

## **The Atlantic humpback dolphin (*Sousa teuszii*) in Gabon and Congo: cause for optimism or concern?**

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### **Introduction**

The Atlantic humpback dolphin is regionally endemic to tropical and sub-tropical waters of western Africa (Jefferson *et al.* 1997, Culik, 2002, Ross 2002, Reeves *et al.* 2003, Van Waerebeek *et al.* 2004, Weir 2009). The available evidence suggests that their distribution is patchy, with small subpopulations distributed between Western Sahara and Angola, each separated from the next by areas of low or no density (Notarbartolo di Sciara *et al.* 1998, Culik 2002, Reeves *et al.* 2003, Van Waerebeek *et al.* 2004). However there has been little to no assessment of any kind in large areas of their potential range. For conservation and management purposes Van Waerebeek *et al.* (2004) identified eight biogeographical management stocks ranging from Western Sahara to Angola. These included a historical Gabon stock associated with the *Estuaire de Gabon* (Komo Estuary). The same authors also suspected distribution in other areas where there were no records due to a lack of observer effort. This included the Republic of Congo (hereafter Congo).

Thorough reviews of the available information are available elsewhere (e.g. Van Waerebeek *et al.* 2004, Weir 2009, SC/62/SM6). The purpose of this document is to provide an update to Collins *et al.* (2004) by providing a brief review of more recent information from Gabon and Congo and to place these findings into the wider context of general concern and information needs for this species.

### *Available information for Gabon and Congo*

Records of humpback dolphins in Gabon are few (Collins *et al.* 2004, Van Waerebeek *et al.* 2004, Reeves *et al.* 2008). These were reviewed by Collins *et al.* (2004) and were limited to incidental sightings and verified strandings. Prior to 2008 no records were available for Congo, although anecdotal evidence and the close proximity of verified sightings just across the border with Gabon, associated with contiguous habitats, strongly suggested that the species occurred in at least the area of the international frontier; the first verified sighting of the species in Congo by the lead author was made at the Conkouati lagoon mouth in late October 2008. The second confirmed record was of a bycaught animal a few days later.

### **Habitat**

Coastal habitats in Gabon and Congo are varied. The continental shelf is typically wide (~50km) and uniform. *Cap Lopez* is an exception where the shelf approaches to within

five kilometers. Benthic substrates on the shelf are mostly of sand or mud with rocky outcrops rare and typically associated with minor capes and embayments along open coastlines. In the north of Gabon there are two major estuary systems; the *Baie de Mondah* (Nzeme river) that is nestled in the sheltered, shallow waters of Corisco Bay and the *Estuaire du Gabon* (Komo or Gabon estuary). Despite their very close proximity the two systems are very different. The Baie de Mondah is largely saline and despite high rainfall in the area freshwater inputs from the Nzeme are limited. In contrast the Estuaire du Gabon experiences strong variations in fresh water flow allied to seasonal patterns of rainfall. There is also a strong east to west salinity gradient in the Estuaire that changes position in accordance with seasonal rainfall. During the dry season saline waters reach Kango which is by definition the limit of the estuary; during the rains saline intrusion is probably limited to the Remboué River, although information on local hydrology is very sparse (Vande Weghe *pers comm.*). Tidal influence is felt as far as *Andok Foula*, 120km upstream (Vande Weghe, 2005). Each estuary harbours extensive mangrove forests, numerous small tributaries and sheltered waters. The Estuaire includes deep channels and shallow banks and currents can be complex. The capital city of Libreville is situated on the eastern bank of the *Estuaire* and includes a terminal at *Owendo* for large vessels. A larger port at *Cap Santa Clara* has been proposed as an element of the Belinga Mine development project (Sally Lahm *pers comm.*).

The prominent peninsula of Cap Lopez lies less than 150 km south of the Estuaire. The peninsula shelters a small but complex delta system that is linked to the largest river in Gabon, the *Ogooué*. An extensive inshore mudflat occupies much of the lower *Baie du Cap Lopez* and in principal offers ideal habitat for humpback dolphins. Cap Lopez is also the site of *Port Gentil*, home to much of Gabon's offshore oil industry and as such hosts active vessel traffic. The bay is also used by forestry companies to transport, stock and load logs.

Between Port Gentil and the Congolese border with Cabinda (Angola) the coast is exposed and generally uniform with a few minor capes and embayments providing shelter from prevailing south westerly swells. Large inshore lagoon systems are prominent and these typically open to the sea via narrow and dynamic tidal inlets that occasionally close. The lagoon systems include mangrove and seasonally flooded swamp forests and provide excellent nursery habitats for fishes and crustaceans. The coast is also remarkably pristine, with a very low human population density and abundant wildlife. *Pointe Noire* in Congo is smaller but similar in character to Cap Lopez but the city of Pointe Noire is much larger than Port Gentil, with nearly one million inhabitants and an active port.

### **National Parks**

Gabon and Congo have large and diverse national park systems that include protected coastal habitats. Gabon's national parks system was created in 2002, and consists of 13 protected areas. Four of these national parks include a marine component, including the exclusively marine Mayumba National Park. In Congo the process has been more gradual and began in the late 1980s'. The coastal Conkouati-Douli National Park (CDNP) was created in 1999 and includes both marine and terrestrial protected areas. CDNP and Mayumba share a common boundary at the international border and recently signed a transboundary management agreement that created the *Park Transfrontalier de*

*Mayumba-Conkouati*. The major motivations for the creation of the transboundary park were management of illegal trawler activity, protection of the world's most important leatherback turtle nesting beaches and protection of marine mammals, including explicit protection of the Atlantic humpback dolphin. CDNP is also notable for the inclusion of a number of coastal fishing villages that predate the creation of the park. These communities are small but active and switch between pastoral and fishing activities on a seasonal basis.

## **Recent work**

### *Small boat surveys*

Incidental boat surveys for humpback dolphins were conducted in Gabon in association with research on migratory humpback whales (*Megaptera novaeangliae*) between 2002 and 2006 (SC/62/SH8, SC/62/SH11). The research period for humpback whales focused on the months of July through to October and was conducted from research stations based within coastal lagoons (see figure 1). Dedicated small boat surveys for humpback dolphins were also completed during 2004, 2005 and 2006 in the environs of Libreville and Mayumba National Park. These were always of short duration (a few days) and were conducted using a variety of small boats.

Initial survey efforts were focused in areas considered favorable for humpback dolphins based on published reports (e.g. Jefferson et al. 1997, Reeves et al 2003). Apparently less typical areas (open coastlines) were added as key sightings were reported. Most surveys consisted of simple transects that ran parallel to shorelines at distances of 100-500 metres. Searches in *Mondah Baie* and the *Estuaire du Gabon* included mangrove channels and creeks. Formal sampling protocols were not used although observers did partition search effort to more effectively scan survey areas. Many areas were surveyed more than once but no attempt was made to stratify coverage with respect to depth or distance from shore and all surveys were confined to less than 10 m depth. Our basic rationale was to optimize the chances of encountering humpback dolphins for photographic identification and thus provide data for mark recapture estimates of local abundance and other population parameters. Other data were also recorded, including survey effort (and associated data), weather and behavioural observations. Anthropogenic activities were also recorded.

### *Beach Surveys*

The motivation for a beach based study was a series of incidental sightings made by two of the authors during other beach based work. A dual focus beach survey design facilitated both fisheries and dolphin specific sightings data to be collected. The fisheries methodology was equivalent to that used in earlier fisheries assessments by IUCN in CDNP (sightings methodology was adapted from published work (Karczmarski *et al.* 2000) for a cliff-based study of a congener, the Indo-Pacific humpback dolphin (*Sousa chinensis*). A three week pilot study in Mayumba National Park during July 2007 enabled refinement for our focal beaches and training of local observers. Observers walked predefined sections of the shore and approximately every 500 m dedicated searches were made from the highest available point (typically the beach crest or backshore) using the naked eye and binoculars. Observers also searched whilst walking between stations. At each observation station a GPS position was recorded and a watch maintained for 5 minutes. Observers focused on the area of ocean between the beach to approximately 500

m offshore and any marine mammals sighted were recorded on a dedicated data sheet. Sighted humpback dolphins were followed on foot until contact was lost. A variety other data were also recorded (survey effort, weather, pollution, fisheries, strandings, other wildlife etc).

In October 2008 two researchers employed by WCS in Conkouati-Douli National Park (CDNP) in Congo were trained in this methodology (Boumba and Thonio). CDNP includes 60km of protected beach that can be easily walked during a 4 day period. Throughout 2009 these observers conducted monthly surveys of the entire CDNP coastline with admirable consistency. They lodged in coastal villages or made use of camps established for teams monitoring nesting turtles and their observations ceased at the Gabon border. The team profited from rests in villages to conduct an artisanal fishery assessment that included an informal interview protocol for marine mammals. A dedicated survey campaign will run throughout 2009 with researchers walking beaches once each month. Initial data are reported here.

#### *Control post seizures*

CDNP maintains a road control post at the exit of the national park on the main coastal route to the coastal city of Pointe Noire. Trafficking of any bushmeat is illegal in Congo and the few vehicles that use this route are routinely searched. Bushmeat is confiscated and where relevant penalties applied (typically a warning or a small fine). Records are kept of the confiscations and include date, species (or senior taxon), quantity and other relevant details of the infraction. Records of infractions from 2003 to 2009 were searched for evidence of marine mammal bushmeat seizures. Park agents (rangers) who conducted searches that yielded these seizures were further questioned about the nature of the item and their certainty of it being of marine mammal origin.

#### *Other reports and incidental sightings*

An informal humpback dolphin awareness campaign was launched in Gabon 2003. The campaign included distribution of a humpback dolphin factsheet *via* email to coastal resource managers, park rangers and researchers. The factsheet included a request for images of dolphins sighted from the beach together with basic data (date, time, locality, estimates of group size, direction of travel if evident). In addition teams monitoring nesting turtles on an annual basis (November to March) in national parks were advised of the species presence and were asked to record any dolphin sightings. They received training in distinguishing humpback dolphins from all other species of dolphins through assessment of dorsal fin shape. Turtle team observers were not provided with cameras.

All sightings were recorded into a common database, and each sighting given a qualitative score of 1-5 based on the confidence with which the id was made by the beach based observers. The majority of sightings were backed with a digital image which, despite never being of very good quality, did enable species confirmation.

## **Results**

### *Boat Surveys – North of Port Gentil*

Corisco Bay and areas within and adjacent to the Estuaire du Gabon were briefly surveyed during 2003 and 2004. Surveys in 2003 were opportunistic and limited to 4 days in the nearshore waters of Pongara National Park. Surveys during 2004 were

dedicated and included 7 days of searching (July 4<sup>th</sup> - 10<sup>th</sup>) in the waters of the Estuaire du Gabon, Pongara National Park and Akanda National Park. All navigable channels on the south western shoreline of the Estuaire were searched, as well as Atlantic coasts south to Pointe Ngombé. Verified humpback dolphin sightings reported to TC at Point Pongara led to these areas being surveyed more than once. A single day of effort was allocated to Mondah Bay (Akanda National Park) and lower reaches of the Mondah River. A single survey day (July 12<sup>th</sup>) was completed at Port Gentil in 2004.

Two sightings of humpback dolphins were recorded on the northern shore of Pongara National Park. The first during shore based observations from Point Pongara (24<sup>th</sup> October 2003) and the second during boat based work (November 6<sup>th</sup>, 2003). Observed groups contained 6 – 15 individuals; both sightings were brief with their duration limited by either observer running speed or the capability of the hired boat.

#### *Boat Surveys – South of Port Gentil*

Opportunistic boat surveys for humpback dolphins were initiated at humpback whale research sites from 2003 onwards. During 2003 and 2004 surveys were launched from the Ngowé Lagoon (Iguela) and were incidental to other work. During 2005 and 2006 surveys were launched from the Banio Lagoon (Mayumba) and were both incidental and dedicated. Sightings were few despite concerted search effort (see summary in Table 1 below).

Year	days	sightings	Km	
			surveyed	sightings per km
2003	4	1	680	0.0015
2004	14	2	1550	0.0013
2005	8	2	1220	0.0016
2006	12	0	1730	-

**Table 1: Summary of boat based survey effort and sightings during small boat work in Gabon south of Port Gentil (2003-2006)**

Sightings during boat based work were notable not only for their rarity but also for their occurrence on open coastlines, the extreme proximity to the beach and surf of sighted animals and the short duration of each sighting. One such sighting was recorded on the 16<sup>th</sup> of November 2003 close in the area of Petit Loango; the group was estimated to include between 30 and 40 individuals. When first encountered the dolphins were widely dispersed over approximately one square kilometer. During the sighting the distribution and behavior of the group changed markedly. The ease with which individuals were approached rapidly declined as the encounter proceeded and after a period of ~40 minutes the group was lost. Radial searches failed to produce another sighting. Efforts to obtain photos solicited marked responses; individuals were remarkably elusive, with many direction changes and long surface intervals. A separate sighting of a small group of bottlenose dolphins was recorded nearby in very similar habitats <20 minutes later.

#### *Beach surveys*

Beach surveys of the entire CDNP coastline were conducted on a monthly basis from March 2009 to December 2009. Surveys were designed to be conducted over 4 days although this varied widely due to the available logistics, weather and other factors. A

total of 136:56 hours of dedicated search effort was recorded, of which 16:21 hours were spent watching dolphins along the beach. Both humpback and bottlenose dolphins were sighted. Once poorly supported records were filtered from the database, a total of 38 humpback dolphins sightings were reported during the 9 month survey period (total individuals = 408, average = 13, median = 10, max = 35). Sighting rates, when compared to boat based work, were very much higher and included an apparent peak in sighting rates during July and August. Whilst interesting, these data are considered too few and too patchy to provide a reliable indication of seasonality or seasonal abundance and too few to provide an indication of habitat preference. Nonetheless, given the higher (much higher) sighting rate from shore when compared to boat based effort, the method is considered effective and should be actively considered in other studies. Some seasonality has been noted in other areas, for instance the Saloum estuary and Banc D'Arguin (Maigret 1982, Culik 2002). Large groups were also observed from shore, as were multiple group sightings (presumably the same animals) over single day periods. The other crucial advantage in this context was elimination of the apparently adverse influence of boat presence; animals were followed for longer periods of time along the beach, including a follow of over 2 hours on the 22 of November 2009.

Beach surveys were also important for collection of other data; this included active assessment of fisheries effort, including the number of nets, boats and fishers active in each village and an both formal (measured) and informal (interview based) assessments of fishing success (not reported here). A key concern raised in the latter was a steep increase in the prevalence of small, Chinese built wooden trawlers in the inshore waters of CDNP. These boats are locally constructed and comprise a Chinese captain and first mate and typically a crew of 4-5 Congolese. These vessels are routinely sighted in nearshore waters and apparently in addition to a nonselective take with high bycatch (evidenced by dead fish observed floating at sea and on beaches) they also frequently take inshore artisanal gillnets; the response of local fishers has been to shift their effort to waters even closer to shore and our presumption is raised risk for coastal groups of dolphins. Interviews suggest that in CDNP alone at least 1 animal per village is taken per year. There are at least 16 landing sites within the park so verifying and mitigating these kinds of takes is clearly important.

#### *Other reports and incidental sightings*

A limited number of sightings were provided by a variety of reporters (see Table 2). Those provided here include either photographic or video confirmation, or reports from observers that were trained by TC. Sightings include those recorded during other work (for instance turtle and humpback whale survey work) as well as sightings made by the authors at other times (typically time off).

#### *Control Post seizures and known bycatch*

Review of the available control post logbooks at CDNP revealed four separate incidents of dolphin bushmeat seizures. Smoked in each case, the species id and precise provenance of each item could not be reliably ascertained. However, five mortalities were recorded by the beach observing team; four of these were bottlenose dolphins and one of Atlantic humpback dolphin (October 30<sup>th</sup> 2008). The latter animal, captured at the coastal fishing village of *Paris*, was seen to be butchered and distributed amongst fishermen for consumption almost as soon as it was landed. Two of the bottlenose dolphins were

considered to have died either naturally or to have been adrift for some time prior to stranding and were left to rot by local communities. Two bottlenose dolphins were however known to have been butchered and dolphin meat seized a few days following each event (see Table 2)

## Discussion

The majority of published records suggest that Atlantic humpback dolphins inhabit estuarine and shallow (<20 m) coastal waters with soft sediment bottoms (e.g. Jefferson *et al.* 1997, Culik 2002, Van Waerebeek *et al.* 2004) and areas of highest density to be brackish, mangrove lined estuaries (Reeves *et al.* 2003). Movements between subpopulations are considered possible but limited (Culik, 2002, Reeves *et al.* 2003) and are likely to be uncoordinated (Maigret, 1980; Ross, 1984; Van Waerebeek *et al.* 2004). In some areas (e.g. Mauritania and Angola) they are known to occur in the surf zone (Busnel 1973, Culik, 2002, Van Waerebeek and Perrin 2008, Weir 2009) and here we provide further evidence of their routine occurrence on the open coastlines of Gabon and Congo, areas with low human population densities and evidently few anthropogenic threats.

Much of the coast of Gabon and Congo is characterized by long, exposed sandy beaches with few sheltered bays and few other protected habitats with easy access to open water. In all likelihood any available ‘ideal habitats’ are few and disparate. This is certainly true when consideration is given to other areas of Atlantic humpback dolphin abundance (Maigret, 1980; Van Waerebeek *et al.* 2004). This we feel is important for at least two reasons; survey effort moving forward should not focus exclusively on areas considered ‘typical.’ Their preference for particular foraging areas is considered a possible cause for limited migrations and typically small group sizes (Van Waerebeek 2004). Whilst these habitats are acknowledged as being incredibly important, the availability of ideal habitats may not limit *Sousa tueszii* distribution in some areas. Moreover, we presume movement of dolphins over reasonably large distances between coastal reaches of Northern Congo and Southern Gabon (in the absence of photographic recaptures sightings are otherwise suggestive of this kind of movement).

These factors are important when considering the potential for movement of individuals between proximal substocks, and active consideration of coastal areas for MPA’s and corridors of various kinds (fisheries exclusion zones, impact mitigation, seismic surveys in coastal waters etc). Several observers have described the species shyness and in particular their sensitivity to boats (Spaans 1990, Notarbartolo di Sciara *et al.* 1998, Weir 2009, Van Waerebeek and Perrin 2008). This tendency is seemingly prognostic of their susceptibility to disturbance. High human population densities along much of the Atlantic coast of Africa and habitat degradation and destruction associated with this development are clearly important determinants of the species’ distribution and status (Van Waerebeek and Perrin 2008). Offshore oil exploration and development are also prevalent in Gabon and Congo and routine spills and chronic low level pollution may have some impact on populations in these areas.

Group sizes for Atlantic humpback dolphins are typically small (Culik 2002, Ross *et al.* 1994, Reeves *et al.* 2003) and published group sizes range from 1 - 37 (Van Waerebeek 2004). Group sizes recorded here fall within the published range (Van Waerebeek *et al.*

2004) and at least 3 groups sightings reported here fall at the upper extreme of reported group size maxima (Van Waerebeek et al., 2004)

There were constraints to formal survey ‘design.’ These included logistical constraints, the fact that we had (and still have) minimal ecological information (where, how, when) for humpback dolphins in Gabon. The animals are also habitually shy, and as described above, observed animals seem to have a surf zone preference, a finding counter to published theory and problematic for surveys. These are small dolphins and sighting them is difficult in the surf filled near-shore waters of Gabon’s coast (see photo below). They are also astonishingly elusive, and few encounters last beyond 20 minutes. They are boat-shy and groups will readily split, adopting repeated direction changes and uneven surface intervals. They may well be more abundant than these surveys suggest but some an adaptive methodology is required (see Weir 2009 for an adaptive methodology). In Akanda NP survey limits were determined more by the availability of suitable boats. The area is considered extremely promising for humpback dolphins and subsequent discussion with both local Nigerian fishers and other biologists in Libreville (JP Vandevoghe) left the firm impression that more effort should be allocated to this area in future.

The Estuaire de Gabon contains (according to published literature) typical habitat yet encounters are rare, and typically recorded by observers engaged in other activities. The question this begs is what does this mean for populations on coasts between Gabon and known areas of occurrence in southern Angola? Sightings along exposed West African coasts have been recorded as far south as southern Angola and as far north as the Iguela Embouchure and few places within this range exhibit the range of sheltered habitats considered typical for the species. In fact the opposite is true, with very few places sheltered from the habitual and sometimes large south-westerly swells that roll in almost continually. It may well be that humpback dolphins along these coasts are extremely adaptable, and certainly not as niche-limited as published reports seem to suggest. It may also be that they migrate between areas that offer some degree of shelter, or simply move further offshore when bad weather and associated swell threaten. Another cfeature of this coast are baymouth (a sandbar extending across the mouth of an embayment) and longshore (a sand ridge or sandbar that runs parallel to shore just outside the trough) bars. These sandbars are maintained by a persistent south to north current and may facilitate the kind of sheltered conditions that these dolphins apparently require; waves break twice on much of this coast, once across the bars and once again with much reduced power onto beaches.

Putative stocks (Van Waerebeek et al 2004) include a Gabon Stock although these authors suggest clustering around a confirmed habitat. In Gabon this is currently represented by the Estuaire de Gabon (Komo Estuary), though this is based on historical evidence. Some of these “stocks,” especially in the northwestern part of the species’ range, may indeed represent discrete biological populations, segregated by stretches of coast of very low density or even virtual absence (Van Waerebeek et al. 2004). Sightings documented here suggest that much of the coastline between the Gabonese frontiere with Equatorial Guinea and the Congolese coast southwards to Point Indienne (just north of Pointe Noire) represents important habitat. As suggested by Van Waerebeek et al. (2004), some of these stocks could ‘coalesce into single biological populations with further



evidence' Evidence provided here suggests that the Gabon stock could be considered a Gabon/Congo stock given apparent cross border movement. However the likelihood of widely separated populations regaining contact is now tiny; stocks should be considered discrete biological populations and managed as such (Van Waerebeek et al 2004).

Incidental mortality of humpback dolphins in fishing nets and lines is known from Morocco, Mauritania, Senegal and Guinea Bissau (Van Waerebeek *et al.* 2004). Although these catches have not been properly assessed they probably occur in most areas and are considered to be the most serious immediate threat to the species (Reeves et al 2003, Van Waerebeek and Perrin 2008). Some Atlantic humpback dolphins are also caught for food in some areas, for example Senegal and the practice is suspected for other parts of the range. (Van Waerebeek *et al.* 2004). Excessive fishing of neritic fish stocks by industrial fleets may have reduced food availability for these dolphins (Van Waerebeek *et al.* 2004).

Atlantic humpback dolphins, although sharing much of the same habitat with inshore-type bottlenose dolphins, only rarely mingle with them. In Guinea-Bissau, no mixed groups were noted by Spaans (1990), but in 1992 a group of ten *S. teuszii* was encountered swimming alongside five *T. truncatus* (Table 3). From the Saloum-Niumi stock, no mixed groups are known to this date. (Van Waerebeek et al 2004). Several sightings recorded during both boat and beach based work here suggest that these two species routinely share the same inshore waters, an important management consideration moving forward.

The high density of trawlers fishing illegally within CDNP is of particular concern, as is the unspecified number of takes. Artisanal Congolese fishers can distinguish between bottlenose and humpback dolphins and they claim that incidental takes of dolphins are more often of bottlenose than humpback dolphins. This clearly needs verification and additional work. The initial surveys and information are both encouraging and alarming. The presence of humpback dolphins in CDNP is excellent news. The possibility of transboundary movement is also excellent and highlights the value of the two parks on either side of the frontier. The take of a humpback dolphin at Paris is worrying, and is made more so with the knowledge that dolphins are taken on occasion by fishers from this village. It is clear that with more effort more information on threats will be identified. These surveys will not only provide information on population size and habitat use by humpback dolphins but will also provide valuable monitoring information.

#### *Wider concerns*

Two areas where *Sousa* were once common are the coastal waters of Senegal and the Gambia and the shallow waters of upper Dakhla bay, Morocco (Van Waerebeek 2000, Notarbartolo di Sciara *et al.* 1998, Reeves *et al.* 2003). Fisheries pressures are implicated in their decline, and threats include incidental takes and decline in the availability of prey. Communities local to Pointe Noire have increasingly relied on the city as a source of revenue, typically for products harvested from the forest (Wieland 2008). This includes bushmeat, a high value product that is preferentially sold for cash in the city rather than consumed, even though this practice is largely illegal. A significant source of these products is CDNP, a national park situated ~150 km from the city. Bushmeat hunting for local consumption is permitted but its transport to the city is policed by park officials at

control posts and through patrols. Despite risks associated with discovery, legal follow through is rare but meat is confiscated (thus wasted hunting effort, a loss of income and loss of a potential protein resource). Hunters prefer to traffic meat to the city in order to sell it. Success in this regard yields cash and a route out of the extreme poverty of rural life in CDNP. In return villagers use a portion of profits to buy fish from either the city or from villages situated along the coast. Fish consumption is not traditional in many areas, but demand for fish protein has increased in relation to the growth of Pointe Noire and market for bushmeat. This may have led to an increase in inshore artisanal fisheries effort. Fishers alternate between near shore (< 1km) and offshore (> 1km) areas in keeping with the distribution of inshore fisheries. Nets are moved inshore between November and late March to coincide with inshore movement of certain fish species. Catches during these months are rich in Croakers and Crevalle Jacks (*Caranx hippos*).

Fishers claim that dolphins are not targeted, and that catches are coincidental to the inshore movement of nets during the rainy season. Seizures of smoked dolphin meat at control posts suggests that there may be some incentive to catching dolphins, a practice termed “directed entanglement” by Clapham and Van Waerebeek (2007). Humpback dolphins are explicitly protected under Congolese law. Thus far dolphin meat appears to have been confiscated from independent buyers, rather than resellers or middlemen.

As Justin Brashares notes (2004), declines in terrestrial mammals follow declines in fisheries. However Clapham and Van Waerebeek (2007) also suggest that declines in marine wildlife (marine mammals and marine turtles) are also associated with declines in fisheries and are frequently overlooked. Initial evidence from interview surveys with artisanal fishers in Congo suggests that significant declines in their catches began only a few years ago, maybe as recently as 2006 (this need verification). There is good market demand to not only supply high quality fish to Pointe Noire, but also bushmeat. Bushmeat trafficking networks in coastal Congo are efficient at circumventing CDNP control posts. As fisheries for high end species decline (in concert with inshore trawling pressure) it is conceivable that other species are targeted for bushmeat trade. A network of middlemen has developed to ship fish to market and it may be that dolphins are not only being assimilated into this traffick but are also going unnoticed. The recent discovery of dolphin meat in control post seizures may be diagnostic of a decline in local fisheries.

## **Conclusions**

Humpback dolphins in Gabon and Congo apparently routinely occur on open coastlines. All sightings made during this work were made within 1 km of shore and should be protected by either the coastal fisheries buffer exclusion zone or the protected waters of national parks. The degree to which the species is afforded protection within these areas remains unstudied. Further assessment of any threats and other impacts is critical, particularly given the apparent low density of groups and the general paucity of data for the species. Given low human population densities and an abundance of relatively undisturbed habitat in Gabon and northern Congo this area may represent some of the best remaining habitat for the species anywhere in its range. The relatively high sighting rate is encouraging, as are occasional sightings large groups. However, bycatches and evidence of a dolphin meat in the bushmeat trade are significant cause for alarm, particularly as demand for fish from cities increases.

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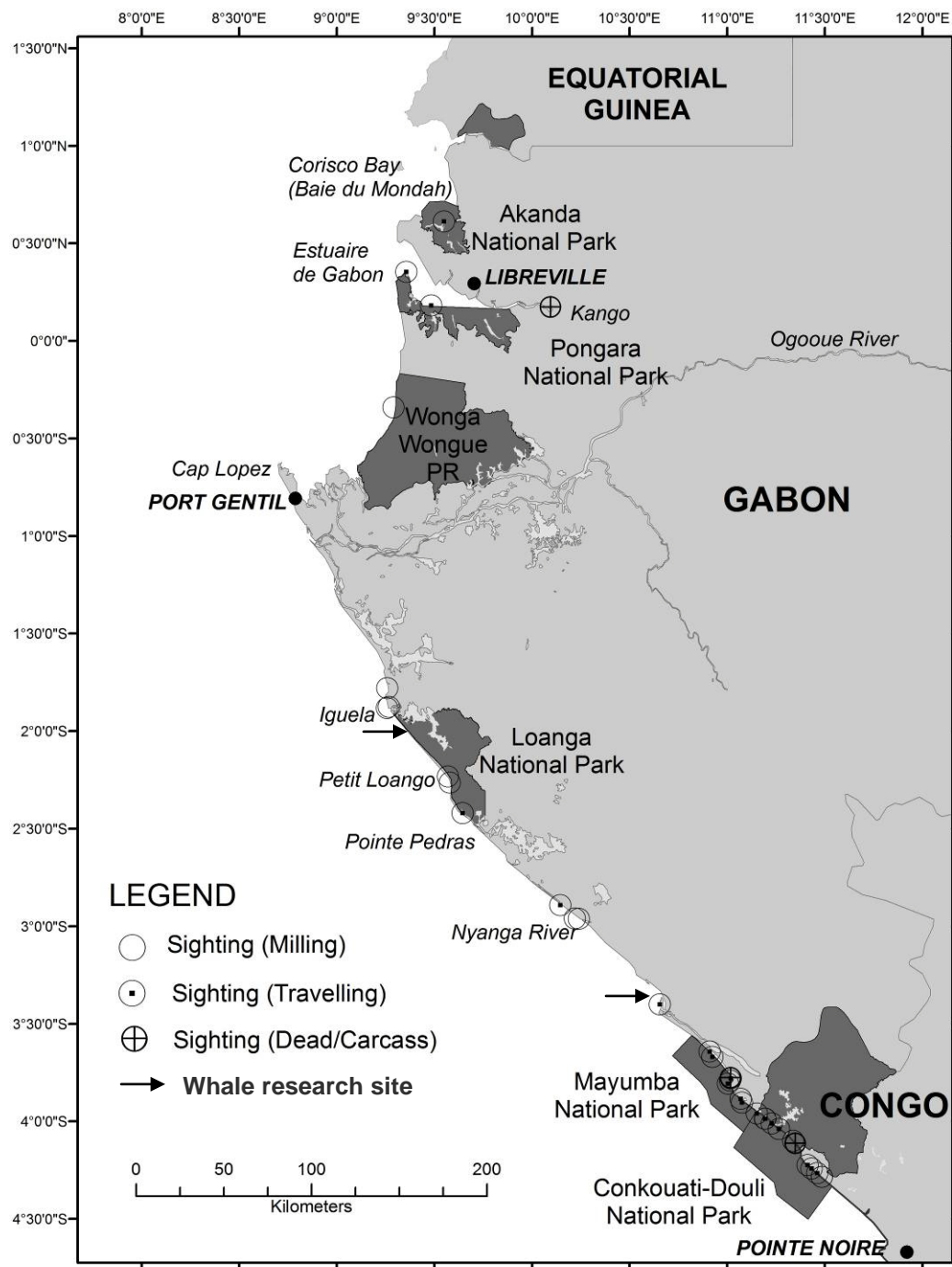
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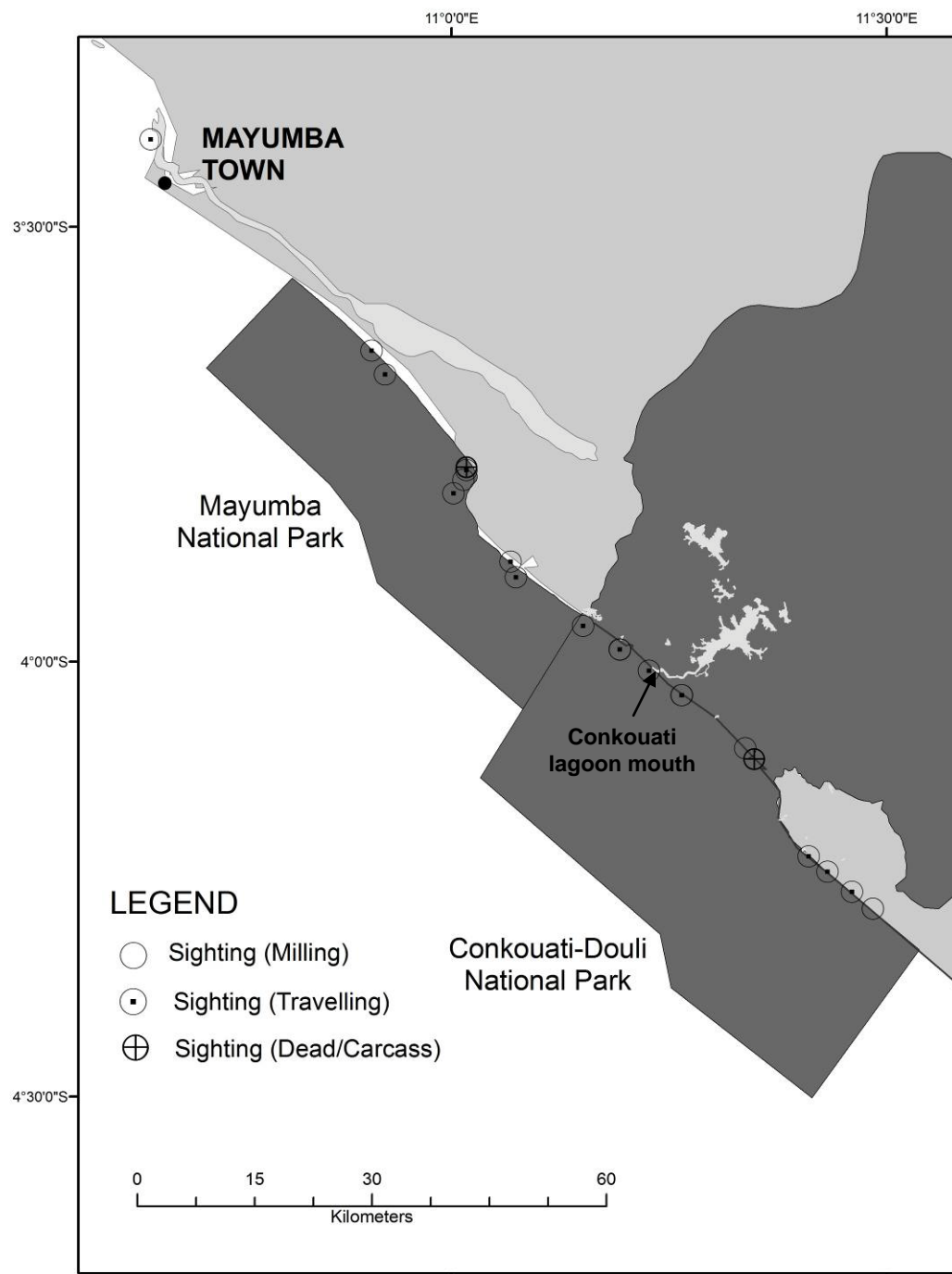
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Date	StartLat	StartLong	DirMove	State	Min	Max	Best	Ranking	Cue
1949	0.1748552	10.0937630		dead	1	1	1	5	
2001	-3.7764830	11.0173360		dead	1	1	1	5	skull
2002-08-01	0.3536930	9.3556500		travelling	6	10	8	5	
2002-09-04	-2.9620510	10.2390580		milling	6	10	8	5	dorsal
2002-09-05	-2.9603190	10.2183000		milling	8	10	8	5	
2003-04-01	-2.2323990	9.5686420		milling	10	15	12	5	dorsal
2003-11-16	-2.2632910	9.5776212		milling	30	45	40	5	dorsal
2004-08-01	0.1822910	9.4824970		travelling				5	dorsal
2004-08-01	0.6134150	9.5479040		travelling				5	dorsal
2004-11-01	-3.8065150	11.0022220		travelling	5	8	6	5	dorsal
2005-07-01	-1.8749180	9.2653690		milling				5	dorsal
2005-07-02	-1.8817830	9.2557250		milling				5	dorsal
2005-07-19	-1.8875460	9.2681050		travelling	1	2	1	4	dorsal
2005-12-09	-2.4196160	9.6428390		travelling	15	20	15	5	flank
2006-09-20	-3.7909140	11.0137850		milling				5	dorsal
2006-12-01	-3.9616510	11.1561300						2	
2007-02-06	-3.6698150	10.9234980		travelling	2	2	2	5	dorsal
2007-04-21	-2.8914104	10.1435709		travelling				5	flank
2007-07-01	-2.6796430	9.8833830		travelling				2	flank
2007-09-01	-3.3992910	10.6542190		travelling	8	10	9	5	dorsal
2007-11-01	0.6063060	9.5912850						3	
2008-01-13	-0.3400000	9.2900000		milling	10	10	10	5	dorsal
2008-08-07	-3.9029500	11.0739000		travelling	9	9	9	5	dorsal
2008-09-04	-3.6422860	10.9080340		travelling	2	2	2	5	dorsal
2008-09-08	-3.6814333	10.9356333		travelling	30	40	35	3	
2008-10-23	-4.0103600	11.2268100		travelling	10	12	10	5	
2008-10-23	-3.9672848	11.1663074		travelling			15	4	
2008-10-24	-3.8848010	11.0676730		travelling	5	8	6	5	
2008-10-	-3.9639824	11.1603632		travelling	7	7	7	4	

28									
2008-10-30	-4.1120480	11.3477990		dead	1	1	1	5	
2008-11-10	-3.9680396	11.1671566		travelling	20	28	20	4	
2008-11-12	-3.7797400	11.0169000		travelling	15	20	20	5	
2008-11-18	-3.9636050	11.1596084		travelling	3	3	3	4	
2008-11-29	-3.9845512	11.1917825		travelling			15	4	
2008-12-24	-3.9584156	11.1516828		travelling			15	4	
2008-12-29	-3.9650203	11.1620615		travelling			20	4	
2009-01-08	-4.0709169	11.3061860		travelling				4	
2009-01-10	-4.0639660	11.2992351		travelling				4	
2009-01-18	-4.0996000	11.3374600		milling	6	6	6	5	
2009-01-25	-4.2239500	11.4101200		travelling		50	35	5	
2009-01-28	-4.2645400	11.4597600		travelling		50	30	5	
2009-02-07	-3.9602083	11.1545134		travelling			8	4	
2009-02-20	-4.2839100	11.4841700		milling				5	
2009-02-24	-3.9860400	11.1932000	SE	travelling	8	10	10	5	
2009-03-01	-3.9714363	11.1725346		travelling			8	4	
2009-03-01	-3.9653977	11.1622503		travelling			17	4	
2009-03-01	-3.9859665	11.1936695		travelling			4	4	
2009-03-01	-3.9859665	11.1936695		travelling			30	4	
2009-03-03	-4.2839100	11.4841700		milling				5	
2009-03-05	-3.9857778	11.1931034		milling	1	1	1	4	
2009-03-14	-3.9862700	11.1933900	NW	milling	18	21	25	5	
2009-03-26	-4.2415600	11.4318400	SE	travelling	36	35	30	5	
2009-04-08	-1.7800309	9.2570466		milling				5	
2009-04-08	-4.0690700	11.3017400	NW	feeding, milling	13	8	10	5	dorsal
2009-06-11	-3.9859000	11.1930200	NW	travelling	2	2	2	5	dorsal
2009-07-24	-3.9864100	11.1939200	SE	travelling			20	4	flank
2009-07-24	-3.9588500	11.1510300	NW	travelling	7	5	3	5	dorsal



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2009-07-26	-4.0385900	11.2645000	NW	travelling			12	4	flank
2009-07-27	-4.0383900	11.2644500	SE				23	4	flank
2009-07-28	-4.0379500	11.2648400	NW	travelling			43	3	flank
2009-07-28	-4.0384200	11.2644600	NW	travelling				3	flank
2009-07-29	-4.0385800	11.2644100	NW	travelling	15	23	18	5	flank
2009-07-30	-4.0384000	11.2641000	NW	travelling	12	20	15	5	flank
2009-08-18	-4.0980900	11.3329600	SE	travelling, feeding	16	27	16	5	flank
2009-08-19	-4.0982100	11.3329800	NW	travelling, feeding	7	10	8	5	dorsal
2009-08-27	-4.1599700	11.3737600	SE	travelling	3	5	4	5	dorsal
2009-08-27	-4.2246500	11.1107000	SE	travelling	1	1	1	5	dorsal
2009-08-27	-4.2660600	11.4621900	SE	travelling	4	7	6	5	dorsal
2009-10-10	-3.9863100	11.1937200	NW	travelling	4	5	4	5	dorsal
2009-11-22	-4.0983100	11.3326300	NW	travelling	5	10	5	5	flank

**Table 2: Updated table of *Sousa* sightings from Gabon and Congo; these are plotted in figures 1 and 2 (the latter a subset limited to Mayumba NP and CDNP).**



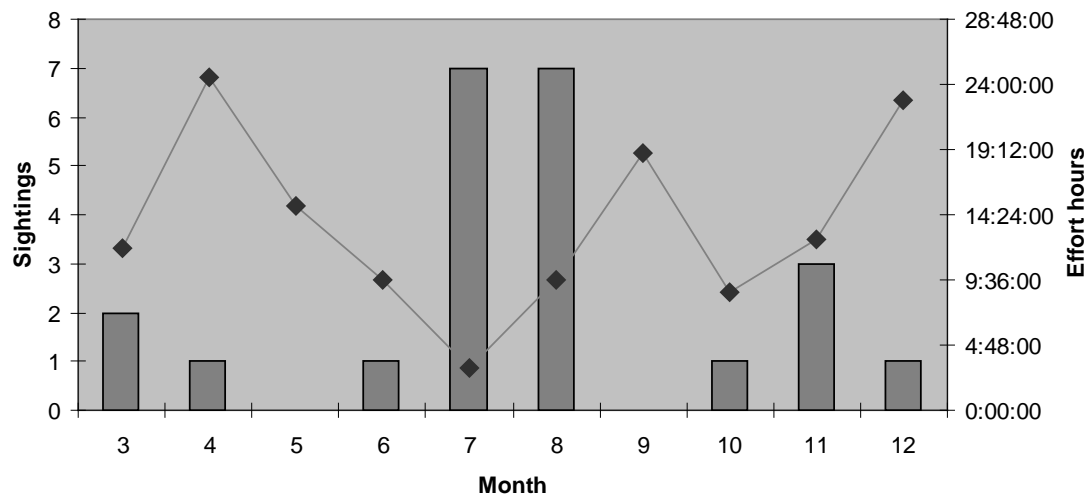
**Figure 3: A bottlenose dolphin (3.28 m) bycaught in a coastal gillnet in the area of Paris (coastal village) in CDNP on January 1st, 2009**



**Figure 4: An Atlantic Humpback Dolphin (~2 m) accidentally captured in a coastal gillnet at Paris (village) within CDNP on October 30<sup>th</sup> 2008. This animal was quickly butchered and distributed among villagers locally. A tissue sample was collected (held at AMNH-NY)**

Days	Month	Search	Focal follow	Observations	Sighting rate
7	3	11:58:00	1:07:00	2	0.0233
7	4	24:34:00	1:21:00	1	0.0562
9	5	15:03:00	0:00:00	0	-
12	6	9:38:00	0:00:00	1	0.0000
8	7	3:03:00	3:09:00	7	0.0188
10	8	9:36:00	1:49:00	7	0.0108
4	9	18:57:00	3:19:00	0	-
10	10	8:45:00	0:00:00	1	0.0000
4	11	12:33:00	2:42:00	3	0.0375
7	12	22:49:00	2:54:00	1	0.1208
78		136:56:00	16:21:00	23	

### Search effort vs Sighting Rate





**Figure 5: Humpback dolphins sighted at Pointe Pedras, Gabon, September 12th 2005. Note the extreme proximity of animals to shore.**



**Figure 6: Humpback dolphins sighted at Pointe Pedras, Gabon. September 12th 2005.**