

CETACEAN RESEARCH IN SENEGAL 1995-97, AN OVERVIEW

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ABSTRACT

Historically Senegal is the West-African nation with the best kept faunistical records for cetaceans. We found verifiable evidence for at least 18 species, but limited life history data. Quantified information on interactions with soaring coastal fisheries is wanting. Here we present preliminary results of recent field work in central and central-south Senegal, which aim was to help design a long-term research plan with Senegalese scientists, offer training and reinitiate data collecting.

With limited monitoring we encountered evidence of dolphin by-catches but no wide-spread directed dolphin fishery. However the presence of tell-tale conditions including spreading acceptance for consumption of dolphin meat and indications of overexploitation of some fish stocks are known warning signs. Future efforts should cover larger areas and generally be more intensive. Three carcasses of Atlantic hump-backed dolphin *Sousa teuszii* found on Sangomar island had rope tied around the tailstock. Fishermen at Djifer and Joal-Fadiouth confirmed regular incidental takes and landings. In the Siné-Saloum delta, inshore *S. teuszii* and *T. truncatus* are probably the most affected species. Senegal's EEZ waters support large industrial fisheries which may constitute an additional source of by-caught small cetaceans. We here document 21 new specimen records and a series of sightings. Dolphins occurring in the Casamance river and upstream in the salt-water canals of the Saloum delta are identified as *T. truncatus*.

INTRODUCTION

In 1992 the United Nations Environment Programme (UNEP) organized a workshop on cetacean conservation and biology in Accra, Ghana, within the framework of the Global Plan of Action for Marine Mammals (Vély, 1992). Two of us (MD and AD) attended the meeting and while it boosted interest for cetaceans among scientists from West and Central Africa (WACAF), follow-up activities have been limited. Powell *et al.* (1996) prepared a review report for UNEP on the distribution and status of marine mammals in the region.

Independently three major field studies have since been implemented and reported on: cetacean strandings and sightings along the Great Mauritanian Beach (Vely, 1991; Robineau, 1995, 1996; Robineau and Vely, 1993; Robineau *et al.*, 1994), an investigation of humpback whale breeding grounds in Cape Verde (Wenzel, 1995a,b), and year-round cetacean surveys off the Canary Islands (Vonk and Martin, 1988; Martin *et al.*, 1992). The latter is perhaps the only indigenous long-term programme in the WACAF. Most recently, Reiner *et al.* (1996) studied cetaceans in the Cape Verde Archipelago. Other papers published concern either analysis of earlier data or incidental observations (e.g. Sequeira and Reiner, 1992; Maigret, 1994a,b; Van Waerebeek and De Smet, 1996).

Although more baseline data and dolphin specimens have been collected since the 1950s in Senegal than

in any other WACAF country (for review see Jefferson *et al.*, 1997; Powell *et al.*, 1996) detailed studies of the natural history, taxonomy and status for most species are wanting. Like Mauritania and Ivory Coast, Senegal has a documented history of cetacean exploitation (e.g. Cadenat, 1959; Perrin, 1989; Maigret, 1994b; Reeves and Leatherwood, 1994), however the lack of comprehensive, up-to-date information impedes directed action.

Projects 25 and 39 of the 1994-1998 IUCN/SSC Action Plan for the Conservation of Cetaceans call for an investigation of the impact of fisheries on coastal cetaceans, especially hump-backed dolphins, in West-Africa (Reeves and Leatherwood, 1994). Success with a bottom-up approach in western South America led KVV to prepare for similar field research on cetaceans in West Africa in coordination with local scientists. Present report summarizes results of exploratory surveys on the central and south coasts of Senegal, in preparation of a more comprehensive investigation of the present status of cetaceans in Senegal's EEZ waters sponsored by the Secretariat for the Bonn Convention on Migratory Species (UNEP/CMS). A parallel effort in The Gambia is discussed by Murphy *et al.* (1997).

MATERIAL AND METHODS

Field work directed by the senior author and hands-on training was organised during three visits to Senegal, 2-19 September 1995, 22 April-8 May 1996 and 7-28 November 1996. The primary goals included: (i) identify Senegalese scientists and fisheries officials with an interest in cetacean management; (ii) determine the location of potential dolphin/fisheries interactions as well as promising study sites; (iii) assess the feasibility and required logistics to gather biological data and samples; (iv) provide training and advice in the implementation of a long-term, autochthonous programme in cetacean research.

By-catch monitoring was initiated in fishing ports and fish markets on the Cap Vert peninsula, Petite Côte (south of Dakar), Siné-Saloum delta, and the Casamance. Comprehensive beach-combing by walking was carried out in a search of stranded material and evidence of discarded cetacean offal. Artisanal fishermen and locals in general were interviewed, most often in Wolof (language), by Senegalese participants. Information on the West African manatee *Trichechus senegalensis*, in particular the occurrence of (illegal) takes, was gathered opportunistically.

A preliminary revision of osteological specimens was conducted at the collections of the Institut Fondamental d'Afrique Noir (IFAN), Université Cheikh Anta Diop in Dakar and at the Musée de la Mer, Ile de Gorée, work to be expanded as part of the UNEP/CMS project. Newly collected specimens (Table 1), provisionally stored *in situ* serve as reference material for field workers outside Dakar who do not have easy access to the IFAN collection. Members of the Association Bokk Xalaat (ABOX), an NGO based at Joal-Fadiouth, were guided in the set-up of a regional *Commission Cétacés* composed of laymen who will gather opportunistic information on aquatic mammals in the Thiès region. Several members acted as adept field assistants (see acknowledgements), a first step towards a network of volunteer collaborators along the coasts of Senegal.

PORT MONITORING AND STRANDINGS

1. Cap Vert Peninsula and Petite Côte

In September 1995 we checked Soumbédioune, Ouakam, Yoff and Hann, artisanal landing sites on the Cap Vert Peninsula, but found no evidence of cetaceans, nor indications from locals.

KVV inspected the ca. 12km beach between Yoff and Cambérène on 9 September 1995 with similar results. Walking the estimated 12km beach between Cambérène and Malouka by KVV and END on 26 November 1996 yielded some small delphinid bones (Table 1).

On 8 September 1995 we surveyed the crowded 'fish market' on the beach of M'Bour. No relevant information could be gathered. Maigret (1981) reported average purse-seine catches of 2-3 dolphins at M'Bour each month of 1977, then the most important fish unloading site south of Dakar. Overall we were met with a great deal of indifference from the people we interviewed on the Cap Vert Peninsula and at M'Bour. Presumably distrust linked to crowding and the nearness of the capital city is to blame. M'Bour is unlikely to yield much information even with intensive monitoring and is assigned low priority for future work.

2. Joal-Fadiouth and Palmarin

Fish and mollusc landings are monitored daily by personnel of CRODT (Centre de Recherches Océanographiques de Dakar-Thiaroye) based at Joal, presently Senegal's foremost artisanal port. In September 1995 unidentified dolphins were still "frequently landed" but not registered (Ibon NDiaye, CRODT, pers. communication to KVV). Carcasses reportedly were butchered at the north side of the terminal and sold for USD 3-4 (CFA 1,500-2,000) per specimen. Retail price in near-by Fadiouth, and another unspecified village was said to be typically USD 8 (CFA 4,000). Dolphin heads and other offal were used for bait in a cephalopod fishery, which may help explain the absence of skeletal remains on near-by beaches in 1995-96 despite exhaustive searches. Surveys of the shores of Fadiouth island in 1996 also failed to yield any cetacean bones.

In June 1996, CRODT officers at Joal informed KVV that by-caught dolphins were no longer openly landed because

of their 'protected species' status. Dolphin meat apparently was sold furtively because it continued to be available, at least in Joal-Fadiouth. In comparison, a black market emerged in Peru in 1990-94 when trade in dolphin meat was banned (Van Waerebeek and Reyes, 1994). On 25 April 1996 two women vendors at Fadiouth, interviewed by ABOX members native of this town, admitted to occasionally sell dolphin meat. M. Diouf of Joal stated that her muslim family regularly consumed fresh dolphin since a family member worked at the fish terminal. Her claim was backed by an accurate description of colour/texture of cetacean meat. This suggests that the depreciation of dolphin meat among the mostly muslim Joal community (P.J.H. van Bree, *in litt.* to KVV, 2 October 1995) is eroding. The minority group of predominantly catholic inhabitants of Fadiouth have traditionally eaten both pig and dolphin meat.

One of us (KVV) instructed five ABOX members of Joal-Fadiouth how to collect basic information from stranded and captured cetaceans. The skulls of a juvenile sperm whale *Physeter macrocephalus* and a juvenile short-finned pilot whale *Globicephala macrorhynchus* were seen in the storage room of the Joal office of the Service de Pêches Maritimes. No accompanying data were available.

Palmarin is composed of four coastal communities (Samsam-Galou, Gounouman, Djakhanor and Goedji). During a first survey on 6 May 1996, no cetacean remains were encountered. Two of us (KVV, END) walked the sandy beaches between Palmarin-Djifer (a 2 hour walk), both ways on 24 November 1996 and recovered a few type V delphinid remains (Table 1). No dolphins were sighted.

3. Siné-Saloum Delta

The 180,000 hectare Siné-Saloum biosphere reserve consists of a swampy delta with mangrove, lagoons, open forests and, near the ocean, dunes and sand islands. Salinity inside the Siné-Saloum exceeds ocean levels due to high evaporation. Mamadou Malick (pers. communication to KVV, 9 Sept. 1995), a shrimp and sea-salt merchant from Fatick, regularly sees dolphins in the delta as high upstream as Foundiougne, especially in the July-September rainy season (l'hivernage) when shrimp are most abundant. Other observers also reported dolphins at Foundiougne. Mr. Malick described in detail a foraging technique whereby the dolphins beach themselves onto the mudflats in pursuit of fish, then wriggle back. Bottlenose dolphins *Tursiops truncatus* in South Carolina salt marshes, but no other marine cetacean, have been described to exhibit such behaviour (Rigley, 1983). Also, bottlenose dolphins are well-known to feed on shrimp (see Barros and Odell, 1990) and cranial material is confirmed from the Siné-Saloum delta (Table 1). We therefore tentatively assign the sightings to this species.

3.1. Djifer

Also spelled Djifère or Djiffer, this is a fairly remote village of fishermen situated on the southern tip of the Saloum west bank. On 25 April 1996, KVV and Pape Dione (ABOX) aided by Doudou Gueye, a respected local leader, interviewed a minimum of 50 fishermen about dolphins. The consensus view revealed that small groups of dolphins appeared off Djifer sometimes daily at unspecified times of the year but not during others and that middle-sized dolphins accidentally killed in gillnets are landed with some regularity, but estimated numbers varied too widely to be interpretable. Fresh, unprocessed meat is consumed locally. Otherwise fishermen seemed to believe that dolphins enjoy legal protection and no evidence of hunting was encountered. Stationed at Djifer from 10-13 and 21-24 November 1996 we maintained a watchful eye of the landing site. No cetaceans were seen disembarked.

However, a harpooned manatee was landed on 21 November 1996. Questioned by the only fisheries inspector present, the fisherman claimed he had found the moribund manatee floating the day before. The carcass was sold for its meat and the skin used to make whips. Manatees have been hunted in Senegal since at least several decades (Dupuy, 1983; Maigret, 1994a), and probably since ancient times.

3.2. Ndangane

Ndangane, situated upstream on the Siné river, was visited with a local guide on 23 November 1996. Several inhabitants reported to see dolphins infrequently but year-round, probably the same species as seen at Foundiougne, ie *T. truncatus*.

3.3. Sangomar Island

On 12 and 22 November 1996, two of us (KVV, END) and P.Dione surveyed beaches of Sangomar island and scanned nearshore waters for dolphins. Three carcasses of Atlantic hump-backed dolphin *Sousa teuszii* (Table 1) were encountered together over a 25m stretch of desolated beach at the south end of the island. A severed piece of rope was found tied around the tailstock of two specimens indicating that fishermen initially had the intention to put the dolphins to some use. The knots were impossible to untie which further suggests the dolphins were transported and trailed by the attached ropes. To our surprise nothing indicated that meat or blubber had been utilised so presumably the carcasses were abandoned because of advancing decomposition or because the fishermen took a more valuable catch. Sangomar has magical significance locally as it is considered inhabited by spirits to whom occasional food sacrifices are made (Doudou Gueye, pers. comm.).

4. Casamance

The southernmost province of Senegal, the Casamance borders on the coast with Guinea-Bissau and is traversed from east to west by the mighty Casamance river. The fishmarket and quay of Ziguinchor (12°35'N, 16°16'W), the principal fluvial port on the river, was checked on several opportunities in September 1995. No cetacean products were seen. Interviewed fish mongers denied any sale of dolphin meat, which was in agreement with comments received from other locals.

BIOLOGICAL RESEARCH

Opportunistic sightings

On 17 September 1995 the following sightings were made by KVV from the observation platform *M/V Joola*, the ferry linking Ziguinchor and Dakar in an 18 hour journey. At 18:30h, KVV observed a fleet of 19 large (> 300 MT) industrial fishing vessels, both purse-seiners and trawlers, working nearshore waters immediately south of the Casamance river mouth. Flags of registration could not be discerned.

Casamance River

(1) 14:40h. Off Pointe St George. Four adult bottlenose dolphins first spotted far ahead of ferry actively approach the vessel and bow-ride for several minutes. One animal jumps and clears the surface three times. At 14:44h dolphins disappear.

(2) Carabane Island. Rising tide. Several bottlenose dolphins alone or in pairs milled around ferry which anchored for 45min north of Carabane Island. Dorsal cape not or hardly visible.

As the ferry resumed its course downriver, 4-5 animals rode the bowwave for ten minutes. The dolphins quit and returned upstream at the last turn in the river before the Casamance river mouth becomes visible. Photos are deposited at CEPEC.

Dr. C.J. Hazevoet (*in litt.* to KVV, 19 August 1997) recorded *T. truncatus* "far upstream" in the Casamance river in 1984-1986.

Coastal waters

(3) 18:21-18:26h. Four dolphins, including one small calf, at high speed took over the ferry heading north and rode the bowwave. Speed of vessel an estimated 10-12knots. The animals showed a very clearly delineated, dark dorsal cape and were noticeably smaller than the bottlenose dolphins seen minutes later (see 4). This and the whitish beak tips seen from above are strongly suggestive of pantropical spotted dolphins, *Stenella attenuata*. No spotting was noted but W.F. Perrin (pers.comm. to KVV) suggested that spotting could go unnoticed in bad lighting conditions, which was indeed the case with a sun set low at the horizon some 30min before sunset. Large, unidentified white terns followed the dolphins.

(4) 18:32-46h. Three small groups of bottlenose dolphins, totalling 8 individuals, joined the northward steaming ferry for 1-2 minutes and positioned themselves at the bow. These included two mother-calf pairs, one apparently a neonate. All bowrode but the latter quit after 5 min. One large male side-breached several times allowing an excellent view of its head and pink anogenital area. Another (unsexed) adult-sized animal also side-breached once but showed a greyish belly. Surface schools of small pelagic fish (*Sardinella*?) were present. Sunset at ca. 19:00h, > 50% cloud cover, seastate 2 Beaufort. Few birds seen, except some unidentified terns and pelicans.

(5) 19:31-34h. After sunset in near-dark, 5-6 bottlenose dolphins overtake ferry at high speed, breach and bowride for a short period. At 19:35 KVV ceases the watch due to obscurity.

Sightings of unidentified dolphins

Several unidentified dolphins were reported by ABOX members:

- 17 November 1996: about 15 jumping dolphins (probably not *Sousa teuszii*) at the southern end of Sangomar Island.
- 17 November 1996: in Saloum delta, small group of dolphins swimming in the direction of the sea (low tide).
- 19 November 1996. Four dolphins sighted in bolon (sea arm) of Fadiougne.

Collection of specimens

The collection of new osteological specimens has just been initiated. These and other samples taken are summarized in Table 1. No fresh carcasses have become available yet.

DISCUSSION

Exploitation by artisanal fishermen

Hand-thrown harpoons for capturing dolphins have long been used by some Senegalese fishermen's communities such as Joal-Fadiouth (Cadenat, 1956). Net captures, presumably incidental, are commonly reported. Some historical examples include 50 common dolphins captured in the Baie de Hann and hump-backed dolphins caught in nets set

by Joal fishermen near the Siné-Saloum delta mouth (Cadenat, 1949, 1956). A pygmy killer whale *Feresa attenuata* was taken off Yenn in 1958 (Cadenat, 1958).

In the course of this preliminary study we did not encounter any evidence of an ongoing directed fishery of small cetaceans in Senegal. If it occurs, fishermen should be expected to take great care to hide these practices and it would be hard to document. The case of a harpooned manatee in Djifer shows that traditions or necessity are still more compelling than legal protection measures.

At the other hand, continuing bycatches in undetermined net fisheries are confirmed, at least for the area from Joal-Fadiouth to Djifer. The authors found that cetacean meat is well-known in coastal villages south of Dakar, despite it not being openly offered for sale. Dolphin meat consumption used to be a habit mostly limited to Christian communities but indications are that it is increasingly acceptable among Muslims. Dolphins are widely perceived to be legally protected and fisheries officers enforce accordingly, although we were unable to point to explicit legal documents.

Maigret (1994a) contended that total catches by artisanal fisheries in Senegal did not exceed 100 cetaceans per year, but considering the enormous fishing effort at present we believe this figure to be considerably underestimated or at least due for revision. The most immediate threat to small cetaceans in West Africa may arise from the unchecked pace with which regional fisheries are developing. Recruitment of new fishermen is soaring, especially by young men unrelated to traditional fishermen families. Former small-scale, traditional fisheries are acquiring an essentially commercial character in which fast return on investment and rapid growth but not sustainability are of prime concern. Senegalese fish stocks, especially demersals (Diop, 1996) are showing signs of decrease because of largely unchecked fishing practices.

A tendency of higher prices, a successive introduction of new target species and a steady offshore movement of fishing grounds has become apparent. Senegalese fishing boats even have expanded operations into EEZ waters of northern Guinea-Bissau (Raúl Inumbo, Ministry of Fisheries Guinea-Bissau, pers. communication to KVV), facilitated by a near-absence of control and the limited competition from an as yet small Guinean fishing fleet. The demand for shark species, often discarded as trash species until fairly recently is rising, as is the use of highly efficient wide-mesh nylon gillnets. All these are warning signs of impending overexploitation of marine biological resources (see Safina, 1995).

A similar pattern preceded a steep increase in incidental takes and in a matter of years a slide towards a directed fishery for dolphins and other small cetaceans in e.g. Peru, Sri Lanka, the Philippines and recently Ecuador (Read *et al.*, 1988; Leatherwood and Reeves, 1989; Dolar, 1994; Félix and Samaniego, 1994; Van Waerebeek and Reyes, 1994; Van Waerebeek *et al.*, 1997). Also, high fisheries pressure on major prey species is bound to negatively affect inshore marine mammal populations and should be investigated. Coastal habitat encroachment, such as water pollution and clear-cutting of mangrove, has become acute in a few urbanizing zones in Senegal, overall it is still considered non-problematic (Maigret, 1994a); however it would be irresponsible to assume this will last for long. Standard monitoring of cetacean takes and dedicated biological data collecting should be implemented on a continuous basis.

Both M'Bour and Hann were overcrowded with fishermen and merchants and are deemed inappropriate as bases for future sampling. Alternatively, Yoff, Joal-Fadiouth, Palmarin and especially Djifer seem suitable sites for data collecting. Ports north of Dakar have not yet been surveyed.

Large-scale fisheries

No by-catch data from direct monitoring of industrial fishing vessels were accessible at time of writing.

Mr. Jule Charle Diatto, captain/owner of the Dakar-based shrimp trawler *Mame Bousso* claimed a zero cetacean by-catch in 20yrs of operation, but he had encountered floating dolphin carcasses twice. According to him, Senegalese twin trawlers catch dolphins regularly due to their considerably bigger net opening and the absence of a 'warning' vessel ahead of the net. Unsolicited, Mr. Diatto described an association between dolphins and tuna in Senegalese waters.

Little information exists on the level of cetacean by-catches in large-scale fisheries off Senegal and NW Africa (Maigret, 1981, 1990a, 1994a), but circumstantial evidence indicates that fishing effort in West African coastal waters is huge and largely uncontrolled (e.g. Stegemann and de Braconier, 1994; Diop, 1996; Notarbartolo di Sciara, 1997).

Biological research

In Table 2 we offer a reviewed list of cetacean species that are fully confirmed from Senegalese waters. The present list is still in progress as formerly reported cases and voucher data are being verified. Striped dolphin *Stenella coeruleoalba* was mentioned from a sighting (Dupuy, 1983) and listed by Jefferson *et al.* (1997) but is definitively unsupported. The skeleton of a stranded, presumed Atlantic spotted dolphin *Stenella frontalis* was first mentioned by Dupuy and Maigret (1976) but could not yet be located and re-examine; *S. attenuata* can not be excluded.

The beaches at Yoff and Cambérène, reputed for mass strandings (Cadenat, 1949; Maigret, 1979, 1994b) should be checked regularly. Small or scattered bones can be found only by an intensive search on foot.

The taxonomy of common dolphins *Delphinus* spp. from West Africa is to be investigated both by morphological and molecular genetic techniques. Precursory cranial examinations reveal that in Senegal the long-snouted common dolphin *Delphinus capensis* is by far the most frequently captured and stranded of the two common dolphin species. A dual approach is programmed also for a study of geographic variation of Atlantic hump-backed dolphin with special reference to potential movements between populations or subpopulations from the Banc d'Arguin, Mauritania, The Gambia river and from inshore Guinea-Bissau. The hump-backed dolphin is accorded a high priority in ongoing investigations because of its restricted range, narrow ecological niche and low population size. Maigret (1980) estimated the population of hump-backed dolphins in the Saloum Delta at no more than 100 individuals. No recent estimate is available but captured specimens confirm that at least the species continues to occur there today.

We plan to reexamine, identify, measure and retag all osteological specimens at the established collections and set up a digital database so that data can be pooled between areas and analysed at regional level.

Departing from a conventional approach where a maximum amount of information is sought in a short period supported by high-tech equipment and inflated budgets, here we emphasize the need for the firm establishment of a basic, reliable and sustainable data collecting routine by well-trained Senegalese biologists and volunteers. Research aims should be realistic and long-term, allowing for a gradually increasing sophistication in data collection and analysis as expertise evolves within a Senegalese context.

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Likely to be most affected by artisanal fishery activities are inshore species including the Atlantic humpbacked dolphin *Sousa teuszii*, long-beaked common dolphin *Delphinus capensis* and coastal bottlenose dolphin *Tursiops truncatus*.
after the customary socializing in order to mitigate suspicion of undercover fisheries control.