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REPORT ON THE EXPLORATORY SURVEY OF CETACEANS AND THEIR STATUS IN CAMEROON

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ABSTRACT

The principal aims of this exploratory coastal cetacean survey in Cameroon (7-29 May 2011) included:
(i) Attempt to relocate 'Cameroon dolphins', the country's population of Atlantic humpback dolphins *Sousa teuszii* lost to science since 1892; (ii) Document cetacean biodiversity towards the compilation of a first cetacean checklist for Cameroon; (iii) Conduct a preliminary evaluation of anthropogenic threats to dolphins and whales in the country, with emphasis on fisheries-related mortality. (iv) Field training and standardization in marine mammal survey and bycatch monitoring techniques among western African researchers. We targeted three different coastal areas where Cameroon dolphins were assumed to be most likely present: the southernmost coast near the Ntem River estuary (South Region); the Limbe to Idenau coastal stretch (Southwest Region); and the southern shores and mangrove channels of the Cameroon Estuary (Littoral Region). Visual surveys were conducted nearshore, both from small boats (effort, 259.1km, 1008min) and from shore, on foot (30.52km, 784min). Both structured and opportunistic interviewing of fishermen was implemented, the results meant to guide survey effort. Limited reliability became apparent as many replies were vague or contradictory, although fishermen almost unanimously failed to recognize humpback dolphins, but recognized bottlenose dolphins. Nonetheless we re-discovered the Cameroon dolphin, and documented it alive for the very first time in Cameroon during a small-boat survey, near Bouandjo on 17 May 2011. Considering the single sighting of ca. 10 (8-12) individuals for the total effort in Cameroon, the species' encounter rate was low: 0.386 sightings/100km survey or 0.099 sightings/100min observer effort. Relative density of 3.86 individuals/100km is also considered low. Beach-based effort did not yield any sightings. Until the present study, no substantiated records of humpback whale (*Megaptera novaeangliae)* existed for Cameroon. Here we report evidence of two calves captured incidentally by artisanal fishers, landed and utilized for food. Singleton whale vertebrae documented at various sites may also belong to that species. The small size of the calves suggest local parturition: Cameroon's nearshore waters may form part of the western African calving ground of humpback whales in the northern Gulf of Guinea. Cranial specimens and photographic evidence of strandings indicate that also the sperm whale may be a common cetacean off Cameroon.
Photographs of fisheries interactions authenticated an additional three delphinid species new for Cameroon, the long-snouted common dolphin *Delphinus capensis*, common bottlenose dolphin *Tursiops truncatus*, and (unexpectedly) striped dolphin *Stenella coeruleoalba*, the latter not before recorded in the Gulf of Guinea. Independent descriptions by interviewees predict that at least one species of spotted dolphin (*Stenella attenuata* or *S. frontalis*) should be encountered in future surveys. Significantly, two of only four dolphin species now confirmed for Cameroon do not feature among the 14 delphinids known from Ghanaian waters, warning against premature generalizations of cetacean distribution in the region.
Several likely conservation problems were identified. By-catches in fishing gear and the potential development of a commercial market of cetacean products that could drive directed takes are the main reasons of concern for anthropogenic mortality. Other threats for neritic cetaceans of varying significance may comprise: coastal development (e.g. port and road construction) and related habitat encroachment (e.g deforestation), over-fishing, chemical and acoustic pollution, ship collisions and ghost nets. The almost complete lack of scientific data on the biology, distribution, stock structure and abundance of cetaceans in Cameroon waters is detrimental for management in that the impact of threats cannot be quantified, let alone addressed. An acceleration in domestic marine mammal research is urged with the involvement of graduate students at national universities.

INTRODUCTION

The Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS), with its subconventions and Memoranda of Understanding (MoU), can claim an important long-term and global role in marine mammal conservation, with many dedicated activities. Although a CMS Party since 1983, Cameroon is currently not a signatory of the 2008 Memorandum of Understanding Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia [1](CMS, 2008). This is quite understandable considering the fact that hardly any studies have been conducted, hence exceedingly little is published on the presence, distribution and biology of aquatic mammals in Cameroon. A review by Perrin and Van Waerebeek (2007) could recognise but a single species of small cetacean from Cameroon, documented in the late 19th century, although several species are expected to be distributed there considering the rich cetacean fauna known from not-so-distant Ghana (Ofori-Danson *et al.*, 2003; Van Waerebeek *et al.*, 2009). The present study apparently can claim to be the first dedicated cetacean survey to occur in Cameroon, implemented under the provisions of the 2008 CMS MoU, and in its spirit 'to foster cooperation, build capacity and ensure coordinated region-wide actions to achieve and maintain a favourable conservation status for manatees and small cetaceans and their habitats and to safeguard the associated values of these species for the people of the region.'

The project's primary goal consisted in an attempt to re-discover the 'Cameroon dolphin', the northern Gulf of Guinea population of the Atlantic humpback dolphin *Sousa teuszii*, lost to science since 1892. Neither contiguous coastal states Equatorial Guinea and Nigeria are known range states (but we suggest they are) and, strangely, it has sofar not been found in Ghana, Togo nor Benin. *S. teuszii* is endemic to western Africa, is listed on both CMS Appendix I and II, CITES Appendix I and although listed as mere 'Vulnerable' by IUCN, specialists increasingly consider it to be threatened in view of its fragmented distribution, low abundance and rapid coastal development in western Africa (Van Waerebeek *et al.*, 2004; Weir *et al*., 2011).

In 1892, German biologist Willy Kükenthal described a new dolphin based on a single skull found in Man O'War Bay, northeast of Douala, Cameroon. This earned the species its common names: Kamerun Delphin (Grzimek, 1970), Kamerun-Flussdelphin (Culik, 2004; Van Waerebeek and Perrin, 2007), Cameroon dolphin (Carwardine, 1995; Culik, 2004), Cameroon river dolphin (Coffey *et al.*, 1977; Lockley, 1979), and Kameroendolfijn (Stonehouse and Camm, 1982), to name a few. With no further specimens reported from the country and a total absence of sightings of humpback dolphins, the historical link with Cameroon faded. When 64 years later *S. teuszii* was encountered in Senegal (Cadenat, 1956) and then in several other coastal areas of western Africa, from Dakhla Bay, Western Sahara, south to Angola (Van Waerebeek *et al*., 2004; Weir *et al*., 2011), the species became more commonly known as the Atlantic humpback dolphin.
Among eight hypothetical stocks, Van Waerebeek *et al.* (2004) proposed a 'Cameroon Estuary stock' of unknown status, based on the sole evidence of the holotype skull (Kükenthal, 1892), presuming that live humpback dolphins were being overlooked. However, the complete lack of data and material evidence of whether this stock is even extant, or not, has been a major impediment to raise awareness, let alone formulate conservation measures.

Secondly, this project set out to conduct an exploratory survey of Cameroon's coast to document cetacean biodiversity and thus prepare a first cetacean checklist, an objective of CMS WAAM Action Plan. Thirdly we aimed for a preliminary evaluation of anthropogenic threats to dolphins and whales in the area, particularly fisheries-related mortality. With Ghana's and Nigeria's cetacean exploitation in mind as a potential model (Ofori-Danson *et al*., 2003; Debrah *et al.*, 2010; Uwagbae and Van Waerebeek, 2010) significant interactions between cetaceans and fisheries were expected also in Cameroon. A precursory rapid survey of fisheries by-catch of all vertebrate taxa by one of us (Ayissi, 2008) indeed suggested cetacean mortality, however its generic approach based almost exclusively on questionnaires did not provide conclusive results, and no species were identified (Moore *et al.*, 2007, 2010).

1 more concisely known as the Western African Aquatic Mammals MoU (WAAM).

Cameroon can boast a highly diverse fish fauna with the list of marine fishes now including as many as 539 species (FishBase, 2011). The fishery sector contributes some 0.6% to the national GDP (Baer, 2001). Exploitable species consist essentially of fish, shrimps and molluscs. The fish comprise of pelagic and demersal subgroups, accounting for about 63% and 19%, respectively, of the total fishery exploitation. Some of the most exploited are pelagic fishes such as bonga fish *Ethmalosa fimbriata*, sardines *Sardinella maderensis* and *Illisha africana.* Others include Scianidae (croakers especially), Ariidae (*Arius* spp), Polymenidae (*Galeodes decadactylus* and *Polydactylus quadrifilis*), big eye (*Brachydeuterus auritus*), *Pomadasys* spp., Soleidae, Cynoglossidae, Scombridae, Pomadasyidae, Lutjanidae, Garangidae, Peneidae, Carcarhinidae, Lethrinidae and Crabs.

STUDY AREA

1. Physical environment

Cameroon's coastal zone stretches over 402 km (Sayer *et al*., 1992), from the Nigerian border in the north (Akwayafe River, latitude N04˚40') to Equatorial Guinea border in the South (Ntem River, latitude N02˚20'), and is wetched between longitudes E008˚15' and E009˚30'.

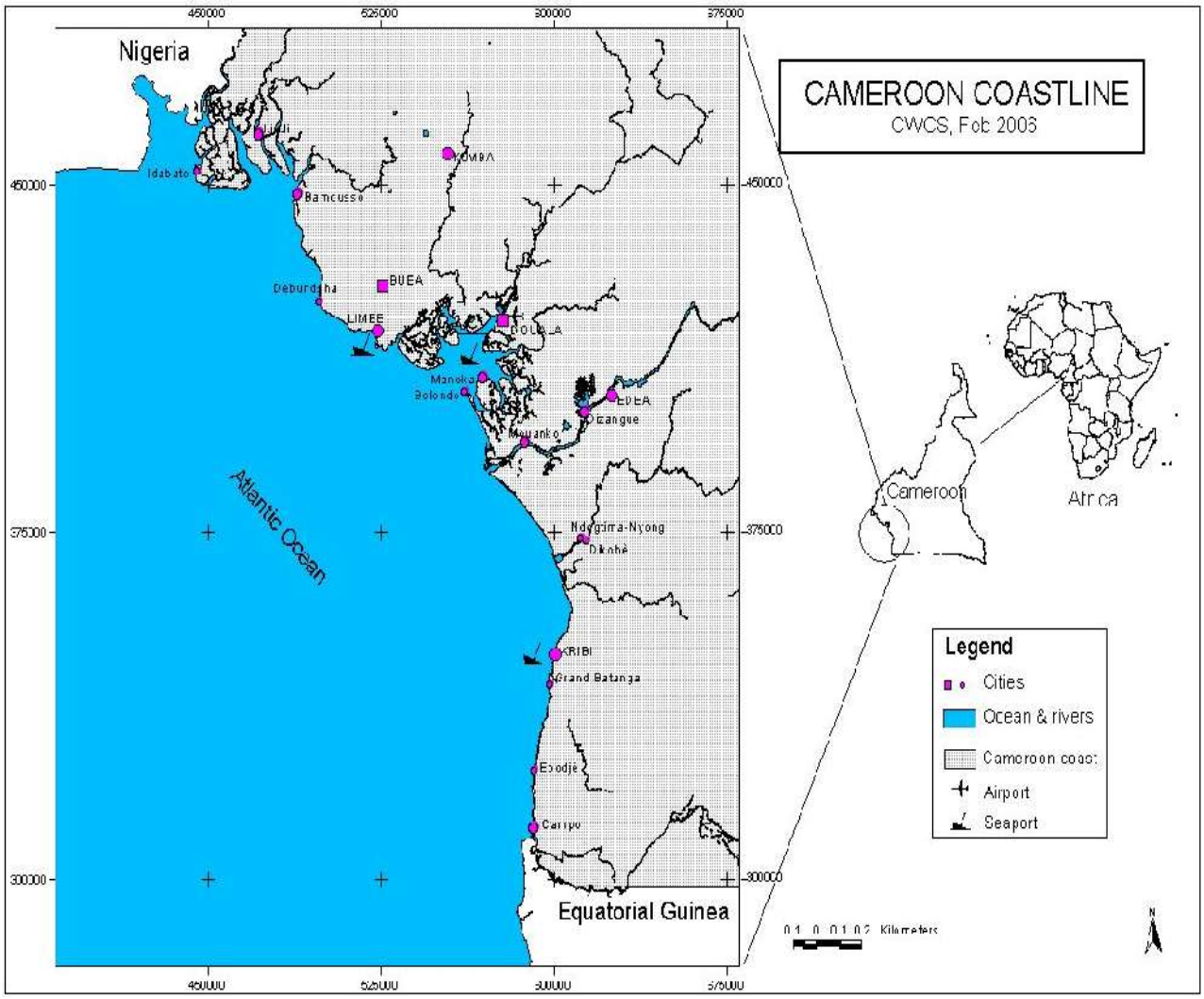

Figure 1. Map of Cameroon coastline (Cameroon Wildlife Conservation Society, 2006)

1.1 Continental shelf

Cameroon's continental shelf occupies an area of about 10,600 km² and gradually descends through 30, 50

and 100m depths (Morin and Kuete, 1989; Zogning, 1986; Boye *et al.*, 1974). The northern part has an average width of about 25nm, while the more narrow southern portion 15nm. Its relief shows two distinct zones separated by a parallel which passes through the mouth of the Lokoundje River. In the north, the slope is gentle, with a drop in altitude of 130m. This zone is rocky, with intermittent occurrence of sandbanks. Meanwhile, two major faults have been identified: a reef north of the mouth of the Sanaga River, and a series of outlier-reefs in the neighbourhood of Macias Nguema Island (Bioko-Equatorial Guinea). This area is favourable for trawling (Crosnier, 1964). South of this parallel, the relief of the continental shelf is more disjointed; there are many reefs and sandbanks. The interruption of the slope occurs quite early (e.g. at 50m depth between Campo and Kribi). This area is not suitable for trawling, but is favourable for small scale fishing. Many corals can be found at depths of 150 m.

1.2 Coastal landscape and hydrology

The mangroves of the Cameroon coast still are a predominant feature, despite the destruction of about one third of their total area. In 1973 they covered 2700 km^2 (Valet, 1973) but no recent figures seem to be available. Four areas can be distinguished within the Cameroon coastal landscape (Kramkimel and Bousquet, 1987):

Figure 2. Mouth of River Ntem with surf forming where fluviatile waters meet the Atlantic Ocean. Note mangrove forest of Equatorial Guinea (left) on the river's left bank. This environment may comprise a potential habitat for the Cameroon dolphin (*Sousa teuszii*).

a) From Campo to the mouth of River Nyong

The coast is high and shows an alternation of rocky outcrops and sandy mud. The main rivers are: Ntem, Lobe, Kienke, Lokoundje and Nyong. Their discharges are low and they transport little alluviums towards the sea. Mangroves are slightly represented, in the form of patches on rocky substrate. On the continent, the vegetation is made up of low altitude Atlantic forest, preceded on the seaward side by patches of few species of grass which grow on the beaches.

b) From River Nyong to Limbe

The coast is low and is characterised by the presence of estuary and river mangroves, separated from the Atlantic forest by a marshy complex of brackish waters. The rivers here are: Dibamba, Wouri, Mungo and Sanaga. These waterways have high discharges and transport huge quantities of sediments towards the sea. The Mungo enters the sea through a delta, while other rivers together form the Cameroon estuary. The creation of the Douala-Edea Wildlife Reserve has been justified by the great fauna diversity in the area.

c) From Limbe to Idenau

The coast is volcanic and is overhung by Mount Cameroon (peak of 4,095m). The vegetation is made up of low altitude mountain forest rich in endemic species. It is characterised by lava flows and 90,000 ha of industrial plantations (mainly oil palm) of the Cameroon Development Corporation (CDC). The Mabeta-Moliwe reserve is found here.

d) From Idenau to the Nigerian border

The coast is once more low and marshy, intersected by the mouths of Rivers Akwayafe, Ndian, Lokete and Meme which together form the Rio del Rey Estuary. The vegetation consists of mangroves and swampy species. In the hinterland, the Atlantic forest includes the Korup (rainforest) National Park

1.3 Geomorphology

1.3.1 Sedimentary basin

The Cameroon coast includes three sedimentary basins of differing dimensions: the Campo-Kribi basin, the Douala basin and the Rio del Rey basin. The Campo-Kribi basin covers an area of 45km^2 (1-3km wide and 25 km long). The Douala Rio del Rey basin stretches from latitudes 20° to 50° North. It is made up of two

sub-basins: the Douala basin in the east (7,000 km2) and the Rio del Rey basin in the West (2,500 km2). From south to north, one passes successfully through symmetrical geomorphological settings on both sides of Mount Cameroon: Sanaga Delta, the bouches du Cameroon, the volcanic horst proper of the Rio del Rey and the Niger delta.
The Douala-Rio del Rey basin takes the shape of an isosceles triangle with its peak at Yabassi and its side measuring 150 km. The height of the triangle corresponds to the maximum width of the basin (50 to 60 km). The relief has preserved traces of destructive tectonic activities which calf out the base into steps. The 200m isobath at Douala is at the same distance from the coast (40 km), as it is off Kribi-Campo. On the other hand, within the Rio del Rey basin, this isobath lies up to 80 km from the beach. The continental shelf in this area is twice as broad as it is in the south east of Mount Cameroon.

1.3.2 Dynamics of sediments
Sediment deposition leads to the creation of sandy offshore bars whose origin is either marine (effect of the Benguela and Gulf of Guinea Currents) or volcanic (Mount Cameroon). The progression of offshore bars and sandy spits parallel to the coast (Souelaba Point), and of various points between Idenau and Bamusso is caused by:
- the predominance of the Benguela current over that of the Gulf of Guinea which flows from the west;
- the low amplitude of tides (2 m on average);
- the low discharge of coarse detritus material in rivers which flow through a woody hinterland.
The build-up of these coastal structures tends to regularise the coastal profile.

Erosion is significant along the volcanic coast of Cameroon. A displacement of the coastline towards the continent has been observed in the South West Region. The estuaries and mangroves are characterised by high turbidity which extends up to 30 km into the sea from Bakassi. This phenomenon is also noticed in the estuaries of 'Bouches du Cameroon.' The entire eastern part of Rio Del Rey Basin is blocked by accumulation of mud and fine sand advancing southwards to the River Meme. The evolution of the coast will also depend on the quantity and rate of deposition of alluvial material. If the discharge is high while the flow is slow, waves will easily disperse alluviums on the shores, thereby creating beaches. Between River Akwayafe and Limbe, the offshore currents can reverse direction. This phenomenon can either lead to enlargement of the beaches, or otherwise cause erosion like in the case of Bamusso. The portion of the coast between Kribi and Campo consists of crystalline rocks which appear sometimes as isolated outcrops in the sea. This rocky portion is characterised by the absence of significant deposits of sand and mud.

1.4 Climate
The coastal climate in Cameroon, just as in the rest of the Gulf of Guinea, is influenced by the meteorological equator, which is the meeting point between the anticyclone of the Azores (North Atlantic) and that of Saint Helen (South Atlantic). This climate results from the combined effect of convergence of the tropical low pressure zone and the inter-tropical front within the continent. Along the coast, rainfall intensity increases from south to north. Recorded values show average annual rainfall of 3000mm in Kribi, 4000mm in Douala and more than 11000mm in Debundscha. There are two distinct seasons: a long rainy season of more than 8 months and a dry season which generally stretches from November to February. Air temperature is high throughout the year (above 25°C). Monsoon winds are of the guinean type, predominantly south-westerly, causing humidity values to hover close to saturation point. Winds speeds attain exceptional values of 18m/s (April 1993) but average wind speeds recorded over a period of 10 years (1983-1993) varied between 0.5 and 2 m/s.

Figure 3. The wide Sanaga River was explored for the potential presence of delphinids (Cameroon dolphin or common bottlenose dolphins), given its marked tidal influence, however none were sighted.

1.5 Oceanography

1.5.1 Water temperature and salinity

Cameroon coastal surface waters are warm throughout the year; unlike the coastal waters of other West African countries (e.g. Cote d'Ivoire, Ghana, Togo, Benin) which are characterised by seasonal upwelling. Water temperatures remain always above 24° C. This warm water layer has a thickness of 20-30m (Crosnier, 1964) depending on the location and the season. It overlies a cooler layer whose temperature varies between 18-20°C. The thermocline between the two water layers plays an important role in the dynamics of living organisms. Cameroon's coastal waters are generally characterised by low salinity due to high rainfall and a dense river network which supply freshwater. Lafond (1967) recorded peak salinity values of 20‰ at 15 km from Douala port in the dry season and less than 12‰ in the rainy season.

1.5.2. Hydrodynamics

Tides on the Cameroon coast are of the semi-diurnal type. In general, the amplitude varies between 0.3-3m depending on the location. Their effects are felt in the estuarine complexes. The propagation of the waves and ebb-tides are enormous, but poorly known. Olivry (1986), Morin and Kuete (1989) estimate them at 10 million cubic meters of the River Dibamba and 50 of River Wouri. Tidal currents can be strong: 1-1.5 m/s for the flux and up to 2.6 m/s for the reflux. The river flow disturbs this already unstable system by submerging the estuarine complexes. According to observations made by Chaubert and Garraud (1977), sea swells are from the S to SW sector and of distant origin. Their peculiarity results from the double obstacle constituted by Bioko Island and the widening of the continental shelf at the level of Rio del Rey.

2. Human Environment

2.1 Demography

The coastal zone runs through three Regions, namely the South, Littoral and Southwest. The population in this area is around 2,785,207 inhabitants, representing almost 15% of Cameroon's total population of 17,463,836 inhabitants (General population and habitats census in 2005). The distribution along the regions are South 1,077,131 inhabitants, Littoral 2,076,846 and Southwest 697,648 inhabitants. The principal ethnic groups are, in South, Batanga, Iyassa, Ngumba, Mvaè, Ewondo, Fang; in Littoral Region, Bassa, Bakoko, Douala, and others coming from various regions and countries; and in Southwest Region, Bakewri, Bayange, and others.

2.2 Fisheries

a) Industrial fishery

No recent statistics are available. Industrial fishery is legally practised beyond the 3nm zone. It employs around 600 persons, of whom 250 work on land and 350 persons offshore (Meke, 2006). If one considers the retailers, the total number of persons engaged in the sector could be estimated at 1,500. The means that the production include fishing gears (trawl, lines) fishing vessels. By 1999, the industrial fishing fleet included 35 vessels, of which 6 were trawlers and 29 shrimpers. The average engine power increased from 430hp to 940hp between 1973 and 1991 (Chidi Ibe *et al*., 1998). A peak output level of the industrial fishery was attained in 1981/82 with 49 vessels, which captured 23,000 tons of fish. Since 1982, the fish catch has continued to drop from 13,900 tons in 1983/84, and 11,400 tons in 1985/86 to between 10,000 and 6,000 tons per year in the period 1986-1996. This drop in catch can be attributed to two main causes: closure of Nigerian waters to Cameroonian fishing vessels and over-fishing of demersal species, especially Sciaenidae. The shrimp catch has reached a maximum of 1,000 tons per year. Daily catch was 4.55 tons between 1975 and 1979, and 2.05 tons between 1986 and 1990. This drop is partially explained by the over-fishing of stocks linked to reduced mesh sizes (33mm *versus* 50 mm, for trawlers). This led to the destruction of juveniles.

Figure 4. Traditional wooden fishing canoes, equipped with gillnets, ready to leave port at Idenau, Southwest Region.

b) Artisanal and semi-industrial fisheries

Practised within the 3nm zone, artisanal and semi-industrial fisheries are diversified with respect to fishing methods, target species and social composition. In 1995, of 24,136 fishermen, 17.19% were Cameroonians, 77.89% Nigerians, 2.15% Beninese, while the rest were mainly Ghanians, Equato-guineans and Togolese. Fishing gear used are varied and include drift gillnets, bottom (set) gillnets, hook-and-line, long-lines, purse-seines, beach seines (Folack and Njifundjou, 1995). The artisanal fishery is carried out using canoes, which may, or may not be motorised. Scet (1979) estimated the potential of pelagic stocks at a minimum of 40,000 tons/year; this would imply that artisanal and semi-industrial fisheries which target those stocks have virtually reached maximum sustainable yield (MSY).

The following types of gear are used by the artisanal fishery sector (FAO, 1987) :

a. the monofilament bonga gillnet or bonga chain (locally known as strong kanda net or strong kanda chain) mainly used to catch bonga *Ethmalosa fimbriata* and *Sardinella*;
b. hooks and line mainly to catch barracuda and marine catfish;
c. drift net (locally known as waka-waka) is used to catch pelagic fish (bonga, *Sardinella*, etc.);
d. artisanal purse seine (locally known as watsha) and recently introduced in Cameroon by Ghanaians to catch bonga and *Sardinella* as target species;
e. the beach seine (also known as drawing net or drawing chain) catches both pelagic and demersal fish in mostly coastal inshore sandy areas;
f. the cast net (locally known as mbunja) also used in the artisanal pelagic fishery;
g. the small mesh-sized conical shrimp net (locally known as ngoto),effective in harvesting white shrimp in the estuaries, creeks and shallow inshore waters, and
h. the multifilament bottom set gillnets (locally known as pésè or musobo net and musobo chain) used to catch mainly demersal fish (croakers, threadfins, soles, catfish, etc.).

c) Interaction between the artisanal and industrial fishing

Artisanal fishermen have complained about trawlers and shrimpers fishing within the 3nm exclusion zone, causing damages and economic losses to artisanal fishing units, leading sometimes even to the abandonment of fishing activities. Due to their ignorance of the regulations in force and the procedure to be followed for claims, artisanal fishermen remain passive. The operation of industrial fishing vessels within the exclusion zone leads to competition over the exploitation of demersal species and the destruction of juveniles and nursery grounds of most demersal species. Open conflicts may arise between the industrial and artisanal sectors and many cases of net destruction are reported.

Figure 5. Freshly caught sciaenid fishes (croakers), *Pseudotolithus* sp., for sale at the fish market of Kribi.

d) Fisheries management

The general policy for fishery development focuses on the promotion of national fish production (revamping artisanal fishery and developing aquaculture) in order to reduce importation of fish. Emphasis will have to be laid on improving the situation of economic operators in the artisanal sector and reinforcing institutional support.

e) Legal framework of fisheries

Includes the panel of Laws, Decrees or Arrestees signed to rule the fishing activities:
-Law 94/01 of 20 January 1994 to lay down the forest, fauna and fish regimes;
-Decree 75/528 of 16 July 1975 to determine exploitation of motorised fishing vessels in Cameroon;
-Decree 95/413 /PM of 20 June 1995 to set up enforcement of fish regime;

-Decree 2005/152 of 04 May 2005 organising the Ministry of Livestock's, Fisheries and Animal Industries;
-Arrestee 0025/MINEPIA/DIRPEC/SPI outlawing the fishing technique of pair trawling (*chalut-boeuf*);
-Arrestee 0002/MINEPIA of 01 August 2001 to set up protection of fish resources;
-Arrestee 0021/MINEPIA of 11 April 2002 to set up inspection of industrial fishing vessels, scientific observations and surveillance of fishing activities;
-Decision 024/MINEPIA of 15 February 2006 to set up satellite surveillance of fishing vessels;

Law 94/01 of 20 January 1994 to lay down, the forest, fauna and fish regime
While waiting for the new fishing laws to be promulgated, current activities of the Brigade derive from the law n° 94/01 of 20 January 1994 to lay down the forest, fauna and fishery regime.
- Article 11: protection of forest, fauna and fish resources is ensured by the State;
- Article 18: it is strictly forbidden to poor toxic products or wastages in public domain such as rivers, lakes or sea water.
In articles 141 and 142, the agents of the Ministry of Livestocks, Fisheries and Animal Industries who have swore in, are surveillance agents in charge of research and routine investigations in terms of fishing activities.
The penalties: from articles 154, 155, 156 157, 158, 160, 161, 162, 163, 167 clearly define the fines to pay, in case of infraction. Some other regulations do exist.

Arrestee 0021/MINEPIA of 11 April 2002: setting up industrial fishing boats inspection modalities.
This Arrestee includes 3 chapters: Chapter I deals with fishing vessels inspection. Chapter II relates to recruitment and employment of scientific observers. Chapter III (9 articles) relates to surveillance of fishing activities. The surveillance agents according to the Arrestee can: "Stop each fishing vessel or ask the vessel to undertake necessary actions to facilitate the visit on board; Ask for the following documents; fishing licence; the fishing book or any document related to the vessel and catches on board and even take copies of these documents; Do inspect fishing gears; Examine the catches; Visit all the cabins where fish products can be stocked".

f) Fleet characteristics and target species
In Cameroon there are 10 companies sharing among them 59 vessels (engine power 294-624 hp; vessel lengths 23.2-31.5 m). The fish trawlers use a single net with an average mesh size of 40mm. The artisanal and semi-industrial fishery mainly target two fish families: Sciaenidae and Clupeidae. However, if the current trend is maintained, stocks may become depleted.

METHODOLOGY

Field work combined with some courtesy visits (Table 1) were implemented by the authors between 7-29 May 2011. One of us (Ayissi) monitored the tidal Dibamba River (Littoral Province) from 1-5 June 2011. An annotated itinerary is summarized in Table 2. While UNEP funding was not received until the 5th day (11 May) forcing some schedule changes, stand-by time was spent visiting a number of officials in the capital Yaoundé (Table 1) for whom mandate comprised marine mammal management issues. The relevance of the CMS WAAM MoU for Cameroon was repeatedly underscored.

Figure 6. A fibreglass vessel with an 40hp outboard motor was used for most small-boat survey efforts. Advantages include it being fast, stable and manoeuvrable.

We concentrated efforts on three coastal areas where Atlantic humpback dolphins were thought to be most likely present in view of environmental elements: 1- the Limbe to Idenau coastal stretch in Southwest Region, near Nigeria, where sandy beaches and mangrove prevail (Plate I); 2- the southern shores of the Cameroon Estuary in the Douala-Edea Wildlife Reserve (Littoral Region) where myriad channels and mangrove forest alternate with open sandy coast (Plate II); 3- the southern part of South Region, near

the Ntem River estuary and the border with Equatorial Guinea (Plate III). Monitoring expertise in other countries has shown that the nearshore occurring Atlantic humpback dolphin can be visually surveyed from both the shore and small boats (Van Waerebeek *et al.* 2004; Collins *et al.*, 2004; Weir, 2009). Up to 81% of fishermen stated to sometimes observe (unidentified) dolphins from the shore, presumably either Atlantic humpback dolphins or common bottlenose dolphins.

Shore-based surveys
Measured shore-based survey coverage, on foot, totalled 784min and 30.52km (Table 3), although there was some additional non-quantified effort. At least one observer walked along the high water line as to maximise distant view, while simultaneously allowing close inspection for stranded cetacean skeletal material among the flotsam. Every few minutes, the sea surface was scanned with 8x40mm binoculars. Prior knowledge of the small-scale geography of coastal stretches is essential to effective beach surveying. Cameroon's beaches are widely interspersed with rocky formations as well as with small and larger freshwater outflows which may be difficult and time-consuming to circumvent or cross. At high tide, dense vegetation at the high-water line can obstruct passage.

Small-boat surveys
Five small-boat sorties were implemented using both indigenous wooden canoes (Figure 7) and a small open fibreglass boat (Figure 6). Duration of visual survey effort was 1008min, with 259.1km distance covered (Table 2). Traditional canoes are ubiquitous in Cameroon and the most economical way to get onto the water. The main drawbacks are poor stability and velocity, low height above sea level (especially the smaller canoes) allowing adequate view only under optimal sea conditions. A fibreglass boat, equipped with a 40hp outboard motor (Figure 6), was found to be the most functional and safest platform for inshore and river work.

Fishing port monitoring
Some 20 ports and fish landing sites (Table 1, 3) were visited and checked for evidence of cetacean catches and landings. Seventeen structured interviews about the presence of cetaceans and by-catches were taken with fishermen (Table 5), three of these representing consensus views among 3-4 individuals after some discussion (e.g. Figure 7), representing 23 fishermen in total. They were shown colour photos of Atlantic humpback dolphins, common bottlenose dolphins and humpback whales when questioned. Several tens of other fishermen were informally queried on a few specific items-only, mostly due to lack of time. Material evidence (bones) photos) was solicited but often brought forward spontaneously.

Figure 7. Interviews with fishers yield useful guidance to help steer field work, but insights need to be confirmed by scientific observations before reliable conclusions can be made.

RESULTS

1. CETACEAN BIODIVERSITY

Cameroon dolphin
The research hypothesis to be tested proposed that the lack of sightings of the Atlantic humpback dolphin *Sousa teuszii* in Cameroon despite the 119years since the species' discovery, was an artefact created by the absence of dedicated surveys. The definition of the 'Cameroon Estuary stock' (Van Waerebeek *et al.*, 2004), derived from the species' type location, had earlier implied this premise. Surprisingly none of the fishermen interviewed recognised Atlantic humpback dolphins from photos shown to them, and 87.5% answered a resolute 'No' (Table 5), but almost all recognised common bottlenose dolphins. This might suggest the latter might be the more common species, however we did not sight any.

The afore-mentioned hypothesis was confirmed on 17 May 2011, when at 11:05am we sighted and photographed a small group of ca. 10 (min 8- max. 12) Atlantic humpback dolphins near Bouandjo, at N02°28.708', E09°48.661' (Figure 8). Some individuals showed the strongly developed dorsal hump, while others, thought to be juveniles, had only a faint indication of a hump. The dolphins were foraging, as interpreted from the rapid movements, frequent directional changes and relatively long dive times (up to 4-6min). They were encountered in shallow inshore water at a distance ranging 250-600m from shore. Aerial display was limited to a single full-body jump. When slowly approached, the dolphins reacted negatively and moved away, despite the small size of the dug-out canoe and light outboard engine (8 HP).

Figure 8. Adult Cameroon dolphin *Sousa teuszii* , member of a small group encountered in South Region.This is the first documented sighting of the species iin Cameroon, and the first confirmed record in more than a century.

Boat avoidance behaviour is well-known for the species (Van Waerebeek *et al*., 2004; Perrin and Van Waerebeek, 2007; Weir *et al*., 2011) and complicates photo-identification efforts. Sighting conditions included excellent visibility, sea state 1, low swell (but still fairly high relative to the low-lying canoe). Mean survey speed was 9km/hr. The survey trackline was maintained at 250-500m parallel to the shoreline, for being a known habitat of *S. teuszii*, while avoiding sand banks and rock formations. With a single sighting for the total small-boat effort off Cameroon in May, the species' encounter rate was low: 0.386 sightings/100km survey or 0.099 sightings/100min observer effort. Relative density of 3.86 individuals/100km is also low. On 3-4 June, Ayissi surveyed the tidal Dibamba River for an additional 6 hours (Table 2), but sighted no aquatic mammals.

During land-based survey effort on the northern coast around the port of Idenau (Southwest Region) we observed intense near-shore boat traffic, including heavy fishing effort, boats that transport merchandise to/from Nigeria, as well as frequent passenger-carriers with large outboard engines navigating at high speed. As intense boat traffic is incompatible with the boat-wary nature of *S. teuszii* and security warnings for the border region[2] could not be immediately addressed, we postponed plans for boat surveys in this area.

Figure 9. A small calf humpback whale (WP#041) landed at Yoyo I and butchered for local consumption, in 2010. The animal was likely born in Cameroon coastal waters.

Departing from Limbe port, we surveyed the waters of Ambas Bay and around the nearby Bota Islands. Another target was Man O'War Bay (N03.94839°, E009.22416°), the *S. teuszii* type locality, in the hope to encounter a humpback dolphin community, or clues that might shed light on the confused circumstances of the Kükenthal's discovery. The scavenged remains of a West African manatee (*cf*. description of nares and herbivore stomach contents) somehow had been mixed up with cranial material of an humpback dolphin -suggested to be herbivore (Kükenthal, 1892). Unfortunately, Man O'War Bay, occupied by a large military garrison, was not accessible.

Humpback whales

2 Mrs. Nteng Nee, chief of fisheries centre at Idenau, was opposed to a boat survey north of Idenau without arranging for police/military protection. Pirates are said to widely roam these waters, leading to frequent kidnapping (especially of non-locals) and violent attacks.

Megaptera novaeangliae are seasonally present for calving and breeding in waters of several coastal nations in the Gulf of Guinea, ranging west from (at least) Côte d'Ivoire, and possibly Guinea, east to western Nigeria (Van Waerebeek *et al.*, 2001, 2009; Van Waerebeek, 2003). Further south the species is well-documented also in Gabon, Republic of Congo, São Tomé and Príncipe and Angola (e.g. Harmer, 1928; Rosenbaum *et al.*, 2004; de Boer, 2010; Picanco *et al.*,2009; Weir, 2007). However until the present study, no substantiated records of humpback whales existed for Cameroon.

Two small calves humpback whales captured by artisanal fishers, presumably incidentally, were landed and butchered for food (Fig. 9). Several vertebrae and other bone fragments kept by fishermen along the coast (Fig. 12; Table 4) may also have been taken from humpback whales. The presence of calves of a few months of age, estimated from their small body size, suggests Cameroon waters may also be part of the large-area calving ground for western African humpback whales in the northern Gulf of Guinea (Van Waerebeek *et al.*, 2001, 2009). Up to 95% of fishermen reported seeing 'whales' at sea (Table 5), either close to shore (55%) or offshore (45%).

Freshly stranded or by-caught whales are cut-up and consumed mostly at the community level. Most interviewed fishers (85%), who confusingly call humpback whales "cachalots"[3], report that whales are present at least between July and October. If so, seasonality would coincide with that known in other coastal areas in the northern Gulf of Guinea (Van Waerebeek *et al.*, 2001, 2009). While this will require verification, presumably the same or a closely related Southern Hemisphere humpback whale population is involved.

Figure 10. Sperm whale entangled and landed at Bakingili in May 2005.

Sperm whales

An entangled sperm whale *Physeter macrocephalus* stranded at Bakingili (N04°04'17", E09°02'27"), Southwest Region, in May 2005. It was flensed in situ and served as food for many people from Limbe and Idenau. Cranial remains and photographs (Fig. 10) allowed species confirmation. The report of an (undocumented) 'humpback' [whale] entanglement at Bakingili in February 2005 (NODC, 2011) is thought to be a misidentification of this specimen. A second, large sperm whale stranded near Kribi in 2009 (Table 4). The weathered skull of a third sperm whale, which stranded ca. 1990, was examined at Mpollongue (WP #012, Table 4). A fisherman who collected nine teeth from a small whale which stranded at Londji, a fishers camp near Kribi, provided the teeth for study. The teeth's pronounced curvedness and their relatively small size (height, 49.70-57.80mm; greatest breadth, 15.05-23.95mm; greatest thickness, 13.30-16.30mm) were believed to belong to a juvenile *P. macrocephalus.* The pulp cavities are filled to about half tooth length. However, the shape, small size and lack of osteodentine (common in sperm whale, see Boschma, 1938) requires a detailed differential morphological comparison with reference specimens to confidently exclude killer whale *Orcinus orca.*

Figure 11. Long-beaked common dolphin *Delphinus capensis* landed at Ebodjé.

Other species

Quantified beachcombing effort was implemented on foot over a distance of 30.52km and a duration of 784 minutes, (Table 3). Some additional effort was not quantified. Flotsam at the high water line was searched but no cetacean skeletal specimens were found. However, after interviews with fishermen, at times we were shown miscellaneous cetacean bones, primarily vertebrae

3 Francophone fishermen in Cameroon typically, but erroneously, refer to humpback whales as *cachalots* (=sperm whale) an obvious source of confusion since the true *cachalot* also appears to show a frequent occurrence in Cameroonian waters.

and ribs, which we documented photographically (Table 4). Cameroonians often keep whale bones, in particular, vertebrae as ornaments or souvenirs. Enquiries resulted in cetacean bones of up to 12 specimens (Table 4). Single whale vertebrae, taken out of serial context, however are difficult to identify to species with any certainty because many morphological features overlap between species.

Earlier field work had yielded photographic evidence (albeit of low quality) for two further species of Delphinidae, both dead due to fisheries interactions: one long-snouted common dolphin *Delphinus capensis* and one common bottlenose dolphin *Tursiops truncatus* (Figure 11, Table 4). No samples or biological information were available.
On 4 August 2011, Ayissi was noted of a dolphin 'stranded' on a beach of Kribi, however the precise circumstances under which the freshly dead animal arrived on shore remain unclear, while (unadmitted) by-catch is most plausible. The posterior body had been severed by the time it was photographed (Fig. 13) but the colouration pattern positively identifies it as a striped dolphin *Stenella coeruleoalba*, a new species record for both Cameroon and for the Gulf of Guinea (cf. Perrin and Van Waerebeek, 2007). No striped dolphins have been found during extensive dolphin bycatch monitoring in Ghana (Ofori-Danson *et al.*, 2003; Van Waerebeek *et al*., 2009; Debrah *et al.*, 2010). Weir (2011) did not sight *S. coeruleoalba* in the Gulf of Guinea whereas it was fairly frequent offshore Angola

Interviews repeatedly suggested the occurrence of at least one species of spotted dolphin (*Stenella attenuata* or *Stenella frontalis*). Two fishers interlocutors when shown images recognized spotted dolphin, the spotted skin of chunks of freshly butchered dolphin had called their attention, one in Londji and another across the border in Rio Muni, Equatorial Guinea. Both spotted dolphin species have been documented from by-catches in Ghana (Van Waerebeek *et al*., 2009; Debrah *et al.*, 2010), and are likely to occur also in Cameroon.

A larger dolphin locally known as *iowa* may be identifiable with *T. truncatus* or, less likely, *O. orca.* It is said to exhibit an assertive, fearless behaviour towards people, vessels and fishing gear. Several fishermen independently mentioned also a *dauphin blanc* (white dolphin), possibly identifiable with a common dolphin (*Delphinus* sp.). *Dauphins blancs* seem to be distinguished from dolphins with darker flank patterns, possibly bottlenose and humpback dolphins.

Figure 12. Two whale ribs and a damaged left mandible of a balaenopterid whale kept as souvenirs by a fisherman in Limbe.

POTENTIAL THREATS TO CETACEANS

Cetacean by-catches

Nigerian and Ghanaian fishermen occupy a dominant niche among many fisher communities in Cameroon and transfer of customs related to fishing and processing techniques and diet habits, including the consumption of cetacean products, are anticipated. Initially, 73% of interviewees denied the occurrence of cetacean by-catches or said they were rare, apparently as they feared any catch could be penalized. When the issue was revisited after establishing trust with the interviewer, most fishers finally admitted that cetacean by-catches occur with some regularity.

Fresh carcasses obtained from such catches and from strandings are utilized in the villages, primarily as food item. The consumption of such 'marine bushmeat' is in line with findings for several coastal nations in western Africa, e.g. Ghana, Togo, Nigeria and Guinea (e.g. Clapham and Van Waerebeek, 2007; Bamy *et al.*, 2010; Uwagbae and Van Waerebeek, 2010; Debrah *et al.*, 2010; Segniagbeto *et al.*, in preparation). However there is a general lack of discarded skeletal evidence. In other regions where cetacean carcasses are utilized by fishermen (e.g. in Peru), significant quantities of bones are retrieved from beaches, especially close to fishing ports and landing sites, as carcasses are filleted and skeletal material is discarded. Contrastingly, in Ghana, bones of cetaceans are cleaved with machetes and remain attached to the chunks of meat that are sold. The smoking process largely burns the bony tissue and little recognisable skeletal parts are left (Debrah *et al.*, 2010). Different processing then explains the scarcity of skeletal specimens on landing beaches, flotsam and among offal in Ghana, Togo and probably also in Cameroon.

Dolphin meat is consumed freshly cooked or smoked. Stranded or bycaught whales are also flensed and eaten. One case of a large sperm whale stranded near Kribi was widely remembered by independent sources who indicated that several people suffered acute gastro-intestinal problems after ingestion, some even were hospitalized. As elsewhere, teeth of sperm whales are eagerly collected for its ivory.

Figure 13. The bisected carcass of a freshly dead striped dolphin, *Stenella coeruleoalba* , handled on a beach of Kribi, August 2011..Circumstances of it's death are unclear. The specimen is the first record of *S. coeruleoalba* for Cameroon and the Gulf of Guinea.

The utilization of cetacean carcasses as bait in longline fisheries for shark, as reported from Ghana (Ofori-Danson *et al.*, 2003; Debrah *et al.*, 2010), was rarely mentioned by interviewees in Cameroon, and perhaps this practice is uncommon. One fisherman claimed small fishes were used as bait. However no overhaste conclusions can be drawn as such (illegal) practices are typically shrouded in silence and are very hard to ascertain.

Direct takes

One of us (IA) surveyed the Dibamba River and the towns Japoma (N4.0365°, E 9.8196°) and Mbongo (N4.4620°, E8.9840°), Littoral Region, 1-4 June 2011. Locals reported that a group of about 12 dolphins were spotted in the Dibamba River near the Pont sur la Dibamba with rising tide, in May 2010. Dolphin sightings are unusual in the Dibamba River. A few days later one dolphin found stranded among mangrove was killed by Nigerian fishermen. Additional stranded dolphins suffered the same fate. The village chief mentioned (pers.comm. to I. Ayissi, 2 June 2011) that two dolphins were butchered in his presence and the meat was distributed among the villagers. The species of dolphin has not been identified but some villagers, when queried, pointed to a drawing of bottlenose dolphin.

The danger exists for the possible repetition of a known phenomenon of rapid, commercial increase in the use of marine bushmeat as documented in a number of developing nations in Africa, Asia and South America (e.g. Clapham and Van Waerebeek, 2007). The consumption of cetacean products initiated with the opportunistic but regular utilisation of by-catches can give rise to a greater demand and the development of a commercial market, overt or covert, fed by directed takes of mainly delphinids, and especially in situations where traditional fish stocks are depleted following over-exploitation. Essentially the start of a dolphin fishery. The relatively low prices cited by four fishers (mean= 44,400 CFA or Euro 68; range 20,000-100,000 CFA) as typically paid per dolphin suggest the current local market for dolphins in Cameroon is still immature, but established. As seen in Ghana, such a market can develop fastly and take off in a matter of a few years (e.g. Debrah *et al.*, 2010).

Figure 14. One of two Chinese stern trawlers, presumably shrimpers, we encountered in coastal waters off Limbe on 21.05. 2011.

Over-fishing

Both humans and marine mammals act as top marine predators and inevitably compete for fish resources. The coasts of Cameroon are characterized by intense fishing effort (Ayissi, 2008; Folack and Njifondjou, 1995). Besides nationals, thousands of fishermen from Nigeria, being long-term residents, were found to operate from Cameroon, as well as lesser numbers from Togo, Benin, Ghana. A wide variety of fishing arts are practised by the small-scale fishers, including drift and set gillnets, long-lines, purse-seine nets and beach seines etc. Both multifilament and monofilament nets are widely used, depending on target species and size. In the course of the past few years, I. Ayissi (personal observations) noted an increase in the presence of Asian trawlers (from China, Korea, Japan) off Cameroon's coast, vessels with the reputation of often unsatisfactory adherence to fisheries regulations. Pair-trawling ('chalut-bœuf') on the continental shelf is well-known for its devastating effects on benthic fauna and flora (Liggins and Kennelly, 1996).

Little or no recent data are published on catch statistics and the status of fish stocks in Cameroon, but circumstantial evidence suggest that these follow the general trend of fisheries in the Eastern Central Atlantic (FAO area 34), i.e. increasingly overexploited stocks (FAO, 2011).

Chemical pollution

Only the lower 20km of the Sanaga River are navigable, up to Edea, home to the second largest hydropower plant in the country (265 MW). The ALUCAM aluminium smelter in Edea is dependent on the Sanaga for process water and is the single biggest energy consumer in Cameroon (van der Waarde, 2007). The lower reaches of the Sanaga including its estuary are sparsely populated (< 20 /km2) with the local population engaged in benthic bivalve harvesting from the river and fishing. The coastline is mostly inhabited by foreign fisherman from Nigeria, Benin, Ghana and Togo fishing along the coast in larger fishing boats. The aluminium smelting industry produces 500,000 tonnes/year of material in suspension in the Sanaga river (Atangana, 1996). The impact on the river's ecology and on its estuary near Mouanko (N 03.58867°, E009.6489°) is unclear. 'Red mud', the waste product from the extraction of aluminium from bauxite, is highly contaminating for the environment since it consists of a highly alkaline fine particulate containing heavy metals and other pollutants (White *et al*., 1997; Pascucci *et al*., 2009). The question arises about heavy metal toxicity among the fisher communities who subsist on bivalves and other locally extracted seafood. Similarly, the health of top level marine predators such as small cetaceans, which are known to accumulate contaminants, may be at risk. The coastal beaches are also important breeding grounds for various species of sea turtles (Ayissi, 2000; Ayissi *et al*.,2006).

Figure 15. Surface and subsurface hydrocarbon contamination of the beach just north of the Ntem River mouth, South Region, photographed on 16.05.2011.

Cameroon is considered to have abundant offshore natural gas. The country's petroleum reserves are located offshore in the Rio del Rey Basin, offshore and onshore in the Douala and Kribi-Campo Basins, and onshore

in the Logone-Birni Basin in the northern part of the country. Cameroon's only refinery, which is located in the port city of Limbe, had a capacity to produce 45,000 barrels per day (Newman, 2009). Tankers, tugboats and other supporting vessels contribute to the heavy vessel traffic around Limbe. Evidence of the hydrocarbon exploration and production industry are ubiquitous (Figure 16). No cetaceans were sighted in the area.

Near Bolondo, on the southern shores of the Cameroon or Wouri Estuary we found considerable quantities of a tar-like substance (a heavy hydrocarbon fraction) which contaminated the sandy beaches. apparently related to Cameroon's single most important shipping lane which leads to the port of Douala. Locals indicated that the fishers community of Bolondo had shrunk over the past decade as fishers moved out, blaming declining fish catches. An earlier gravel road that connected Bolondo with Mouanko, no longer maintained, has been reclaimed by the forest and current access to Bolondo is only by sea or motorbikes via the beach at low tide.

Figure 16. Drilling platform in Ambas Bay, Limbe (WP#35), on 21.05.2011..

North of the Ntem River estuary (near Campo), hydrocarbon pollution was seen dispersed through the upper sand layers at several sites along the shore (Figure 14). However, locals claimed pollution had actually improved since 1990-2000 when major timber exploitation along the Ntem saw logs transported by tugboats down the river and out to cargo ships anchored in deeper water. Then, both river and near-by coastline was alleged highly degraded by hydrocarbons. Since timber was transported by road to Kribi, pollution was said to have decreased. However, dolphins which reportedly had been 'fréquent' in the Ntem River estuary did not return and had become 'rare'. No documentation was found on this subject.

Discarded nets

On open shores and around ports we encountered important quantities of various types of abandoned, lost or discarded nets, both monofilament and multifilament (Figure 16). Long after fishing gear is lost or abandoned at sea by fishers, it continues to ensnare fishes (so-called ghost fishing) and thus harms the marine environment. The drifting gear also causes entanglements of sea turtles and marine mammals (MacFadyen *et al.*, 2009). A nationwide awareness campaign might help reduce abandoning of damaged nets and urge fishers to dispose them on land and/or incinerate them. Alternative uses, disposal methods or recycling should be explored. Nets also pose a hazard to propellers of, especially smaller, vessels.

Following a visit to Youmé-I village and after spotting discarded nets at the landing site, our team offered 12 fishermen, including their chief, a (well-received) constructive recommendation as why not remove the useless nets. Several readily acknowledged the problem while the chief announced they would address it. This spontaneous reaction suggested that with a carefully planned and implemented educational effort, perhaps linked to some incentives, this severe marine environmental problem may not be as intractable as it seems.

Figure 16. Abandoned or lost gillnets were found washed ashore on all beaches surveyed. Such ghost nets form a major threat to marine life. They may also damage small boat propellers.

Shipping and port construction

Heavy shipping traffic to and from the Gulf of Guinea is channeled via the Cameroon Estuary via deep-water shipping lanes that lead to Douala, the country's main industrial port. Concerns are that this waterway may be linked to (observed) hydrocarbon pollution and, inevitably, underwater acoustic pollution.

Vessel collisions are also suspected to pose a significant risk, perhaps seasonally, to the coastal-dwelling population of humpback whales. Collisions with whales have been documented near several West African ports, e.g. in Senegal, Guinea, Côte d'Ivoire, Ghana and Togo (Bamy *et al.*, 2010; Félix and Van Waerebeek, Van Waerebeek *et al*., 2007).

Figure 17. Near Lolabé a broad coastal strip of rainforest was seen cleared over several km (a sign indicated involvement by 'Razel' a French company), reportedly for construction of roads and a deep-water sea port.

Near Lolabé, in the South Region, extensive coastal forest clearance was reported to accommodate new port construction and access roads (Fig. 17). Coastal development at this scale is of obvious concern to inshore species like the Cameroon dolphin, sighted in the South Region. Sediment and detritus run-off may significantly alter and degrade the nearshore ecosystem with a negative impact on littoral biodiversity. A fully operational port would inevitably cause increased disturbance and other impacts. If neritic fish populations decline, prey for nearshore-living cetaceans such as the Cameroon and common bottlenose dolphins, these dolphin populations will in turn become affected, probably move out. It is worth reminding that no sightings of Atlantic humpback dolphin have been reported near a major port anywhere in its range (Van Waerebeek *et al.*, 2004).

DISCUSSION AND CONCLUSIONS

(1) We re-discovered the Cameroon dolphin, a population of Atlantic humpback dolphin *Sousa teuszii* 'lost to science' since 1892, as we documented for the first time live individuals in the country's South Region. This encouraging finding however is tempered by the low sighting rate (0.099 sighting/100min effort; 0.386 sighting/100km) and low relative density of 3.86 individuals/100km, the result of a single sighting despite significant search effort. As was found for Angola's stock (Weir *et al*., 2011), total population size of the Cameroon dolphin may be very limited. The sighting was made inshore along an open, sandy coastline. No dolphins were encountered in any of the mangrove channels or rivers surveyed.

(2) Other authenticated cetacean species are the long-beaked common dolphin, common bottlenose dolphin and striped dolphin, all known from by-catches. The latter species has not been found before in the Gulf of Guinea, but is relatively common off Angola (Weir, 2007).
A species of spotted dolphin is likely present in Cameroon, as described by fishermen, but as yet no material evidence is avaliable.

(3) Until now no large whales were documented, but the present exploratory survey demonstrated humpback whales and sperm whales to be common visitors to Cameroon waters. By-catches of small calves of *M. novaeangliae* suggest that Cameroon may form part of the large western African calving ground of humpback whale in the northern Gulf of Guinea (Van Waerebeek *et al.*, 2001).

(4) Potential threats to Cameroon cetaceans were identified and some were documented. By-catches in fishing gear, the establishment of a market for cetacean meat and the potential for a dolphin fishery developing are of highest concern. Habitat encroachment from coastal development, port construction, over-fishing, chemical and acoustic pollution, and ghost nets may cause conservation problems of variable magnitude, especially for coastal cetaceans. The complete lack of data on the biology, stock structure, distribution and abundance of cetaceans in Cameroon waters has as result that the impact of threats cannot be properly evaluated.

(5) Although Cameroon is not a signatory to the CMS MoU concerning the Conservation of the Manatee and

Small Cetaceans of Western Africa and Macaronesia, it has been a CMS Party since 1983. Results of this survey demonstrate the presence of several species of marine mammals in Cameroon's coastal waters, including a recognised Vulnerable species, and hence the high relevance of the MoU for the country.

Recommended follow-up activities

• Expand survey effort for Cameroon dolphins and other cetaceans. Particularly, promising habitat should be surveyed also in rainy season (e.g. October-December) as to determine seasonality and residency. Fishermen report large groups of unidentified dolphins nearshore in rainy season. Future survey coverage should try locate other Cameroon dolphin communities, photo-identify individuals and determine trends in status.

• Promote aquatic mammal research at science departments of Cameroon's universities, through lectures and with encouragement and supervision of thesis students.

• The historical link of the *S. teuszii* discovery with Cameroon as primary range state, re-inforced here by its re-discovery, might be benignly promoted to foster national awareness for marine mammals and marine conservation in general. The Cameroon dolphin as national icon and a remarkable flagship taxon deserves and will require pro-active conservation measures.

• Cameroon lacks a national Natural History Museum. We recommend that a specific proposal be considered for a precursor facility, namely a National Biological Reference Collection. With a realistic multi-year budget such a collection could be built and maintained in an modular, affordable fashion. Aquatic mammal specimens could be started with. A national study collection is indispensable as (i) scientific archive to Cameroon's rich biodiversity as Natural Heritage; (ii) biological reference material to allow comparative morphological studies and swift identification of specimens for the purposes of research and conservation projects, EIAs, incidental takes, seized illegal trade and captures, etc.

• Assess and develop options for marine ecotourism, especially related to nearshore occurring humpback whales and dolphin-watching, in parallel with already operating marine turtle ecotourism (Ayissi, 2000, 2008; Ayissi *et al.*, 2006).
Ayissi (ACBM) submitted a proposal (in review stage) to the Yaoundé-based UNDP/GEF Small Grants Programme to help develop marine ecotourism, including whale- and dolphin-watching. Our team paid a courtesy visit to UNDP national coordinator Mrs. Marie-Laure Mpeck Nyemeck in order to show support for the project and offer further clarifications on the purpose of the application.

• Identify appropriate channels to set up a nationwide awareness campaign among fishermen's communities to reduce at-sea discarding of broken or otherwise irrecuperable nets. Study and propose an alternate method of disposal, re-cycling and/or provide instructions for safe incineration.

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Plate I. Survey area in Northwest Region of Cameroon

Plate II. Survey area in Littoral Region of Cameroon

Plate III. Survey area in South Region of Cameroon

Table 1. List of Cameroon officials visited during the mission.

N°	Names	Fonction	Institution	Address	Phone & Email
01	Dr Ndongo Barthelémy	Inspector General N°2	Ministry of Environment and Nature Protection	PO.Box 1933 Yaounde-Cameroon	+237 77564096 +237 97917706 bandongo@yahoo.fr
02	Dr Wounissi	Director of Conservation	Ministry of Environment and Nature Protection	PO.Box 1933 Yaounde-Cameroon	
03	M. Pouth Jean Paul	Cooperation Unit	Ministry of Environment and Nature Protection	PO.Box 1933 Yaounde-Cameroon	+237 96811629 botpouth@yahoo.fr
04	M. Djonou Roland	Cooperation Unit	Ministry of Environment and Nature Protection	PO.Box 1933 Yaounde-Cameroon	+237 74173873 +237 99196534 roldjou@yahoo.fr
05	M. Beyiye Gerard	SDPRN CMS Unit	Ministry of Environment and Nature Protection	PO.Box 1933 Yaounde-Cameroon	+237 94255826 Beyiye2002@yahoo.fr
06	Dr Ngo MpecK Marie Laure	National Coordinator GEF-Small Grants Programme	PNUD/Cameroon	PO.Box 836 Yaounde-Cameroon	+237 22200800/1 +237 74830447 Marie-laure.mpeck@undp.org gefsgp_cmr@yahoo.com
07	Dr Jean Folack	Chief of Station	MINREST/IRAD	PO.Box 219 Kribi-Cameroon	folack@yahoo.fr
08		Ocean Division Delegate	Ministry of Livestock and Fisheries		+237 77461134
09	M. Mouri	Ocean Division Staff	Ministry of Livestock and Fisheries		+237 76460164
10	M. Abessolo	Ocean Division Staff	Ministry of Livestock and Fisheries		
11	M. Sebastien	Fisher of Londji			
12		DO of Campo	Sous-Préfecture Campo		
13	Sa Majesté Kema	Chief of Mbiako Village			+237 77513306
14	Sa Majesté Edimo	Chief of Suellaba village			
15	M. Victor	Fisher of suellaba			+237 77513306
16	Sa Majesté Ewandje	Chief of Yoyo I Village			+237 77102381
17	M. Hamed Youfedi	DO of Mouanko	Sous-Préfecture Mouanko		
18	Sa Majesté Moudjol Jean Bernard	Chief of Dibamba Village			+237 96614853 +237 78412638
19	Ms. Nking Gwendoline	Chief Post of Edinau	Ministry of Livestock's and Fisheries		
20		DO of Edinau	Sous-Préfecture Edinau		

Table 2. Annotated itinerary of the 2011 exploratory survey of cetaceans in Cameroon. In-country preparations by Ayissi in April. Authors (IA, KVW, GS).

Date	Main activities	Comments	Temporary base
Sun 24 Apr	preparations, travel to Yaounde	IA contact Officials in MINEP and CMS focal point	Yaounde
Mon 25 Apr	preparations, travel to Limbe	IA contact D/O of Limbe and Edinau Sub-Division and Divisional Delegate of MINEP	Douala
Tue 26 Apr	preparations, travel to Mouanko	IA contact D/O of Mouanko	Mouanko
Wed 27 Apr	preparations, travel to Kribi	IA contact Divisional Delegate of MINEP Sanaga-Maritime	Kribi
Thu 28 Apr	preparations, travel to Campo	IA contact D/O of Campo	Campo
Sat 7 May	International travel, mission briefing	GS: Lomé-Douala (Asky Airlines); KVW: Brussels -Paris-Douala (Air France); IA: Kribi- Douala (ground)	Douala
Sun 8 May	travel, meetings	Douala-Yaoundé. Meet with ACBM vice-president	Yaoundé
Mon 9 May	meetings (officials), for permit, logistics preps.	Ministere de l'Environnement et la Protection de la Nature (MINEP); UNDP Cameroon; ECO Bank	Yaoundé
Tue 10 May	meetings (officials), logistics, travel	[am] MINEP, ECO Bank (Yaoundé). [pm] Yaoundé – Kribi.	Kribi
Wed 11 May	monitoring, interviews, logistics	Kribi port monitoring. Communications with UNEP Treasury. Nzami fish landing site.	Kribi
Thu 12 May	coastal survey	Nanga-django, Bogandoue	Kribi
Fri 13 May	coastal survey	Londji port and beach monitoring, interviews	Kribi
Sat 14 May	coastal survey	Kribi port monitoring; Mpala- Mpollongue beach survey	Kribi
Sun 15 May	travel, survey	Kribi-Campo: via Eboundja I, Nlende-Dibè, Lolabé	Campo
Mon 16 May	beach survey, meetings	Estuary River Ntem to north	Campo
Tue 17 May	beach and boat survey; travel	Boat from Campo to Ebodjé (south coast); return by road [pm]. Travel Kribi-Buea	Buea
Wed 18 May	travel, port monitoring, meetings	Buea – Bakingili – Limbé- Idenau	Limbé
Thu 19 May	interviews, coastal survey	Limbé – Idenau : port monitoring, beach survey	Limbé
Fri 20 May	port monitoring	Limbé fishing port, [national holiday]	Limbé
Sat 21 May	boat survey	around Limbé port	Limbé
Sun 22 May	travel	Limbé-Douala-Mouanko	Mouanko
Mon 23 May	meetings, boat survey	Sanaga river and estuary; Mouanko-Mbiako	Mbiako
Tue 24 May	boat surveys	[am] coast south of Mbiako; [pm] Mbiako-Bolondo	Bolondo
Wed 25 May	boat surveys	around Bolondo-Youmé I, Manoka-Bolondo	Bolondo
Thu 26 May	boat survey	Bolondo-Mouanko (KVW); beach survey (GS,IA)	Mouanko
Fri 27 May	travel	Mouanko-Edéa-Douala	Douala
Sat 28 May	mission debriefing, travel	in Douala; travel Douala-Lomé (GS); Douala- Ayos (IA)	Douala
Sun 29 May	international travel	KVW travel Douala-Paris-Brussels (arrival 30 May)	
Thu 2 June	travel	Ayos –Yaoundé-Douala (IA)	Douala
Fri 3 June	river survey	Along Dibamba River: Pont Dibamba-Sio Sio (IA)	Douala
Sat 4 June	river survey	Along Dibamba River: Douala-Japoma (IA)	Douala

Sun 5 June	travel	Travel back to Kribi	Kribi
Fri 10 June	travel	Kribi-Douala-Yabassi (Bodiman)	Yabassi
Sat 11 June	travel	Yabassi-Douala-Kribi	Kribi
Tue 26 July	travel	Kribi-Edéa-Mouanko	Mouanko
Wed 27 July	coastal survey	Kombo Mukala (Ayissi)	Mouanko
Thur 28 July	travel	Mouanko-Kribi (IA)	Kribi

Table 3. Details of visual survey effort for live cetaceans on the coast of Cameroon, from 07- 28 May 2011.

Date	Departure point	Destination (arrival time)	Effort	Comments
Boat-based surveys		**total: 259.1km (1008min)**		
17/05/11	Campo, N02°22.861',E09°49.465' (09:25h)	Ebodjé, N02°34.550', E09°49.497' (13:00h)	[22.5] km (215min)	coastal strip Campo-Ebodjé. 2p, small canoe, 8HP outB
21/05/11	Limbé, N04°00.012',E09°12.551' (09:40h)	N04°00.012',E09°12.551' (11:05h)	20.2km (85min)	Limbé harbour and environs. 2p, canoe, 40HP
23/05/11	Mouanko,N03°38.371',E09°48.060' (14:54)	Mbiako, N03°35.317',E09°38.934' (16:28)	33.91km (94min)	downriver Sanaga and short estuary excursion; 3p, fibreglass boat; 40HP
24/05/11	Mbiako, N03°35.317',E09°38.934' (10:30h)	Sitan, N03°28.347',E09°44.183' and return to Mbiako (13:14)	42.56km (164min)	100-200m off beach, return 300-500m off beach; 3p, fibreglass boat, 40HP
24/05/11	Mbiako, N03°35.317',E09°38.934' (14:27)	Bolondo, N03°48.731,E09°33.470' (16:23h)	35.65km (116min)	150-300m off beach, 3p, fibreglass boat, 40HP
25/05/11	Bolondo, N03°48.731,E09°33.470' (09:15)	Manoka N03°52.004',E09°37.761' (12:00h), penins.tip, N03°49.273',E09°32.711' (14:57)	50.88km (201min)	survey of main creeks and estuary, 3p, fibreglass boat, 40HP
26/05/11	Bolondo, N03°48.731,E09°33.470' (11:41h)	Mouanko, N03°38.371',E09°48.060' (13:54h)	53.40km (133min)	coastal strip; 13:03h entering Sanaga river and upriver survey.
Beach-based surveys		**total: 30.52km (784min)**		
16/05/11	river Ntem mouth (06:00h)	river Ntem estuary, right bank (07:30h)	0km (90min)	1person, stationary position
16/05/11	N02°21.104',E09°49.397' (10:20h)	N02°24.384',E09°49.345' (14:35h)	6.45km (255min)	2p, on foot, NE direction
16/05/11	N02°24.384',E09°49.345' (14:35h)	N02°22.861',E09°49.465' (15:45h)	2.95km (70min)	2p, on foot, SW direction
17/05/11	N02°21.104',E09°49.397' (07:30h)	N02°22.861',E09°49.465' (08:35h)	3.50km (65min)	2p, on foot, NE direction, low tide
19/05/11	Idenau, N04°13.045',E08°59.133' (10:25h)	N04°13.629',E08°58.537' and return to Idenau (11:55h)	3.75km (90min)	3p, on foot, NW/NE, rising tide
19/05/11	Seme, N04°03.358',E09°03.181' (15:06h)	N04°03.579',E09°02.726' and return	2.22km (86min)	2p, on foot, high tide
25/05/11	northern tip peninsula, N03°49.273',E09°32.711' (15:12h)	N03°47.722'E09°33.724' and return to Bolondo, N03°48.731,E09°33.470' (18:20)	11.65km (128min)	2p, on foot

Table 4. Cetacean specimen records from Cameroon, chronologically ordered, in 1892-2011.
Abbreviations: (WP#) GPS waypoint number in Plates; (GS) Gabriel Seniagbeto; (IA) Isidore Ayissi; (KVW) Koen Van Waerebeek.

Date event	Locality	Position	Description	Voucher (specimen, photo)
1892	Man O'War Bay, NE of Douala	N03.94839° E09.22416°	circumstances of collection of Atlantic humpback dolphin specimen unclear as a manatee carcass is described and erroneously linked to a dolphin skull	Holotype of *Sousa teuszii* (Kükenthal, 1892) deposited at British Museum (Natural History)
ca. 1990 (estimated)	Kribi (Ngoyè)	N03°01.900' E009°57.661' (WP#012)	Sperm whale *Physeter macrocephalus* Stranded “some 20 years ago” (dixit local resident).	Very weathered calvaria on beach-front private property; occipital width ca. 116cm; condylar width 35cm. Photographed on 14.05.2011.
ca. 2000-2002	Sittan	N03°28.347' E09°44.183' (WP#40)	Biologist Isidore Ayissi was offered dolphin meat as food. Reportedly animal was taken by a 'chalutier' (trawler) however this was unverifiable.	None.
2001	Kombo Mukala		Stranded whale, species unknown	1 vertebra photographed (IA) on 27.07.2011
2003	Yoyo II	N03°40' E09°38'	Common bottlenose dolphin *Tursiops truncatus* Captured.	Digital photo taken with cellular phone by fisherman. Examined and archived (IA).
ca. 2005	Nlendé-Dibè	N02°46.463' E09°52.898' (WP#14)	Stranded whale, species unknown	1 weathered vertebra photographed by authors on 15.05.2011
May 2005	Bakingili	N04°04'17” E09°02'27”	Sperm whale *Physeter macrocephalus.* Stranded, flensed in-situ and consumed by people from Idenau and Limbé. Teeth taken for commercial items.	Partial calvaria at Bakingili lava stream information site examined and photographed on 18.05.2011. Three photos of fresh animal obtained from local guard (in Archives).
Sept 2007	Mbiako	N03.53964° E09.64741° (WP#039)	Small whale stranding on southern beach of Sanaga Estuary	Vertebra collected by fisherman seen by IA in Mouanko
2008	Ebodjé	N02°34.550' E09°49.497'	Long-beaked common dolphin *Delphinus capensis.* Captured.	Digital photo taken with cellular phone by fisherman. Examined and archived (IA).
June 2009	Nlendé-Dibé (south of Kribi)	N02°46.463' E09°52.898'	Large “cachalot” *P. macrocephalus* stranded alive; reportedly teeth were taken by white man (source: Manne Emile Serge). Locals ate parts and suffered gastrointestinal problems	None available, although photos should exist; several independent local sources reported the same event.
2010, month unknown	Limbé	N04°00.012' E09°12.551'	Balaenopterid whale stranded, juvenile	2 ribs, left mandible and postorbital process of frontale kept by local fisherman; photographed on 21.05.2011

unknown	Bolondo	N03°48.731' E09°33.470' (WP#042)	Whale, juvenile; species unknown.	Lumbar vertebra of whale, physically immature (epiphyses absent), (centrum H=28cm; W=24cm); photographed on 26.05.2011
unknown	Bolondo	N03°48.731' E09°33.470' (WP#042)	Dolphin (Delphinidae), juvenile	Lumbar vertebra, physically immature (epiphyses absent); Centrum W=49mm; H=50mm (*Sousa* or *Tursiops* sized).
2010, [month indeterminate]	Yoyo I	N03°40.545' E09°37.763' (WP#041)	Small calf, humpback whale *Megaptera novaeangliae* was landed as by-catch; flensed and eaten locally.	22 digital photos taken with cellular phone archived
	Mzami	N02°57.829' E09°54.719'	Whale (humpback?) reported taken by sardine purse-seiner, net was cut to discard whale; carcass was found stranded	No voucher.
unknown but later than 2006	Lolabé	N02°39.556' E09°51.065'	Visitor to Lolabé witnessed landing of two dolphins by Lolabé fishers and was offered cooked dolphin meat later that day	No voucher; Ms. Falone Okono, pers. comm.to KVW
Dec 2009	Londji	N03°04.976' E09°58.34'	Stranded large whale (sperm?). Vertebra used as seat by Londji fisherman Mr. Freddy Bitha.	1 juvenile caudal vertebra (epiphyses absent); photographed on 13.05.2011.
unknown	Londji	N03°04.976' E09°58.34'	*under study*	9 teeth (purchased on 13.05.2011 for reference collection); photos archived.
May 2010	Pont Dibamba (bridge over Dibamba River), near Douala	N03°57.025' E09°49.398'	ca. 12 dolphins sighted, stranded and captured in Dibamba where river is 370m wide, tidal, and bordered by mangrove forest	*under study* (bones claimed to be from these animals were non-cetacean)
between July-August 2010	Boussibilika		Whale stranded.	No voucher; pers.comm. local witness
Sept-Oct 2010	Youmé I	N03°46.862' E09°35.206'	Calf humpback whale *Megaptera novaeangliae* stranded fresh condition; flensed and eaten locally	KVW confirmed species (*in situ*) examining digital photos stored on cellular SIM-card from local fisherman
“2 months ago” (ca. March 2011)	Mpollongue	N03°01.855' E09°57.594'	Dolphin was landed and consumed locally; species unknown	No voucher; pers.comm. local witness
Unknown	Eboundja I	N02°48.00' E09°53.597' (WP#13)	stranded whale, species unknown	large rib, point-to-point length 229cm, photographed by authors on 15.05.2011 at turtle museum
Unknown.	Lolabé III	N02°39.556' E09°51.065'	stranded whale, species unknown	1 large lumbar vertebra (damaged), photographed on 15.05.2011

Table 5. Summary results of 17 structured interviews of 23 fishermen. Three interviews represent consensus views of 3-4 fishermen each. Note questions with highly varying replies (even contradictory between interviewees) and a few questions that generated more consistent replies.

	1 Kribi, 11/05	2 Kribi, 11/05	3 Nzami, 11/05	4 Nzami, 11/05	5 Bogandoue 12 May	6 Londji 13/05	7 Londji, 13/05	8 Mpala, 14/05	9 Mpollongue, 14/05	10 Lolabé III, 15/05	11 Nlende-Dibe, 15/05	12 Eboundja, 15/05	13 Eboundja, 15/05	14 16/05/11	15 Campo, 16/05	16 Limbe, 20May	Summary Numbet (%)
QUESTION	fisher	3 fishers	fisher	fisher	fisher	fisher	4 fishers	3 fishers	fisher	fisher	fisher	fisher	fisher	fisher	fisher	fisher	fishers
Do you sometimes see dolphins at sea?																	
yes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16 (100)
no																	0 (0)
If yes, how often do you see dolphins ?																	
Very often (almost every fishing trip)			X					X	X		X		X	X	X		7 (44)
Once in a while (a few times per month)	X	X		X	X	X	X			X		X				X	9 (46)
Rarely (a few times per year)																	0 (0)
Which months of the year do you see dolphins?																	
all year round	X		X			X		X				X		X			6 (37)
mostly dry season, months?					Nov-Jan		Nov-Feb		Sept-April	Oct-Dec					Oct-Mar		5 (31)
mostly rainy season, months?	Aug-Oct	May-Aug		Sept-Oct							July-Oct		Aug-Dec				5 (31)
do not remember																X	1
Do you sometimes see dolphins from the beach/coast?																	
yes	X	X	X		X		X	X	X	X	X	X	X	X	X		13 (81)
no				X		X										X	3 (19)
Have you ever seen dolphins that have a fin-on-a-hump on their back?																	
yes, close to shore																	0 (0)
yes, far away from shore																	0 (0)
no	X	X	X	X	X	X	X	X		X	X	X	X	X	X		14 (87.5)
unsure									X							X	2 (12.5)
Do you sometimes see whales at sea?																	
yes, close to shore	X		X	X		X	X	X	X	X	X	X	X				11 (55)
yes, far away from shore	X	X	X		X					X		X	X	X	X		8 (40)
No																X	1 (5)
If yes, how often do you see whales at sea?																	
Very often (almost every fishing trip) in season	July-Aug		May-Aug				Aug		Dec-Jan	Aug-Sept	June-Oct						6 (55)
Once in a while (a few times per month)		X		X				X									3 (27)
Rarely (a few times per year)						X								X			2 (18)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Summary
	Kribi, 11/05	Kribi, 11/05	Nzami, 11/05	Nzami, 11/05	Bogandoue 12 May	Londji 13/05	Londji, 13/05	Mpala, 14/05	Mpollongue, 14/05	Lolabé III, 15/05	Nlende-Dibe, 15/05	Eboundja, 15/05	Eboundja, 15/05	16/05/11	Campo, 16/05	Limbe, 20May	
QUESTION	fisher	3 fishers	fisher	fisher	fisher	fisher	4 fishers	3 fishers	fisher	fisher	fisher	fisher	fisher	fisher	fisher	fisher	fishers
Do you sometimes see very young ones (calves) ?	possible																
Often																	0 (0)
Rarely			X			X	X		X								4 (57)
Never				X	X									X			3 (43)
Which period of the year do you see the whales?								NA									
All year round (or about)																	0 (0)
mostly dry season (months?)					X							April					2 (15)
mostly rainy season (months?)	July-Aug	May-Aug	May-Aug	July-Sept		X	May-Sept		July-Dec	Aug-Sept	June-Oct		July-Aug	X			11 (85)
Have you ever seen a stranded whale																	
No																X	1 (8)
Yes, specify	X	2007-09	X	X	2003	X	X	X		X	X	X	X				12 (92)
How often are dolphins captured accidentally?																	
Frequently (at least 1 times a week)																	0 (0)
Once in a while (a few times per month)		X					X			X		X					4 (27)
Rarely			X	X		X		X	X				X	X	X		8 (53)
Never					X						X					X	3 (20)
Do you sometimes hunt dolphins on purpose ?																	
Frequently (at least 1 times a week)																	0 (0)
Occasionally (a few times a month)	X						X										2 (14)
Rarely													X	X			2 (14)
Never		X		X	X	X		X	X	X		X			X	X	10 (71)
What happens with captured dolphins?																	
A) Dolphins are landed and used like any other fish as food.	50000	50,000-100,000	X	X			but cut up in boat		X	X		X	X	X	X		11 (85)
B) Dolphins are mainly cut-up in the boat and used as bait.																	0
C)Dolphins are thrown out at sea and are considered useless.																	0
D) Other						X	X									Ghanaians e	2 (15)
When did fishermen first started utilizing dolphins?																	
A) Long ago: it is an old tradition.				X			X						X				3 (43)
B) A fairly recent custom, it started only in the last 10-15 yrs.	X																1 (14)
C) Other, specify										capt accid		capt accid	capt accid				3 (43)