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Occurrence, distribution and composition of marine mammals in the bight of Bony, Nigeria

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ABSTRACT

Information on the distribution, occurrence and population structure of cetaceans (whales and dolphins) of the Atlantic coast of Nigeria in West Africa remains fairly sparse to date, with few detailed studies being conducted on this valuable marine resource. This paper highlights the abundant cetacean community sighted in the Nigerian coastal waters and the respective importance of this area as a prime coastal habitat for these mammals. The secondary objective was the evaluation of this resource and development of appropriate management policies. Opportunistic data was collected on board six different marine vessels belonging to some international oil companies (IOC) in Nigeria, whose primary objective was to conduct seismic operations. 8,327 hours and 36 minutes of effort was logged during 2 wet and 3 dry seasons respectively, covering almost 880 km² at a depth range of 10 to 70 m. The total number of individuals recorded was 2199 of which 80% were dolphins and 20% were whales. Out of these, 55.14% was sighted at depth range of 21 – 30 m. This was followed by 30.42% recorded at depth range of 31 - 40 m. The least frequency of 0.75 % was recorded at depth range of 61- 70m. Five hundred and twenty-five (525) individual whales was recorded, out of which 77.14% were adults and 22.86% were juveniles, while 1674 individual dolphins were recorded with 52.63% juveniles and 47.37% adult. Four species of dolphins were identified. The bottlenose dolphins, *Tursiops truncatus* was the most abundant owing to the large size of the groups observed, followed by common dolphin, *Delphinus delphis*. All species of dolphins identified occurred throughout the sampling months. Two species of whales were identified with the humpback whale (*Megaptera novaeangliae*) predominant and killer whales (*Orcinus orca*) which seem to be present in just a part of a year. Nigerian coastal water is moderately rich in cetacean diversity, which is currently underreported due to limited research.

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INTRODUCTION

Cetaceans are marine mammals that are primarily ocean-dwelling and migratory in nature. (Jefferson et al., 1993). They play a significant role in the balance of the marine

ecosystem where they represent the top predators and the most important species within the marine ecosystem. Cetaceans are divided into two suborders: Mysticeti (baleen whales) and Odontoceti (toothed whales,

which include dolphins and porpoises). The toothed whales use their teeth for catching fish, squid or other marine life that they then swallow whole (Rice, 1998). Baleen whales do not have teeth, but have plates made of keratin that act as a giant filter, straining small animals from the seawater. Not all Mysticeti feed on plankton: the larger whales tend to eat small schooling fish, such as herrings and sardines. One species of Mysticeti, the Gray Whale (*Eschrichtius robustus*), is a benthic feeder, primarily eating sea floor crustaceans (Rice 1998). These marine mammals spend their entire lives in the water and most of the times (>90% for most species) entirely submerged below the surface, when at surface, cetaceans bodies are almost entirely below the water surface, with only one blowhole exposed to allow breathing. This makes cetaceans more difficult to locate visually, (Robinson et al., 2007).

Cetaceans have low reproductive rates with only one calf being born at a time and a long time between calving. The smaller cetaceans such as the porpoises can have a calf every year but in other larger species it may be as long as four years before the next calf is born. Cetaceans are the only mammal other than humans known to have a post-reproductive period when ovulation stops and this has only been observed in a few species. This low reproductive rate is offset by the fact that they are generally long lived and can therefore produce many calves in one lifetime. The average life span of a cetacean ranges from 20 to 40 years with some species being considered old when they are 15 compared to others which can live for 80 years.

Defining geographical ranges and distribution limits for highly mobile marine species such as cetaceans is intrinsically difficult. Nevertheless, many studies have shown that the distribution of cetaceans (especially in relation to foraging areas) is linked to environmental features, both physiographic (e.g. water depth and oceanographic (such as temperature and chlorophyll-a (chl-a)

concentrations) at various scales (Baumgartner et al., 2001; Murase et al., 2002; Tynan et al., 2005; Marubini et al., 2009; Scott et al., 2010). Such relationships may be either direct or indirect. Thus, temperature may have direct and indirect effects on cetacean distribution, for example through its effects on the energetic costs of thermoregulation (MacLeod et al., 2009) and on the distribution of fish, cephalopod and zooplankton prey (Murase et al., 2002; Tynan et al., 2005). As evident from recent interest in defining characteristics of Essential Fish Habitat (Valavanis, 2008), the distributors fish and cephalopods have been found to be related to numerous oceanographic and environmental features, including depth (Gil de Sola, 1993), upwelling (Guerra, 1992; Rubi'n, 1997) and fronts, which create hotspots of primary and secondary production (Rubi'n, 1994). The horizontal and vertical mobility of the prey of cetaceans, combined with temporal variability, make it difficult to predict habitat use of cetaceans over small spatial and temporal scales. In general, it is easier to measure environmental parameters accurately than fine-scale prey distribution. According to Torres et al. (2008), environmental parameters generate better models of cetacean habitat preferences due to the relative ease of accurately measuring them at an appropriate scale. Understanding the relationships between cetacean distributor and environmental factors is necessary to identify cetacean habitat requirements, to predict their distribution and provide insights into their feeding habits. In turn, this provides valuable information to underpin conservation measures directed at cetaceans, for example identifying areas suitable for designation as Special Areas of Conservation. In addition, implementation of Ecosystem Approach to Fisheries Management (EAFM) requires collection of data on the status of all ecosystem components, including top predators. There had been paucity of

information about marine mammal species inhabiting the coastal waters of Nigeria, and until recently most information was based on historical catches of large whales in the gulf of Guinea (Gideon and Williams, 2014). Nigeria like most oil producing countries in the region has received increasing focus from offshore industry, and some companies have engaged Marine Mammal Observers (MMOs) during geophysical seismic surveys along Nigerian coast. While marine mammals observers are primarily onboard to mitigate against any potentially adverse impacts on marine fauna, the use of trained indigenous marine biologists has also provided an invaluable opportunity to collect scientific data which was almost non-existent (Olakunle and Myade, 2014). Dedicated scientific surveys had been moderately carried out in countries like Côte d'Ivoire, Ghana, Togo and Benin, Gabon & Cameroun with the exclusion of Nigeria, leaving the nation with little or no scientific information that can enhance policies formulation. This has created a knowledge or information gap which this study tends to bridge. This publication is to document the different species of marine mammals sighted within the Nigerian coastal waters for the purpose of monitoring the population dynamics so as to scientifically determine possible threats to this invaluable marine resource.

MATERIALS AND METHODS

Study Area

The survey covers about 800 km² located in the bight of Bonny (3°50' N & 70°10' E to 4° 50'N & 80° 40' E) in the oil rich south-south region of the Niger delta area of Nigeria. The site is delineated OML (oil mining license). It consists of OML 67, 68, 69 and 70 (Figure 3).

Survey

Technique

Opportunistic data was collected on

board six different marine vessels whose primary objective was to collect seismic data. The overall observation effort was 8,327 hours 36 minutes accomplished over a period of 26 months (Nov.2007-Dec.2009) covering 800 km². The presences of cetaceans were sought for before a survey line was started, and the start was delayed by at least 20 minutes if cetaceans are within 500 metres (mitigation zone). Two experienced cetacean observers worked as onboard observers throughout the survey from the highest vantage points aboard (14.5m a.w.l.), following standardised protocols and data collection methods. Data were collected throughout daylight hours. During marine mammal "search mode," the observers scanned 360° around the vessel with the naked eye and with binoculars. Scans focused on the area within 1 km of the air gun array (situated 180 or 340 m astern of the vessel) and on the 180° sector ahead of the ship in order to detect animals before they entered the 500 m exclusion zone around the air gun array.

Photographs were taken at the maximum of individuals possible and dorsal fins for individual recognition and confirmation of group size and group composition, with digital cameras equipped with 75-300 mm zoom lenses. Surveys were only undertaken in sea states of Beaufort wind scale of 4 or more nautical miles in visibility to ensure that few or no cetaceans present at the surface were missed. However, any cetaceans not at the surface were likely to be missed. While this bias will have relatively little impact on observations of surface-dwelling cetaceans, it is likely to lead to an under-recording of deep and long diving species, hence a correction factor of 1.5 for sighting per unit effort (SPUE) was used. (adapted from Kawamuro et al., 1977; Anglis et al., 2007).

Species were identified through Photo-identification method which is the utilisation of computer-assisted matching software for the identification of known species (Morten,

2000). The species, school size and composition were recorded for each encounter. School sizes were defined as small (< 30), medium (31-60) and large (> 60). In order to have a value of occurrence of cetaceans relative to the sampling effort (hours) a number of sightings per unit of effort (SPUE), expressed as the number of sightings per hour of search effort at sea was calculated. Time (hours) was used as the unit

of effort rather than distance. Marine mammal monitoring took place between 06.00hr to 18.00 GMT.

Statistical analysis

Information from JNCC record of Sighting forms were analyzed using descriptive statistics, correlation and Analysis of variance (ANOVA) at $p=0.05$.



Figure 3: Map of study site.

RESULTS

Population structure and Sightings per unit effort (SPUE) in relation to various water depth ranges (10 m interval) was presented in Tables 1 and 2 for whales and dolphins respectively. Records of sighting showed that animal groups consist of adults and calves (juveniles) both for the whales and dolphins. Two hundred and seventy-seven (277) sightings comprising of 189 (68%) sightings of whales and 94 (32%) sightings for dolphins was recorded, whales recorded more adults than juveniles while the adult dolphins were less in number than the juveniles (Figure 2). Sighting per unit effort (SPUE) value of 0.06 ind./hr was estimated for whales and 0.20 ind./hr (see Tables 1 &2).

Whales

Two species of whales were identified with the humpback whale (*Megaptera novaeangliae*) as the dominant specie, killer whales (*Orcinus orca*) which was sighted once seem to be present in just a part of a year. Total number of individual whales (adults and calves) sighted within the period is

525 comprising of 405 adults (77.14%) and

120 juveniles (22.86%). Four hundred and eighty-five whales (92.38%) were sighted between 10 and 40meters. The highest number of 219 (41.71 %) of individuals sighted was recorded at the depth range of 21 -30 m, this is closely followed by depth range of 31 - 40 m with a total of 184 (35.05 %) of individuals sighted. The least number was recorded at the depth range of 51 - 60 m with only one (0.19%) individual (Table 1).

Whales were found to be more abundant between the months of June to November. This pattern was consistent, though the number of individual sightings dwindled the following year (Figure 2).

Dolphins

Four species of dolphins were identified. The pantropical spotted dolphin (*Stenella attenuata*), bottlenose dolphin (*Tursiops truncatus*), Common dolphin (*Delphinus delphis*) and hump-backed dolphin (*Sousa teuszii*). The bottlenose dolphins *Tursiops truncatus*, being the most abundant owing to the large size of the groups observed, followed by *Stenella attenuata*, the least abundant was *Sousa teuszii*. All these species were sighted all year round with oscillations in peak period which follows no definite pattern throughout the sampling period (Figure 2). Total number of individual dolphins (adults and calves) sighted within the period is 1674 comprising of 793 adults (47.37%) and 881 juveniles (52.63%). One thousand and eight individuals (60.21%) were sighted at the water depth of 21 and 30meters followed by 443 (26.46 %) of individuals sighted at the depth range of 31 - 40 m. The least number was recorded at the depth range of 61 - 70 m with only 8 (0.48%) individuals. Calves were observed to stay close to their mothers and occasionally "bow ride" beside her in order to keep up with the adults. However they do not join their mothers when they dive deeply to feed and remain with the others in the group at this time.

Table 1: SPUE of Whales in Relation to Depth.

Depth range	Adult	Calves	Total	SPUE
10-20	44	38	82	0.01
21-30	155	29	184	0.02
31-40	183	36	219	0.03
41-50	12	11	23	0.003
51-60	1	0	1	0.0001
61-70	11	6	17	0.002
Total	405	120	525	0.06

Table 2: SPUE of Dolphins in Relation to Depth.

Depth range	Adult	Calves	Total	SPUE
10-20	60	66	126	0.02
21-30	501	507	1,008	0.12
31-40	162	281	443	0.05
41-50	36	15	51	0.006
51-60	29	9	38	0.005
61-70	5	3	8	0.001
Total	793	881	1,674	0.20

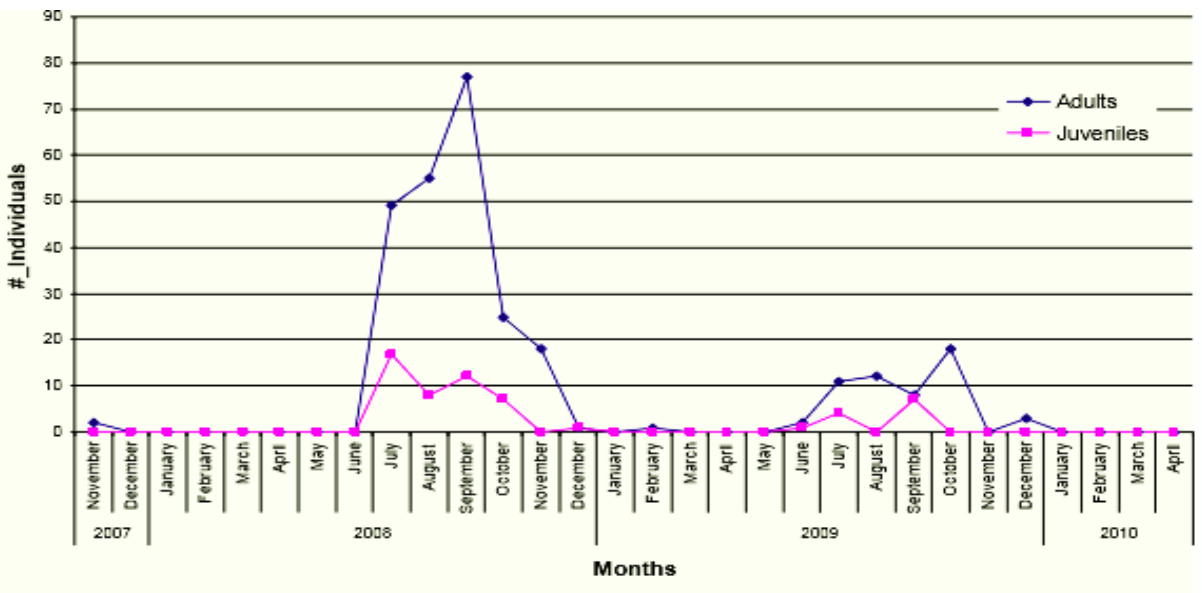


Figure 1: Total number of adult and juvenile whales recorded.

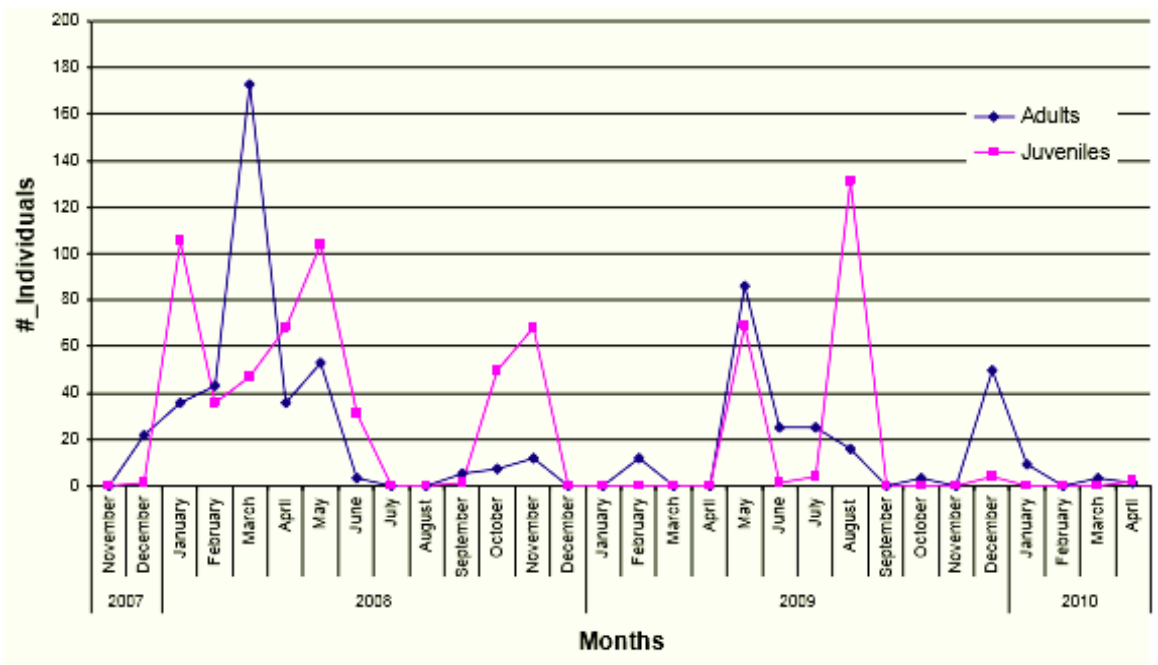


Figure 2: Total number of adult and juvenile dolphins recorded.

DISCUSSION

Free-ranging whales and dolphins, which are visible above water for only short periods, are notoriously challenging research subjects. The lack of precision in most cetacean research is best exemplified by population estimates, which can vary over orders of magnitude for the same cetacean population, i.e. we cannot even accurately count most populations of cetaceans with any degree of confidence. Nevertheless, data obtained as these are potentially informative and could help curb the growing threat to marine mammals in our oceans and provide some respite for some endangered cetaceans species.

Humpback whales (*Megaptera novaeangliae*) feed in Antarctic waters during the austral summer and migrate to their breeding grounds in subtropical and tropical waters during the winter; this explains the reason for their abundance between the

months June and November of the year. Historical whaling records also suggest that the bight of Bonny, Nigeria, located in the Gulf of Guinea, serves as a possible breeding ground for this animal. Of the 189 groups encountered, mother/calf pairs made up a large proportion (68%). Given the high percentage of mother/calf pairs, sometimes with very young calves, and the low frequency of mating activity, the waters of Nigeria may be primarily serving as a calving and nursing or resting area for *Megaptera novaeangliae*. Opportunistic sightings events (mentioned by fishermen) suggested present-day abundance of humpback whales in Nigerian coastal waters. Two stranding of this specie have also been recorded between 1999 and 2006 in the Lagos bar beach (pers. comm. A. Williams, 2009). This confirms the assertion that this species frequents Nigerian coastal waters.

Humpback whales in Nigerian waters

are actively migrating. Any disturbance could affect these animals. Whales require personal space, and harassment may severely stress them-possibly causing accidents both for humans and whales if the whales feel threatened. This is especially important in the case of the adults with calves, which may be either resting or sucking. (Department of Environment and Heritage, 2012). Whales were more likely to avoid a boat moving within 100 metres (Stamation et al., 2010). Similar studies conducted by researchers in New Caledonia showed that whales significantly increased their drive time and changed their direction when boats were within 1000 metres (Schaffer et al., 2009; Scheidat et al., 2004). It implies that when cetaceans are disturbed they move away, resulting in decreased abundance, this possibly explained for the decrease in the sighting rate of whales in the second year of the survey.

The four species of dolphins identified; the pantropical spotted dolphin (*Stenella attenuata*), bottlenose dolphin (*Tursiops truncatus*), Common dolphin (*Delphinus delphis*) and hump-backed dolphin (*Sousa teuszii*) are seen year round and may be considered permanent members of the cetacean community found in Nigeria coastal waters.

The spatial distribution of cetaceans is influenced by the distribution of fish, cephalopod and zooplankton prey (Murase et al., 2002; Tynan et al., 2005). This is evident from the catch composition of the fisher folks around the survey area. Common dolphins feed on small schooling fish as well as squid and crustaceans, and prey preference varies with habitat and location (Pusineri et al. 2007; Perrin 2002). Cetaceans identified appear to take advantage of these several prey species

found around the surveyed area where artisanal fishery is intensely active, though there was no study of stomach content. The result shows that Nigerian waters shelter an abundant and diverse population of cetaceans. These preliminary results also corroborate a trend of cetaceans' occurrence and distribution previously obtained by author off-Lagos coast. (Gideon and Williams, 2014). The result obtained might not completely capture all the species as with all cetacean surveys, positive identification proved difficult at times. However, with continuous trainings identification skill could be improved. Further data collection in the future surveys may add to the present knowledge on cetaceans' population frequenting Nigerian coastal waters. This will enable the relevant authorities to take appropriate policy decisions. Therefore, additional surveys are required to provide an accurate knowledge of each species status promoting long term monitoring for the conservation of the cetacean population.

Conclusion

The six cetacean species recorded during this survey may not be a complete representation of all the species present in Nigerian coastal waters. Nevertheless, the results confirm a similar trend of occurrence and distribution previously documented along the gulf of Guinea. The result shows that Nigerian waters shelter an abundant and diverse population of marine mammals. Therefore, dedicated surveys are required from time to time to provide an accurate data of the species diversity and status for long term monitoring and consequently for conservation and tourism benefits.

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