD, Ramsar, and UNCLOS). It has been a contracting member to IWC since 1982, but rarely attends meetings.

The Gambia

Distribution—The presence of *S. teuszii* in the mouth of the Gambia River, and south of the capital Banjul, was mentioned without specification by several researchers (Dupuy, 1983; Maigret, 1980; Murphy et al., 1997). All substantiated sightings were situated in estuarine waters between the North Bank of the Gambia River mouth and the Saloum Delta, particularly in the Niumi National Park (Table 2). A group was observed crossing the border at Niumi (this paper) and passing from Barra Point to Buniada Point (Murphy et al., 1997). None have been documented from the Gambia River proper, although it is conceivable that humpback dolphins may occasionally enter the brackish inner estuary, particularly with rising tides; however, most dolphins seen regularly inside the Gambia River are bottlenose dolphins (Van Waerebeek et al., 2000). Also, some movements may occur between the outer estuary of the Gambia River and the open Atlantic coast of southern The Gambia, considering a skull (PFM005) was retrieved at Sanyang Point, ca. 30 km south of the river mouth (Bakau). It still stands as the first and only specimen available from The Gambia (Murphy et al., 1997; Van Waerebeek et al., 2000).

Fisheries Interactions—Information exists for one possible case of directed take in The Gambia (Murphy et al., 1997). Bottlenose dolphins were documented to be captured incidentally by local fishers (Van Waerebeek et al., 2000), and we infer from sympatry that the same probably applies to Atlantic humpback dolphins.

Status—No population estimate is available, but *S. teuszii* in The Gambia shares range with the known community in Senegal's adjacent Saloum Delta; therefore, we propose the name "Saloum-Niumi" to designate this management stock (Figure 1).

The Gambia is party to CBD, CITES, Ramsar, and UNCLOS, and recently ratified CMS.

Guinea-Bissau

Distribution—Spaans (1990) first reported Atlantic humpback dolphins from Guinea-Bissau. The species occurs around the islands composing the Arquipélago dos Bijagos, particularly off Formosa, Canhabaque, and Bubaque Islands. Further, they are associated with the sea-arms and estuaries of (from north to south) Canal do Gêba and Canal de Bolola as far "inland" as the confluence with the Río Sahol,⁶ Río Fulacunda, and Río Empada (Krömer et al., 1994; Spaans, 1990; Van Waerebeek et al., 2000; Wolff, 1998). It is not reported from the mouth of the Río Cacine, but survey effort in southern Guinea-Bissau has been minimal. While doing fieldwork on waders, Spaans (1990) opportunistically recorded 56 sightings of *S. teuszii* over an eight-week period (December 1986-February 1987) in the Canal do Gêba and the Arquipélago dos Bijagos. Bottlenose dolphins were also present in the area, but none mixed with humpback dolphins. The latter were observed mainly in the more sheltered areas, in turbid (Canal do Gêba) as well as clear water (south). Additional sightings are listed in Table 3 (Rafael Matias, unpublished data; Van Waerebeek et al., 2000; Wolff, 1998). The most recent sightings occurred in 1997.

The first specimen from Guinea-Bissau was a male collected at Canhabaque Island in March 1989. Its skeleton is presently at the Museu Bocage, Lisboa, as No. 89.03.01 (Hazevoet, 1999; Sequeira & Reiner, 1992). Ornithologist R. Matias found a carcass of a relatively small specimen, of undetermined sex at the southern end of Bruce Beach, Bubaque Island, on 13 July 1997 (Table 1).

Fisheries Interactions—None documented, largely due to lack of monitoring effort. Few fisheries observers are active in Guinea-Bissau and, understandably, little priority is given to dolphin research in the country (see Van Waerebeek et al., 2000); however, fisheries effort, especially from foreign, industrial fisheries, has sharply risen over the past two decades (e.g., Stegemann & de Braconier, 1994) and the incidence of by-catches is bound to have kept pace to that increase.

Status—The high number of opportunistic sightings (Table 3) suggests that the still relatively undisturbed coastal waters of Guinea-Bissau, enclosing extensive mangrove forest habitat, may support one of the largest known populations of *S. teuszii*. Here, we propose the name "Canal do

⁶ Canal de Bolola is also known as "Rio Grande de Buba"; it is a sea-arm, however—and not a river.

Table 3. Atlantic humpbacked dolphins sighted opportunistically during research on wader birds in Guinea-Bissau, 10 October–13 December 1992; data from B. Spaans (in Wolff, 1998); except two 1997 records by Rafael Matias and five 1998 sightings by Gordon d'Arcy (from boat).

Species	Date	Time	Coordinates N/W	Group size	Locality
<i>Sousa teuszii</i>	31 Oct. 1992	15:05	11. 30.78°/15. 38.24'	15+	Near Galinhas
<i>Sousa teuszii</i>	31 Oct. 1992	16:05	11. 30.26°/15. 37.69'	6+	Near Galinhas
<i>Sousa teuszii</i>	31 Oct. 1992	16:08	11. 29.98°/15. 37.36'	2+	Near Galinhas
<i>Sousa teuszii</i>	31 Oct. 1992	16:11	11. 29.80°/15. 37.17'	5+	Near Galinhas
<i>Sousa teuszii</i>	7 Nov. 1992	14:03	11. 32.40°/15. 29.50'	8-10	Near Ponta Calmancu
<i>Sousa teuszii</i>	7 Nov. 1992	18:00	11. 33.50°/15. 27.40'	2+	Canal do Ponto
<i>Sousa teuszii</i>	9 Nov. 1992	15:15	11. 27.87°/15. 30.43'	2+	Between Bolama and Galinhas
<i>Sousa teuszii</i>	10 Nov. 1992	12:28	11. 50.10°/15. 34.33'	2+	Near Bissau
<i>Sousa teuszii</i>	13 Nov. 1992	12:35	11. 32.40°/15. 28.10'	8+	Canais
<i>Sousa teuszii</i>	13 Nov. 1992	18:15	11. 32.40°/15. 28.10'	4-5	Canais
<i>Sousa (+5 Tursiops)</i>	14 Nov. 1992	10:05	11. 42.29°/15. 49.09'	10	Rio Geba
<i>Sousa teuszii</i>	18 Nov. 1992	indet.	11. 40.92°/15. 36.42'	20	Areias
<i>Sousa teuszii</i>	24 Nov. 1992	17:03	11. 15.93°/15. 49.35'	20	Bubaque
<i>Sousa teuszii</i>	24 Nov. 1992	18:00	11. 15.93°/15. 49.35'	3	Bubaque
<i>Sousa teuszii</i>	24 Nov. 1992	19:03	11. 15.93°/15. 49.35'	1	Bubaque
<i>Sousa teuszii</i>	26 Nov. 1992	17:32	11. 35.20°/15. 54.30'	6	Canais
<i>Sousa teuszii</i>	27 Nov. 1992	13:15	Indeterminate	6	Flamingos
<i>Sousa teuszii</i>	1 Dec. 1992	17:03	Indeterminate	5	Ponta Oeste
<i>Sousa teuszii</i>	2 Dec. 1992	16:03	11. 32.55°/15. 28.20'	3	Bolama
<i>Sousa teuszii</i>	4 Dec. 1992	11:03	Indeterminate	3	Rio de Canchaua
<i>Sousa teuszii</i>	5 Dec. 1992	16:00	11. 30.44°/15. 37.95'	10	Ponta Oeste
<i>Sousa teuszii</i>	7 Dec. 1992	16:03	11. 36.87°/15. 39.71'	1	Ponta Alvarez
<i>Sousa teuszii</i>	7 Dec. 1992	16:24	11. 37.43°/15. 37.86'	5	Areias
<i>Sousa teuszii</i>	9 Dec. 1992	20:03	11. 32.40°/15. 28.10'	1	Canais
<i>Sousa teuszii</i>	22 March- 5 April 1997		Bubaque Island	<10	Near Bubaque village; several sightings
<i>Sousa teuszii</i>	13 July 1997		Bubaque Island	ca 15	Bruce beach (south); one small calf
<i>Sousa teuszii</i>	10 Jan. 1998		11.59°/16.23'	4	Canal de Jeta
<i>Sousa teuszii</i>	10 Jan. 1998		Not recorded	20	Canal de Jeta
<i>Sousa teuszii</i>	11 Jan. 1998		11.52°/16.05'	6	Canal de Pecixe
<i>Sousa teuszii</i>	11 Jan. 1998		11.52°/16.05'	2	Canal de Pecixe
<i>Sousa teuszii</i>	21 Jan. 1998		11.30°/16.25'	3	Caravella Island

Gêba-Bijagos" stock, referring to the local area with highest recorded density (Figure 1). Powell et al. (1996) also indicated that "*Sousa* appear to be relatively common in the shallow waters around the Bijagos archipelago."

Guinea-Bissau is party to CBD, CITES, CMS, Ramsar, and UNCLOS.

Guinea (Conakry)

Distribution—French biologist, J. Cadenat (1956a) reported [literal translation]: "... the characteristic shape of the dorsal fin of this species and its colour pattern [...] make me think today that the delphinids which showed exactly these

characteristics and which I could observe in January 1953 in the silt-laden inshore waters of French Guinea, south of Conakry, must also belong to the species *Sotalia teuszii*" (p. 558). Cadenat was familiar with Atlantic humpback dolphins from his work in Senegal, and he is one of only a few biologists to have examined fresh carcasses. His account is, therefore, considered credible. There are no additional sightings reported, possibly due to a paucity of effort. Guinea's coast features prime *Sousa* habitat—that is, shallow coastal waters (0-40 m), an up to 200 km wide continental shelf (Chavance et al., 1998), and extensive creeks and mangrove forest

around four river mouths: (1) Río Komponi, (2) Río Nuñez, (3) Fatala, and (4) Konkouré. The Konkouré Estuary has been a recognized Ramsar wetlands site (No. 575) since 1992.

Fisheries Interactions—The only specimen record confirmed from Guinea, a 222 cm male weighing 220 kg, was landed by artisanal fishers on 13 March 2002 in the Bay of Sangaréah, Mansabo district, north of Conakry (Figure 3). It was consumed locally (I. L. Bamy, pers. obs.). A photographic record and the specimen's penis (in formalin) are deposited at the Centre National des Sciences Halieutiques de Boussoura (CNSHB). It is unclear whether it was a directed catch or a by-catch. Over the past decade, national fisheries have developed rapidly, and by-catches may be important. In 1995, some 75,300 MT (69% artisanal, by 2,300 canoes) of fish products were landed (Chavance et al., 1998).

Status—Unknown. The only documented records from Guinea are the Cadenat (1956a) sighting and the above-mentioned recent take in the Bay of Sangaréah, which were both in the same general area; hence, we provisionally refer to it as the "South Guinea" management stock (Figure 1). Human encroachment on the coastal environment may be a significant threat in Guinea, especially around the capital, Conakry. Since early 2001, the CNSHB field research centre at Boussoura has been given the task by Guinée's Ministry of Fisheries and Agriculture to collect information on aquatic mammals.

Guinea has ratified all relevant environmental conventions (CBD, CITES, CMS, Ramsar, and UNCLOS) and is a contracting state to the IWC.

Sierra Leone, Liberia, and Ivory Coast

Distribution—Northridge (1984), in an otherwise well-researched review, equivocally affirmed that Cadenat (1956a, 1957, 1959) "records a number of individuals from coasts of Senegal and the Ivory Coast" (p. 62). A careful reading of these papers show that all Atlantic humpback dolphins referred to were taken in Senegal. Klinowska (1991), reviewing *S. teuszii*, designated Sierra Leone, Liberia, and Ivory Coast as "known countries of origin" (p. 62), which is speculative in the absence of documentation. We know of no marine mammal research in Sierra Leone and Liberia. Some research effort in Ivory Coast (Cadenat, 1959; Cadenat & Lassarat, 1959) did not indicate the presence of humpback dolphins, but any pronouncement is premature.

Sierra Leone is party to CITES, Ramsar, and UNCLOS; Liberia ratified only CITES; while Ivory Coast ratified CITES, Ramsar, CBD, and UNCLOS and is signatory to CMS.

Ghana and Togo

Distribution—Klinowska (1991) cited *S. teuszii* for both Ghana and Togo without supporting evidence. Van Waerebeek & Ofori-Danson (1999) monitored a small-scale fishery for small cetaceans in coastal waters of mostly western Ghana (ports of Axim, Dixcove, and Apam), and while identifying more than ten species of small cetaceans, they did not encounter *S. teuszii*. Follow-up field research in 2001 and 2002 by the senior author, as part of the UNEP/CMS WAF CET-3 Project, in collaboration with teams headed by P. K. Ofori-Danson (University of Ghana, Legon) and K. Okoumassou (Ministère de l'Environnement et des Ressources Forestières, Lomé, Togo), has not led to any specimens nor scientific sightings of *S. teuszii* (unpublished data); however, at least three Togolese fishermen's leaders from the Lomé area independently interviewed by Gabriel Segniagbeto and KVV coincided and recognized a humpback dolphin (called "Kposso" by one) when showed a plate in a guidebook. They remarked on its quieter behavior in comparison with a different and sturdier, aggressive dolphin species ("giga," almost certainly *T. truncatus*) that regularly steals fish from gill nets (Van Waerebeek & Segniagbeto, unpublished data). One of us (KVV) has observed bottlenose dolphins moving from one deployed gill net to another off Cotonou, Bénin.

The possible existence of a Togo stock of *S. teuszii* requires further research. The port of Lomé, in western Togo, is situated *ca* 90 km east of Ada (eastern Ghana) where the Volta River meets the ocean, and where sandbanks form a dynamic neritic habitat, reminiscent of others where *Sousa* have been preferentially encountered.

Ghana has ratified all major conventions (CBD, CITES, CMS, Ramsar, and UNCLOS); Togo is a party to CITES, CMS, and Ramsar and is a signatory of CBD and UNCLOS.

Bénin

S. teuszii was cited, unauthenticated, for "Dahomey" (present-day Bénin) by Klinowska (1991). Cetacean surveys in Beninese coastal waters in October 2000, September 2001, and October 2002, and the perusal of two biological collections in Cotonou has so far failed to yield any evidence for the presence of *S. teuszii* (Van Waerebeek, 2002; Van Waerebeek et al., 2001). Sinsin & Owolabi (2000) in a Bénin biodiversity review did not list the species; however, it may still be premature to offer a conclusive answer on its status there.

Bénin is party to CBD, CITES, CMS, Ramsar, and UNCLOS and is a contracting government to the IWC.

Nigeria

According to some authors (Jefferson et al., 1993), Atlantic humpback dolphins inhabit rivers “such as the Niger.” Maigret (1994) stated [under Nigeria] that fishing occurs in the area where both humpback dolphins and manatees live, and both are probably caught in nets. Klinowska (1991) and Rice (1998) also cited Nigeria as a range state for the species, without supporting evidence. The present authors could identify only a very dubious reference by Danham and Clapperton from 19th century Nigeria, as reported by M. Aucapitain (1859; not seen but cited in Pilleri & Gihl, 1972 as follows): [literally translated from French] “In the same hydrographic basin of the Niger River, still so poorly studied, cetaceans occur, which are marine animals except for one genus. It seems therefore very much possible that among the unique fauna of central Africa, species might be encountered that till date have been considered exclusively marine” (p. 239). This description is so vague as to leave open any aquatic mammal, including the West African manatee (*Trichechus senegalensis*), whose range of greatest abundance is precisely the Niger River and its tributaries (Nishiwaki et al., 1982; Powell et al., 1996). The fact that Aucapitain (1859) does not name the hard-to-miss manatees of the Niger further raises questions. Van Beneden (1892), while he believed in the existence of an African river dolphin, had earlier pointed to the caveat that material evidence was lacking: [translated] “This is not the first fluvial dolphin from Africa; Danham and Claperton [sic] reported one from the Niger Delta, which M. Aucapitain referred to in the *Revue Zoologique* of 1858, but of which nothing has been conserved” (p. 351). Van Beneden added that another report by Aucapitain of “a cetacean” from Lake Tradé was probably “*du Manatus vogelii*, un Sirénien,” which confirms that Aucapitain considered manatees among the Cetacea. We conclude that, to date, no verifiable records exist of *S. teuszii* from Nigeria, although it is most likely that they inhabit, or at least inhabited, the Niger Delta in the past before wide-scale oil exploitation began in the area. We doubt that any humpback dolphins reside in the true fluvial environment of the Niger River.

Nigeria is party to CBD, CITES, CMS, and UNCLOS. It is a signatory of Ramsar.

Cameroon

Distribution—Only a single specimen has ever been documented from Cameroon. In 1892,

Willy Kükenthal described a new dolphin species, *Sotalia teuszii*, from the Bay of Warships in the Cameroon Estuary off present-day Douala, about which he wondered whether it was an herbivore. His correspondence with the Flemish marine mammalogist, Pieter Joseph Van Beneden (1892), illustrated the confused circumstances of the finding, and the several instances of the specimen(s) changing hands, where the possibility of a mismatch between a manatee stomach and a dolphin skull is easily imagined: “At the end of the Bay of Warships, after a heavy rain storm, a dolphin [carcass] swept by the current was preyed upon by sharks. The director of plantations in Cameroon, M. Tëusz, witness of this event, luckily managed to salvage what remained of the carcass.⁷ The viscera were lost, with the exception of the stomach. The contents of the latter consisting of grassy herbs and above all of partly digested fruits, indicates that it is a dolphin with a vegetarian diet. The head, which Mr. Tëusz organized to have it prepared *in situ*, luckily fell into the hands of a distinguished naturalist, namely professor Willy Kükenthal from Jena, who after having given it the name *Sotalia Teuszii*, and having sent a note to the editor of the *Zoologischen Jahrbucher*, has been so kind to send me the photograph, with the permission to publish it” (p. 350).

Fisheries interactions—None reported. Either interactions do not occur (anymore) or the complete lack of monitoring effort is to blame.

Status—We refer to this historical stock as “Cameroon Estuary” (Figure 2), the status of which is unknown. Since the 1892 discovery of the holotype, no other specimens nor sightings have been reported from Cameroon waters. In the absence of aquatic mammal research in the area, it is unknown if the holotype specimen was a vagrant, or if the species still occurs there.

Cameroon is party to several conventions, including CMS, CITES, CBD, and UNCLOS.

Equatorial Guinea

No sighting or specimen records of humpback dolphins are published for either the mainland Río Muni nor Bioko (Fernando Póo) and Pagalu Islands. The offshore islands are most likely not part of *S. teuszii* distribution, but Río Muni is potential coastal range, considering the species has been encountered in the Gabon Estuary. No marine mammal information is published from

⁷ Apparently it is the director of plantations himself, M. Tëusz, who determined the shark-damaged carcass was of “a dolphin.” The suggested connection between this animal’s stomach and a dolphin skull that appeared at the office of Dr. Kükenthal in Jena, Germany, is poorly documented and presumably was inferred equivocally.

these areas beyond some descriptions of aboriginal whaling activities for humpback and Bryde's whales off Pagalu (see Aguilar, 1985). Equatorial Guinea is a party to CBD, CITES, and UNCLOS.

São Tomé and Príncipe

No records of the Atlantic humpback dolphin exist for the Democratic Republic of São Tomé and Príncipe, and it is unlikely that an inshore species such as *S. teuszii* would have crossed into this oceanic archipelago. São Tomé and Príncipe is nonparty to CBD, CITES, CMS, and Ramsar. It is only a signatory since 1987 to UNCLOS.

Gabon

Distribution—Knowledge of small cetaceans occurring along the 885 km coastline of Gabon is scant (see Fraser, 1950; Van Waerebeek & De Smet, 1996) and no published accounts of humpback dolphins are available; however, Howard Rosenbaum (in litt. to KVV, 31 January 2002) informed us of one skeletal *Sousa* specimen (AMNH 120268) in the Mammal Department collections of the American Museum of Natural History, New York, collected during the Maclatchy-Malbrant expedition. The locality is Kango (00°15'N, 10°11'E), situated at the eastern end of the Gabon Estuary. The only field notes available from the expedition are typed lists of specimens received by the AMNH. Maclatchy and Malbrant were probably working for some other agency with an agreement to send specimens to the AMNH: "During the war [World War II], there were very few field expeditions, but the museum continued to receive material from Army tropical medicine personnel. Unfortunately, no field journals or published accounts of the expedition are available" (H. Rosenbaum, in litt.).

Fisheries Interactions—None reported, probably due to lack of monitoring.

Status—We propose to provisionally name this the "Gabon stock" (Figure 2). Gabon is party to CITES, Ramsar, CBD, and UNCLOS, but not to CMS. It recently became a member of the IWC.

People's Republic of the Congo

The People's Republic of the Congo (often referred to as Congo-Brazzaville) with its 169 km of coastline is not a known range state for *S. teuszii*. Congo-Brazzaville has ratified all the major relevant environmental conventions, including CBD, CITES, CMS, and Ramsar.

Democratic Republic of the Congo (formerly Zaire)

No humpback dolphins have been reported along the very short (37 km) coast of the Democratic Republic of the Congo (DR Congo) or in the Zaire River; however, the Parc National des Mangroves,

a 66,000 ha Ramsar site at the mouth of the Zaire River, provides suitable *S. teuszii* habitat, including large estuarine channels lined by mangrove forest. Surveys are needed to determine whether or not the DR Congo is a range state of *S. teuszii*.

DR Congo is party to CITES, CMS, and Ramsar, and is a signatory of CBD.

Angola, including Cabinda

Distribution—Jefferson et al. (1993) suggested that *S. teuszii* may possibly [occur] to northern Angola, while Rice (1998) stated that "published assertions that it ranges to Angola are purely conjectural" (p. 103). Dr. Victor Cockcroft⁸ (in litt. to KVV, 24 August 1999) received "numerous reports from divers on the oil rigs and pilots flying the area, that they occur off northern Angola" and Cabinda. While flying an aerial survey off the northern Angolan coast in the early 1990s, John Hatton reported a group of *Sousa* from about 150 km north of Luanda. Dr. Hatton was familiar with *Sousa* from Mozambique. Cockcroft himself searched two weeks off Luanda and south in the Kwanza (Coanza) River without sighting any humpback dolphins. No specimens were in the Luanda Museum.⁹ He spoke to many fishermen, both commercial and artisanal, but none could identify humpback dolphins.

Cockcroft recently provided us with a photograph taken by Alex Vogel (Figure 5), solid evidence for the presence of humpback dolphins off southern Angola. Mr. Vogel indicated that, while paddling the coast of southern Angola in February 1997, between the towns of Namibe (15°03'S, 12°10'E) and Tombua (15°47'S, 11°47'E), he saw small groups of four to five *Sousa* daily. This is just north of the area influenced by the cool Benguela Current.

Fisheries Interactions—None reported to date, but no monitoring of fisheries has taken place.

Status—The present status of an "Angola stock" of Atlantic humpback dolphins (Figure 2) can now be updated from unconfirmed-contemporary (Van Waerebeek, 2003) to confirmed. No abundance estimate is available, but all groups seen have been very small.

Angola ratified only the World Heritage Convention and UNCLOS. Signatory status of CMS and CITES is currently in process (Fretey, 2001).

⁸ Centre for Dolphin Studies, P.O. Box 1856, Plettenberg Bay 6600, South Africa

⁹ *S. teuszii* is unlikely to be found in the Kwanza River.

Status

Stock Structure

The morphological and molecular genetic samples required for biological population assessments are currently lacking; however, for practical (nominal) reasons and for conservation purposes we have provisionally discerned eight “management stocks.” These are comparable to the biogeographically defined management units of large whales by the IWC (Donovan, 1991), where biological stock data are absent or deficient. In the definition of the six extant management stocks, we were guided by sightings, or other contemporary records, clustered around a confirmed habitat (Figures 1 and 2)—that is, from north to south, Dahkla Bay, Banc d’Arguin, Saloum-Niumi, Canal do Gêba-Bijagos, South Guinea, and Angola. Historical evidence suggests the existence of another two stocks, namely the Cameroon Estuary and Gabon. A potential existence of a ninth management stock, off western Togo, is currently under investigation. Although no claims of biological population status are made here for any of these management stocks, some are expected to acquire such status pending future research. Notably, the three northernmost stocks—Dahkla Bay, Banc d’Arguin, and Saloum-Niumi—may exhibit some restriction in genetic exchange. If so, it may be a recent phenomenon, like following local extinctions of communities due to mounting human pressure (particularly fisheries). Some of the above-defined contiguous management stocks may prove artificial and, as datasets improve, may ultimately coalesce into a single biological population.

In summary, confirmed range states of *S. teuszii* presently include nine West African maritime nations: Morocco (Western Sahara), Mauritania, Senegal, The Gambia, Guinea-Bissau, Guinea-Conakry, Cameroon, Gabon, and Angola. Encouraging anecdotal evidence exists for their recent occurrence off Togo. It is expected that increased search efforts will result in further discoveries.

Abundance

No abundance estimates for *S. teuszii* are available from any area, but abundance is certainly low compared with those of more widely distributed, oceanic delphinids. Some relative appreciation of density can be formulated as follows. The northernmost community, Dahkla Bay, is small by any definition. In four sightings, the aggregated total number observed was 28 dolphins, and some of these may have been resightings (Notarbartolo di Sciarra et al., 1998). The Banc d’Arguin stock has been suggested not to exceed more than 100

individuals (Maigret, 1980), but a more recent guess put it at least at high hundreds (Alex Aguilar, pers. comm.). A guesstimate of “not more than 100 animals” was also cited for the Saloum Delta population by Maigret (1980), while Mitchell (1975a) stated that for coastal waters of southern Senegal “it is rather common” (p. 910). From our observations of the Saloum-Niumi stock since 1997, it appears highly unlikely that abundance would exceed low hundreds, and may be less.

From Spaans (1990) and more recent sightings (Table 3), it follows that at least until 1998 the species was not uncommon in the waters of Canal do Gêba and Bijagos Archipelago in Guinea-Bissau; the same was remarked by Powell et al. (1996), and we believe this is one of the healthiest stocks. Nothing can be said about the Guinea-Conakry and Angola stocks, except that recent records have confirmed their existence, but groups seen off southern Angola were very small. No meaningful guesses can be made for Gabon, Cameroon, Togo, and intermediate areas, nor for any other West African country.

Past and ongoing fisheries monitoring in western Ghana (Debrah, 2000; Van Waerebeek & Ofori-Danson, 1999; Van Waerebeek et al., unpublished data) documented hundreds of landed dolphins, taken in coastal fisheries, none of these *S. teuszii*. It suggests that Atlantic humpback dolphins, if not absent, are very rare west of Tema port (05°37'N, 00°01'E), central Ghana, possibly extending west several hundreds of kilometers into Ivory Coast, considering it has neither been reported there. We suggest that the apparent absence may be due to local extinction after decades of high levels of by-catches, if not direct exploitation.

A huge fisheries effort, both artisanal and industrial, in the exploitation of neritic fish stocks in most of West Africa (e.g., Armah et al., 1996; Deme, 1996; Khan & Mikkola, 2002), including both known prey species of *S. teuszii* (see below), is thought to be an additional factor, the result of reduced foraging success, that may hamper dolphin stocks to recover from high mortality.

In the absence of scientific abundance estimates, unknown recruitment, population structure, and trends, combined with a lack of understanding of threats, honouring the precautionary principle, population managers need to plan for the worst.

How often individual animals move between proposed management stocks is unknown, but as field research intensifies, the failure to encounter more than a few individuals in some areas is reinforcing the argument for increasingly isolated

¹⁰ As last amended by the CMS Conference of the Parties in 1999, effective from 14 February 2000.



Figure 4. An adult male Atlantic humpback dolphin was taken by artisanal fishers on 13 March 2002 in the Bay of Sangaréah, north of Conakry. This animal, consumed locally, represents the second record of *Sousa teuszii* for Guinea in half a century, and the first specimen record for the country. (Photo: I. L. Bamy)

reproductive units, and a concomitant greater risk of virtual local extinction, as we hypothesize for western Ghana.

The conservation status of *S. teuszii* has been assigned to CMS Appendix II,¹⁰ IUCN “Data Deficient,” and CITES Appendix I (all *Sousa* species). We strongly recommend that we continue granting *S. teuszii* the maximum possible legal and other protection, considering its many unknown biological parameters and low prospects for efficient monitoring of stock status.

Habitat and Ecology

Habitat

Atlantic humpback dolphins use predominantly tropical coastal and estuarine habitat with soft-sediment bottoms. The species typically lives nearshore in the Saloum Delta and Niimi National Park, often within 100-200 m from the beach. Off southern Angola, animals were seen on a daily basis from a kayak, clearly within a short

distance from shore (see photo by Alex Vogel, Figure 5). All confirmed sightings in Senegal and The Gambia have occurred within viewing distance from shore, and a young individual was taken alive in a beach-seine near Joal in 1955. No offshore sightings have been reported.

Tolerance for variable salinity levels seems important and includes both the brackish water of large estuaries and highly saline waters (39-55%) such as found in the Saloum Delta, particularly during dry season (E. Ndiaye, unpublished data, in Van Waerebeek et al., 2000). Although *S. teuszii* has repeatedly been suggested to also occupy riverine habitat (Dupuy, 1983; Jefferson et al., 1993; Klinowska, 1991; Powell et al., 1996; Van Beneden, 1892), this remains unauthenticated. To date, there is not a single positive record from fresh water biotope. If occasional stragglers were to be confirmed from higher upstream than the estuary, we predict they may have moved in with rising tidal seawater intrusion. In some dry years, the Saloum and Bandiala are like

nonfunctional “rivers” with little freshwater runoff; they function rather like huge tidal creeks. In the dry season, the upper reaches are characterized by hypersalinity linked to high evaporation (E. Ndiaye, unpublished data). Others are broad estuaries with massive tidal penetration like the Gambia River and Gabon Estuary. Claims of sightings in the Niger (Klinowska, 1991), Senegal, and Casamance Rivers are unsupported. Bottlenose dolphins, which have been sighted considerably upstream in the Casamance and Gambia Rivers, may have been mistaken for Atlantic humpback dolphins.

Seasonal Movements

Maigret (1980) suggested a possible seasonal movement between Banc d’Arguin (Mauritania) and Senegal’s Saloum Delta; however, there are no indications of seasonality in occurrence in either area, nor any observations that would point to long-distance seasonal migration. It is much more probable that some season-dependent movements occur around one particular stock’s core area. The absence of specimens in northern Senegal and the paucity of records in southern Mauritania suggest that movements between presumed home ranges of the defined stocks are rare.

Cross-border movements between Senegal’s Saloum Delta and the north bank of the Gambia River Estuary (part of which forms Niimi National Park) were observed directly on several instances, which is the reason why the Saloum-Niimi is considered a single stock, while *S. teuszii* is technically, if not ecologically, a “migratory species” under CMS/UNEP terminology. Unpublished and published observations from October through March (Table 2; Cadenat, 1959), a sighting in April (Cadenat, 1959), and a capture off Joal in August (rainy season), point to a year-round presence in Saloum-Niimi, which also was noted by Maigret (1977).

Some movements between Saloum-Niimi and Bijagos (Guinea-Bissau) are probable, considering the relatively limited distance (*ca.* 280 km) and higher densities in southern regions.

Feeding Ecology

Limited qualitative and no quantitative data are available on the feeding ecology of *S. teuszii*. The stomach of a 248 cm adult male landed at Joal, Senegal, and it contained the remains of various fishes, including one specimen of grunt (*Pristipoma jubelini*, Pomadasysidae; “carpe blanche”) (Cadenat & Paraiso, 1957). These same authors stated that for three humpback dolphins whose stomachs were not empty, all firmly indicated an ichthyophage diet (p. 331). Other prey species reported from Senegal are bongo fish

(*Ethmalosa fimbriata*) and mullet (*Mugil* spp.) (Cadenat, 1956; Maigret, 1980), both abundant nearshore. One humpback dolphin among a pod of bottlenose dolphins was photographed while herding mullet against gill nets set by Imragen fishermen in Mauritania (Busnel, 1973).

The suggestion by Kükenthal (1892) of a possible herbivore diet in Cameroon is highly doubtful. Considering the nature of the plants (mangrove) and description of morphological traits of an examined carcass attributable to a manatee and not a dolphin, we agree with Cadenat & Paraiso (1957) that the stomach contents of a West African manatee may have been confused for that of a dolphin, and were not secondary from stomachs of ingested herbivore prey species or plants swallowed by accident (Leatherwood et al., 1983; Mitchell, 1975a).

Social Organization and Behavior

Deducted from four sightings in January 1996, mean group size for the Dahkla Bay stock was estimated to be 6.9 individuals (Notarbartolo di Sciara et al., 1998). Similarly, in Guinea-Bissau, based on raw data by Wolff (1998), group size ranged from 1-20 individuals, with a mean of 6.5 (SD=6.09, n=15). Information published by Spaans (1990) from the same area permitted us to compute comparable results (mean 4.4, SD=4.19, n=54, range 1-15, mode 2, median 2.5). These are significantly smaller ($p<0.001$) than the group size observed in the Saloum Delta (mean 22.9, SD=9.33, n=8, range 10-37), even allowing for a somewhat variable interpretation of what precisely constitutes “a group” by the various authors, it would probably not explain all the variance. There is some evidence from Senegal (KVV, pers. observations) that larger aggregations form when feeding occurs, then scatter into smaller subgroups after the event. In Guinea-Bissau, Krömer et al. (1994) also observed foraging groups of 6-25 animals and small groups of two to four animals when traveling. The number of preferential feeding areas seem limited in the Saloum (e.g., Djinack Creek, Bandiala, and Sangomar Point), conducive to a fair degree of site fidelity; whereas in Guinea-Bissau, home ranges may be wider and many more foraging localities may exist, permitting small groups to scatter more widely.

Atlantic humpback dolphins, although sharing much of the same habitat with inshore-type bottlenose dolphins, only rarely mingle with them. In Guinea-Bissau, no mixed groups were noted by Spaans (1990), but in 1992 a group of ten *S. teuszii* was encountered swimming alongside five

T. truncatus (Table 3). From the Saloum-Niumi stock, no mixed groups are known to this date.

Aerial displays are not common, and Spaans (1990) reported that almost all sightings (in Guinea-Bissau) refer to quietly swimming and regularly surfacing groups. In only four cases, humpback dolphins jumped clear off the water surface. Similarly, in the Saloum-Niumi population, only on one occasion (26 December 1991) did several individuals of a 40-strong group jump clear of the surface off Ginack Island. On another occasion, at least four large individuals chased alongside a dinghy and porpoised (Table 2). Spaans never saw the species bowride. In Togo, reports of notably quiet and unobtrusive dolphins suggested that fishermen's descriptions of dolphins with a hump on the back may indeed point to *S. teuszii*.

Life History

Reproduction

Little data on reproduction are available, partly because Atlantic humpback dolphins, like South African humpback dolphins (Barros & Cockcroft, 1991), rarely strand. Size and age at attainment of sexual maturity are unknown. Perrin & Reilly (1984; citing as source Allen, 1977, not seen) indicated 200 cm ($n=3$) as average length of sexually mature males for *S. teuszii*, and offered no information for females. Evidence for this datum is unclear, but may be a simple extrapolation from *S. chinensis* since Allen (1977) referred to dolphins kept in Australasian oceanaria.

In the Saloum Delta and Bijagos Islands, births were thought to occur in March and April (Krömer et al., 1994; Maigret, 1980), but no specific documentation was offered to support this. No *S. teuszii* neonates have ever been examined, but length at birth would probably be similar to the 100 cm cited for humpback dolphins (*S. plumbea*) from South Africa (Ross, 1979). No growth or age determination studies have been carried out.

Mortality and Predators

No predators are known for *S. teuszii*. In comparison, shark predation is important in humpback dolphins from Natal, South Africa, and Queensland, Australia, as evidenced by abundant shark-induced scars and wounds (e.g., in 36% of *Sousa* in Moreton Bay), which happen to be useful in photo-identification (Corkeron et al., 1987; Karczmarski & Cockcroft, 1998). In the Saloum Delta, we found humpback dolphins to be virtually devoid of notches, scars, and other marks, suggesting low levels of predation and no or insignificant levels of boat contact. With one

exception, we were unable to identify individuals based on dorsal fin patterns (Defran et al., 1990), but close encounters have been very few and the longest lens available was 210 mm.

No live-strandings of *S. teuszii* have been reported, which is expected. Shallow-water species like the Atlantic humpback dolphin should have developed the ability to avoid lethal strandings. One strategy would consist in approaching sand banks (for feeding) only with rising tide, which agrees with our own and with earlier observations (Maigret, 1980). Moreover, strandings of individuals which died of natural causes seem to be rare. All *S. teuszii* specimens of documented origin were derived either from confirmed catches, directed or accidental, or were beach-cast where cause of death was unknown but likely fisheries related. Finally, some strandings might go unreported due to the lack of researchers, stranding networks, and other resources, or because they occur in remote areas.

Parasites and Pathology

Nothing has been published on parasites, pathology, or deformities. In a sample of six skulls from Senegal, none showed osseous deformation indicative of *Crassicauda* nematode infestation (KVV, unpublished data).

Morphology

Little has been published on individual variations in morphology and colour pattern of *S. teuszii*, as only a handful of specimens, and even fewer fresh carcasses, have become accessible to biologists (Table 1). No descriptions of soft tissues, organs, or histology are available. The largest specimens in a sample of eight measured 261 cm (KVV-3018, from Senegal) and 235 cm for males and females, respectively. The highest recorded body mass was 166 kg for an adult male that measured 248 cm.

Individual variation in cranial measurements and tooth counts is presented in Table 4. It includes data from 19 adult and subadult skulls, mostly from Saloum Delta and Banc d'Arguin stocks. Other cranial material examined by KVV was either too damaged to be useful or was juvenile. It should be noted that, unlike in most delphinids, the premaxillaries and maxillaries fail to fuse apically, even in older specimens that exhibit bony fusion in other bones. A study of interspecific variation in cranial morphometrics of *Sousa* spp. (Jefferson & Van Waerebeek, 2004) found convincing evidence of the distinctness of *S. teuszii*, confirmed at specific level. Too few skulls

Table 4. Statistics of craniometrics and meristics for 19 cranially adult and large subadult specimens of *Sousa teuszii* from Senegal, Mauritania, and one each for Cameroon and Gabon; the sample is not gender-stratified because most skulls are derived from specimens of unknown sex.

Cranial measurement	Mean (mm)	SD (mm)	Maximum (mm)	Minimum (mm)	Median (mm)	N
Condylobasal length	494.4	10.7	511.0	478.0	493.0	16
Rostrum length	292.3	9.7	307.5	274.0	292.5	17
Rostrum width at base	113.5	5.8	126.5	100.0	114.0	17
Rostrum width at 60 mm	82.9	3.0	90.5	80.0	82.3	10
Rostrum width at ¼ length	76.6	1.0	78.0	75.5	76.5	4
Rostrum width at ½ length	49.9	4.6	64.0	44.0	49.0	16
Rostrum width at ¾ length	34.3	3.1	38.0	28.0	35.0	16
Premaxillary width at ½ length	33.7	3.9	44.0	27.0	34.0	16
Rostrum tip to external nares	328.9	9.4	342.0	314.0	328.0	9
Rostrum tip to internal nares	338.9	25.8	371.0	308.0	339.3	8
Preorbital width	199.3	5.0	210.0	192.0	198.0	16
Postorbital width	217.7	7.0	236.5	208.5	217.0	17
Zygomatic width	217.0	6.8	238.5	209.0	217.0	16
Parietal width	165.8	15.9	183.0	135.0	173.0	16
Greatest width of premaxillaries	85.9	2.4	90.0	83.0	86.0	16
External nares width	53.5	4.3	59.5	44.0	53.5	16
Internal nares width	61.0	7.0	72.0	46.0	61.5	15
Temporal fossa length	105.3	4.4	116.0	97.0	104.3	17
Temporal fossa width	81.6	12.2	98.0	53.0	85.5	17
Orbit length	55.8	2.6	60.0	51.0	57.0	16
Antorbital process length	42.8	3.2	49.0	39.0	43.3	15
Upper tooth row length	254.3	8.5	270.0	241.0	255.0	16
Lower tooth row length	245.0	-	250.0	240.0	245.0	2
Ramus length	424.0	1.4	425.0	423.0	424.0	7
Ramus height	83.9	5.8	89.0	72.0	85.0	7
Number alveoli upper left (UL)	29.8	1.2	32.0	28.0	30.0	12
Number alveoli upper right (UR)	29.4	1.4	31.0	27.0	30.0	14
Number alveoli lower left (LL)	29.0	1.7	31.0	28.0	28.0	8
Number alveoli lower right (LR)	28.0	-	29.0	28.0	28.0	6
Tooth width	7.0	0.4	7.4	6.3	7.2	9
Height braincase	140.7	-	152.0	133.5	138.0	5
Length braincase	153.4	-	157.0	150.0	153.3	4
Maximum width palatines	57.5	-	60.5	55.5	56.5	3
Maximum span occipitals	104.0	-	110.5	99.0	102.0	5
Maximum width nasals	52.3	-	54.0	50.5	52.5	3
Alveolus width	9.7	-	9.9	9.3	9.8	4

are available to evaluate intraspecific variation at stock level.

A few marked cranial and postcranial morphological differences between Atlantic humpback dolphins and other *Sousa* spp. have been documented. *S. teuszii* has 52-53 vertebrae (Cadenat, 1956, 1957), higher than congeners (e.g., 49-52 in *S. chinensis*, Ross et al., 1994); and they exhibit lower tooth counts (27-32 in this study), a shorter mandibular symphysis, and a significantly broader cranium (Jefferson & Van Waerebeek, 2004; Pilleri & Gahr, 1972; Ross, 2002).

Kasuya (1973), in a systematic study of toothed whales, described the morphology of the tympano-periotic bone in one specimen. Cherbit & Alcuri (1978) tested sonic propagation in the *S. teuszii* skull using holographic interferometry. They suggested that sound transmission (echolocation) was unlikely via the bony tissue of the rostrum.

The skull of *S. teuszii* can be distinguished from the very similar skull of the rough-toothed dolphin *Steno bredanensis*, which also occurs off West Africa, by the absence of a prominent cylindrical ridge on the ventrolateral aspect of the

Table 5. External body measurements in cm and percentage of standard body length (SL) in parentheses for two Atlantic humpback dolphins landed at Joal, Senegal, in 1955 and 1958; the unusual great distance from midpoint genital slit to anus in the first specimen which, if not an error, strongly suggests it to be a male rather than a female; NA=not available.

External measurement	From	Subadult female Cadenat (1956a)	Adult female Cadenat (1959)
Standard body length (SL)		191.0 (100.0)	235.0 (100.0)
Middle of base dorsal fin to flukes notch		107.0 (56.3)	116.5 (49.5)
Tip of snout to melon crease (length of snout)		12.5 (6.5)	15.5 (6.6)
Tip of snout to anterior border blowhole		26.5 (13.9)	32.5 (13.8)
Tip of snout to anterior border eye		30.0 (15.7)	NA
Length of gape		26.0 (13.6)	NA
Distance from midpoint of genital slit to anus		30.0 (15.7)	7.3 (3.1)
Length of flipper		28.0 (14.7)	33.0 (14.0)
Maximum width of flipper		NA	14.0 (5.9)
Height of dorsal fin		17.0 (8.9)	21.5 (9.1)
Base length of dorsal fin		50.0 (26.2)	63.0 (26.8)
Maximum span of flukes		47.5 (24.9)	60.0 (25.5)
Height of caudal peduncle at insertion of flukes		15.0 (7.9)	16.5 (7.0)
Depth of fluke notch		4.0 (2.1)	NA

frontal bone (see Van Waerebeek et al., 1999) and a higher tooth count (> 26 per tooth row), but the identification of beach-worn specimens can be tricky.

External measurements are available for only two individuals—one subadult and one juvenile (Table 5). Coloration patterns have been noted during recent observations in the Saloum Delta by the senior author. All dolphins, including large adults, were colored uniformly light grey on the back and whitish underneath; many showed dark specks on the tailstock, but nowhere else. The fresh Guinea specimen also showed some flecks below the anterior edge of the dorsal fin (Figure 4). All had pronounced humps mid-dorsally (except for one larger calf accompanied by an adult), like the *plumbea* form but very different from humpback dolphins (*chinensis* form) of Southeast Asia and Australia (see Jefferson & Karczmarski, 2001). Evans (1987) asserted that “as with previous [*Sousa*] species, pale cream young darken as grow older” (p. 42); however, the basis for this is unclear.

Exploitation

Incidental Takes

The majority of specimens archived in collections are derived from dolphins taken either incidentally or directed in small-scale coastal fisheries (Table 1). The only specimen record from Morocco (Western Sahara) was a carcass found entangled in an octopus line in 1996. Imragen fishermen of Mauritania were photographed in

1967 butchering an animal reported “stranded” (Busnel, 1973); however, it was most probably a dolphin by-caught in nets. A second specimen, an adult killed in a gill net in 1995, also was eaten by fishermen at Ile Arguin (Table 1). At least five individuals from Senegal have been derived from by-catches in shark gill nets in the period 1955–1956, and another one in 1943 (Cadenat, 1947, 1956a, 1957; Cadenat & Paraiso, 1957).

On 22 November 1996, when two of the authors (KVV, END) and Pape Dione surveyed beaches of uninhabited Sangomar Island, three carcasses of *S. teuszii* were found over a stretch of 25 m. Nylon rope was tightly knotted around the tailstocks of two animals, indicating fishermen had pulled the dolphins for some reason. They were abandoned on the island without being utilized, presumably for animist-religious reasons as explained by fishers from the nearby village of Djiffer, the only documented example of such circumstances (Van Waerebeek et al., 1997). The single known specimen from Guinea-Bissau died in a fishing trap in 1989 (Sequeira & Reiner, 1992).

The true extent of incidental mortality in all range states is probably considerably higher than these few examples suggest. Based on observations and specimens recovered and well-documented steep increases in fishing effort (e.g., Khan & Nikkola, 2002), incidental mortality may be the most important threat to the species’ survival and the hardest to address (Van Waerebeek, 2003).



Figure 5. Small groups of Atlantic humpback dolphins were observed almost daily by Alex Vogel nearshore between Namibe and Tombua, southern Angola, in February 1997. This sighting is the first documented record of *Sousa teuszii* for Angola. (Photo: A. Vogel)

Directed Takes

The species lives in an area of high human population growth and protein food deficit, so where they are locally common there is potential for fisheries for human consumption (Klinowska, 1991). The Senegalese fishing communities of Joal and Fadiouth, and some others along the Petite Côte, have long been known to harpoon dolphins with regularity until at least 1996 (Cadenat, 1947, 1956b; Van Waerebeek et al., 1997), including humpback dolphins of the Saloum-Niumi population. One animal was caught off M'Bour in the rainy season (summer) of 1943, and a second was harpooned at the mouth of the Bandiala in the summer of 1942 (Cadenat, 1947). The illegality of the practice induces fishermen to hide all evidence of captures, which they do efficiently, so no estimates on numbers caught exist. Butchered dolphin remains are either discarded at sea, used

as bait, or buried on the beach (Van Waerebeek et al., 1997, 2000).

A 191 cm female was taken alive in a beach-seine near Joal in August 1955, but was not returned (Cadenat, 1956a; Table 1); the young animal presumably was killed and used for food. No other live-captures are known (Mitchell, 1975b; Van Waerebeek et al., 2000). Mörzer Bruyns (1971) briefly mentioned (without details) that “a living dolphin was recently obtained” (p. 99) perhaps referring to the Cadenat (1956a) case. Worldwide, few humpback dolphins and no *S. teuszii* have been kept in captivity (Ross et al., 1994). Besides Allen (1977), little appears to have been published on the biology of captive *Sousa*.

The very high intensity of fishing is viewed as a threat to humpback dolphins because of both entanglement in fishing gear and reduced prey availability.

Conclusions

While distribution may have been quasi-continuous over the species' range historically, indications of contemporary distribution gaps are emerging, presumably one important factor being high mortality in fisheries. Baseline abundance data need to be obtained, or for many countries, to start with, information on whether or not they are range states. Other research priorities include assessment of the levels of gene-flow between the eight defined management stocks, the collection of carcasses and biological samples to obtain basic insights in the species' natural history, and the implementation of an in-depth study of *S. teuszii*'s behavioral ecology.

The IUCN Cetacean Specialist Group indicated *S. teuszii* as a high priority for research and conservation because of its restricted range, narrow ecological niche, generally low abundance, and continuing threats (Reeves et al., 2003).

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