Fisheries and Aquaculture Journal
ISSN: 2150-3508

Ayissi and Jiofack, Fish Aquac J 2014, 5:3
DOI: 10.4172/ 2150-3508.1000099

Research Article Open Access

Impact Assessment on By-catch Artisanal Fisheries: Sea Turtles and Mammals in Cameroon, West Africa

Ayissi I[1,2,3,4,*] **and Jiofack TJE**[5]

[1]*University of Abdelmalek Essaâdi, Department of Biology, Faculty of Science, Tetouan 2121, Morocco*

[2]*Cameroon Marine Biology Association, Morocco*

[3]*Specialized Research Center for Marine Ecosystems in Kribi-Cameroon, Cameroon*

[4]*Institute of Fisheries and Aquatic Sciences (ISH) at Yabassi, University of Douala, PO Box 2701, Douala, Cameroon*

[5] *Sub-Regional School and Postdoctoral Water Development and Integrated Management of Forests and Tropical Territories, Kinshasa, RDC, Congo*

[*]**Corresponding author:** Ayissi I, University of Abdelmalek Essaâdi, Department of Biology, Faculty of Science, Tetouan 2121, Morocco, Tel: +237 97350175; E-mail: isidoreayissi@gmail.com

Received date: January 20, 2014; **Accepted date:** July 09, 2014; **Published date:** July 16, 2014

Abstract

The by-catch assessment has been carried out along Cameroon coastline to map artisanal fishing effort and quantify impact of by-catch on sea turtles and marine mammals during three months from June to September 2011 and specific objectives include:

- To interview fishermen in various fishing villages or ports in Cameroon regarding fishing effort and catch.

- To estimate fishing gears used in these fishing ports.

- To evaluate impacts of by-catch on marine mammals and sea turtles.

In total 30 fishing ports were been planned but 23 were covered with 932 files in total (245 long forms and 685 short forms). In total we have 4121boats (none motorized and motorized) and the common gears used are gillnet and surround seine.

The results reveal that, yearly around 1228 turtles with back (green, hawksbill and olive) were caught and 13 Leatherback; most not intentionally. But in Sandje port we noted the intentional catch by local fishermen with around 400 individuals per year for international commercial uses. These numbers are low according to certain data on sea turtles surveys along Cameroon coast. About cetaceans and manatee we had the following data 97 and 292 respectively for each group, but most manatees are caught intentionally for bush meat trade. The survey was limited in time and lack of baseline information on the issue but in future it could be good to involve more permanent data collectors and scientific observers. These results must be feedback to official services for good monitoring of marine faunal and their ecosystem.

Keywords: Artisanal fisheries; By-catch; Cameroon; Dolphin; Mantee; Sea turtles; Whale

Introduction

By-catch is a common threat to marine fauna such as mammals and reptiles. Recent analysis has shown that around 300,000 whales, dolphins and porpoises die each year (about one each two minutes), WWF (In Review). Our minimum by-catch estimate (~1000 loggerheads yr^{-1}) for two small-scale [artisanal] fleets [in Baja California] rivals that of North Pacific industrial-scale fisheries.

The issue of fisheries by-catch of sea turtles has been largely focused on the high-seas industrial fisheries in Alfaro Shigueto et al. [1]. By-catch in artisanal fisheries has now been recognized as a major threat Alfaro Shigueto. Nevertheless, small scale artisanal fisheries are distributed throughout the world in areas that overlap important sea turtles habitats, and are therefore significant challenge for sea turtles conservation efforts Alfaro Shigueto et al. [1].

In some areas such as Cameroon there is no information available about this problem. The few data available are from Ayissi and Moore [2,3]. Fishing is one of the most important occupations of rural population; it contributes more than half of animal protein consumed in Cameroon. This activity has undoubtedly impact on marine faunal, particularly sea turtles, manatees and cetaceans.

Goals and Objectives

The goal of this assessment is to map artisanal fishing effort and catch of sea turtles and marine mammals in a data-deficient country. Specific objectives include:

- To develop a sampling protocol specific to Cameroon that will be a representative sample of fishing in that country.

-To conduct a qualitative and quantitative analysis through questionnaires and personal interview of local fishermen in respect to fishing methods, fish catch and marketing.

- To assess the impacts of by-catch on marine mammals.

Methods

Site description

The coastal zone of Cameroon stretches over 402 km [4], from the Nigerian border in north (Akwayafe river, latitude 4°40'N) to the Equatorial Guinean border in the South (Campo river, latitude 2°20'N). In terms of longitude, it is located between 8°15'E and 9°30'E) (Figure 1).

The continental shelf is about 10,600 km^2 and gradually descends through 30, 50 and 100 m depths [5,6]. The rainfall is ordinary heavy on the coast with average at 3,000-4,000 mm with the peat of 10,160mm yearly at Debunscha around Mount Cameroon.

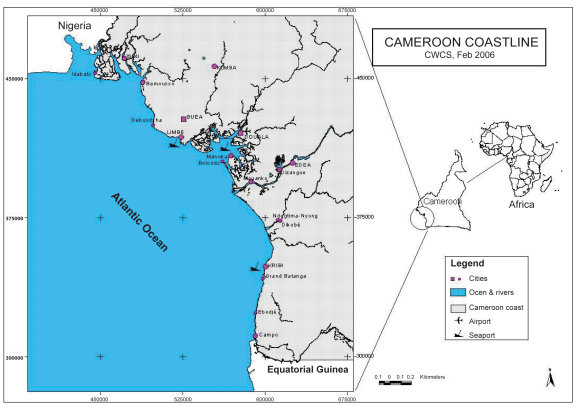

Figure 1: Map of Cameroon coastline (CWCS 2006)

The temperature is always high with average at 25°C. The main characteristic of the hydrology in the Cameroon coast is the permanent existence of a warm, low salinity surface layer cold, high salinity bottom layer [7]. The warm surface layer is 20-30 m thick and is separated from the bottom layer by a permanent thermocline whose position fluctuates with season and location, considered effect of current systems, the rainfall as well as the important water discharge from numerous coastal rivers.

Faunal

Sea turtles: The occurrence of sea turtles was first reported in Cameroon in 1902 by Tornier, Loveridge and Williams [8,9] confirmed the presence of certain species. Four species of sea turtles are common along the Cameroon coast: Leatherback turtle (*Dermochelys coriacea*), Green turtle (*Chelonia mydas*), Olive ridley (*Lepidochelys olivacea*) and Hawsksbill (*Eretmochelys imbricata*). Two of them Leatherback and Olive ridley are nesting along sanding beaches of this coast from September to April. Green turtle and Hawskbill are common in foraging habitats on rocky and on mangroves areas to feed algaes and crustaceans; the origin of these two species is unknown because they are not breeding in this zone. The nesting zones are the southern part from Campo to Kribi, the coast along Douala-Edea wildlife reserve and the beach from Limbe to Idinaua. The foraging are the rocky sites and mangrove areas particularly in Douala estuary and Bakassi bay near Nigeria.

Manatee: The West African Manatee (*Trichechus senegalensis*) is common in all Cameroon coast in shallow and fresh water from Ntem River in southern part to Bakassi area in northern part. The specie occur particularly in the estuaries sites of main coastal Rivers as Ntem, Nyong, Sanaga, Dibamba, Wouri, Moungo, Akpa-yafe, Ndian, Manyu, Cross River and Lake Ossa which can be considered as sanctuary of Manatee. The specie is common in rainy season. Since several years the manatee is faced to many threats.

Continuing uncontrolled and likely unsustainable hunting must be considered as the major threat to the population. Despite legal protection, the manatee is still-hunted throughout its range for meat leather and oil by harpoon, trap, net, and snag line. Oil is used for medicinal and cosmetics purposes. In some areas as in Sanaga estuary hunting is highly traditional and ritualised, and the meat is consumed locally and other areas hunting are opportunistic. The bush meat trade is also the common threat because the manatee is common in local market hunted by local fishers.

Whales and dolphins: The existence of Whales and Dolphins along Cameroon coast is known, but the species distribution is unknown. The few information available are from observation to death of bycacth and collisions with ships in feeding ground, as in September 2007 and January 2008 two whales fall on Lolabe and Mombo beaches respectively. In 2003 one unknown Dolphin falls on the beach in Yoyo. Ayissi et al. reported the presence of Sousa teuszii which is endemic specie on Cameroon coast [10]. Those species are facing of many threats such as bycacth (gillnets, longlines and trawlers), habitats destruction by pollution, noise, seismic surveys by oil companies and lastly strucking by ships.

Birds: Ayissi confirmed the presence of 302 species of birds on the only coast of Kribi-Campo which according to the criteria of International Birdlife is classified like priority area for the conservation of the birds [10]. A preliminary study with the current of the months of January and March 2007, made it possible to on the whole consider the avifauna watery at a non-exhaustive 65 palearctic and afro-tropical species with a total of 18,326 individuals for 300 species.

Reptiles: With regard to the reptiles, one meets the crocodiles, in particular the crocodile with long muzzle particularly driven out for his skin and his flesh; other species of crocodiles meet in the site of Kribi - Campo are Crocodilus cataphractus, *C. niloticus* and Ostealaemus tetrapis all classified like species in danger (IUCN). With its 122 species of reptiles, the zone of Kribi-Campo is the zone richest in reptiles in the world. The saurians are represented by Rampholeum spectrum, *Chameleo quadricornis* and *C. montium*; this last species is endemic with the Mount Cameroon. The ophidiens are represented by 150 species, among which *Pithon sebae, Boulangerina annulata, Bitis gabonica,* and *Dendroaspis viridis Ayissi* [10].

Fishs and amphibians: There are 27 families and 232 species of which 18 are of major economic importance, especially *Heterotis niloticus* and *Clarias spp. Chrysichthys spp. Mormyrus spp, Synodontis spp, Labeo sp, Brycinus macrolepidotu, Lates niltoticus.* There are over 200 species of which 75 are endemic to at least the coastal forest. In the Edea region, giant frogs are found: the largest frog in the world Conrua goliath which can measure up to 30 cm and weigh more than 2.4 kg. This species is also found in the Kribi-Campo home alone more than 80 species of amphibians.

Flora

Mangroves: In Cameroon, the mangrove swamps are located in the Gulf of Guinea. They account for 30% of the 400 km coast. To Akwa-Yafe at the border with Nigeria in Rio Ntem at the border with Equatorial Guinea. They cover a total surface area of approximately 400,000 hectares (250,000 ha before the retrocession by Nigeria of the peninsula of Bakassi in Cameroon). They were left again according to three great units.

- The mangrove swamp of the Rio Del Rey who is in the area of the Western South with mouth of the rivers Akwa-Yafé, Ndian and Mémé. It has a surface of 218,000 hectares, is the larger second mangrove swamp in West Africa, one of richest in the world leaves its biodiversity.

- The mangrove swamp of the estuary of the Cameroon of 180,000 ha includes the mouths of the Rivers Moungo, Wouri, Dibamba, Sanaga and Nyong towards the South which mixes with the largest metropolis of the Douala country, which assumes the role of Economic capital through a strong establishment of industries of transformation and agro industries.

- The last block with 2000 ha, is located at the estuary of Ntem and some small islands with the mouths of the rivers Bouandjo and Lobe. It is the least important block but which under goes a strong anthropic pressure since the advent of the sea port out of deep waters.

The Cameroonian biocenose of the mangrove swamp is very diverse on the morphological level and as regards the floristic and faunal composition the flora is primarily made mangroves of the *Rhizophora* type. There are 6 indigenous species *(Rhizophora racemosa, R. harrisonii, R. mangle (Rhizophoraceae); Avicennia germinans (Avicenniaceae); Laguncularia racemosa, Conocarpus erectus (Combretaceae);* and an introduced species *Nypa fruticans* (Araceae); that is to say 7 species belonging to 4 large families of plants. Other species are associated of which most important are : *Drepanocarpus lunatus, Dalbergia ecastaphylum, Paspalum vaginatum, Hibiscus tilaceus, Phoenix reclinata, Acrostichumaureum, Pandanus candelabrun, Sesuvium portulacastrum, Alchornea cordifolia, Annonaglaba, Elaeis guinensis, Athocleista vogeli, Bambusa vulgarus, Coco nucifera, Eremospathawendlandiana, Guiborutia demensei, Raphia palma-pinus*, etc. [11,12].

Coastal forests:

Littoral forests: They are formations of low and average altitudes seasonally flooded with species like *Lophira alata (Azobé), Coula edulis (Noisettes), Saccoglottis gabonensis (Bidou)*, Approximately 20 types of vegetation are identified at the level of the Kribi-Campo coast. This coast only shelters with them more than 1500 plant species divided into 640 kinds and 141 families.

Mountain forests: They are formations of altitudes on the Mt. Cameroon and the bordering formations whereas agro-forests: They result from the expansion of agricultural processing industries of the palm plantations, rubber and plantain giving the aspect of raised savannas.

Phytoplankton: They are macrophytes phanerogames, the algae abundant are formed there by the species fixed on rocks. More than 29 species of algae and 170 species of sea plants were identified in the Kribi-Campo zone.

Data's collection

This survey has been carried out by seven persons in various domains, four technician of the Ministry of fishing and livestock's, one Master's student from university of Yaounde I, one member the of National Association of sea turtle "Kuda à Tube", one conservationist biologist (Team Leader) and various guides and interpreters on the field. Three trainings were held, one per area because of the large covering distance and files were being translated in French for certain data collectors who were not able to speech English. To ensure that the collectors have understood the techniques of this survey, the Team Leader spend few days with them at the field. The sites were not covered at the same time, we started in the south Province from Campo to Lokoundjé, secondly the Douala and Tiko areas and at last in the Limbe zone. Most data collections were conducted by local guides because most fishermen were foreigners and had a poor understanding of neither French nor English and majority of the fish species and gears names were only given in local languages. In each port, we had the obligation to contact local authorities particularly from the fishing Ministry and local chiefs to explain to them the meaning of this survey.

Sampling protocol

Initially 30 ports were sampled in Cameroon (4 large and 26 small) according to the fact that in previous studies there are around 300 artisanal ports along this coast. The distribution of these sites was along the Cameroon coast landscape. The survey was suppose to be done for three months but due to certain difficulties such as rainfall, the process of disbursement and illiteracy of most fishermen it took around seven months.

Rapid by-catch survey

The survey was conducted from November 2007 to march 2008 from the Southern part of the Cameroon coast at River Ntem to the North part around Bakassi peninsula using questionnaires. The data collectors were supervised by one Biologist as Team Leader. Fishermen were selected at random and the survey was conducted particularly in the afternoon and on Sundays when fishermen were free in their homes but some were contacted at the landing site during their arrival from the fishing trip. In certain areas where data was available, we collected certain information from Government Official Service at The Ministry of Fisheries and Livestock's which the manager of fishing activities is.

The data collection took various hours to cover each port according to the size, some took few hours but others more than a week particularly in the big port. The fact that most fishermen were illiterate enabled us to use guides in certain areas to interrelate with fishermen in local languages particularly for foreign fishermen as Nigerians.

About the port description, this task was done by the Team Supervisor. When additional information was needed such the destination of fish or organization of fishing activity inside the port, the head of the village or local fisheries officer guided us to have the right information. The total number of boat and active boats was gotten from information gathered by local services.

Data analysis

The time series data were analysed using mainly simple descriptive statistics especially totals, mean, percentages, tables and charts; and inferential statistics especially correlation analysis.

Results

Landing sites characteristics

For 30 ports planned during this survey 23 were been covered (76.66%) due to the instability in the Nigerian border which host conflict in the Bakassi peninsula and one of our data collector from Nigerians (local fishermen) were out to the Cameroon during data collection. In total 3125 boats were counted with 1445 none motorize (46.24%) and 1680 motorized (53.76%). These numbers are from official documents from local fisheries services and do not reflect the reality because most boats are not registered in official documents and in certain areas, those information are not available. The landing site characteristics are reflected in the Cameroon coastline landscape which can be divided in four zones following sandy and rocky area from Campo to River Nyong, Sandy and muddy area from River Nyong to River Moungo, Rocky and sandy area from Tiko port to Idenau and lastly sandy and muddy area from Sandje to Bakassi peninsula. This geostructure has important influence on the type of gears, boats and engines used, on target species and by-catch species.

Boats and engine characteristics

The boat sizes vary from small boats (4-8 m long), large boats (8-12 m long) and extra-large boats (12-22 m long). This variation is according to the type of gear and engine. The smaller size and larger size are commonly used for Gillnet, Long line, Trawl, Beach seine and Hook line; therefore the extra-large are commonly used for surrounding seine, The distribution of engine size is also according to the type of boats, the smaller size and larger size commonly used 9.9, 15, 20 and 25 HP, but extra-large only use 40 HP to cover long distances and heavy load charge with more than 20 fishermen per boat. The average size of engine varies from 10 HP to 21.33 HP but most are between15HP.

Fishing gears distribution and target species

The Gillnet, Long line, Beach seine, Hook line are commonly used on sandy and rocky areas in Kribi, Tiko and Limbe areas but the Gillnet, Long line, Beach seine, Hook line, Trawl and Surround seine in sandy and muddy areas around Douala because of the abundance of species in Clupeidae and Peneidae families. There are more than 21 family species commonly caught on Cameroon coast, the main on caught are species in families of Clupeidae, Sciaenidae and Ariidae.

Fishing patterns

Most fishermen along Cameroon coastline are always involved in the activity, mostly from Monday to Saturday, on Sunday, they staying in their houses for cultural matters or to repair boats and nets. The peak of their activity is always with the area. The highest fishing effort is the dry season in Kribi and Douala areas but in Tiko and Limbe areas is the rainy season. The fact in Kribi and Douala areas, certain fishermen are Cameroonians and they are involve in other activities such as farming, while in Tiko and Limbe areas, most are essentially foreigners and commonly involved in fishing activities along the week (Figures 2-4).

Number of fishing trips per month

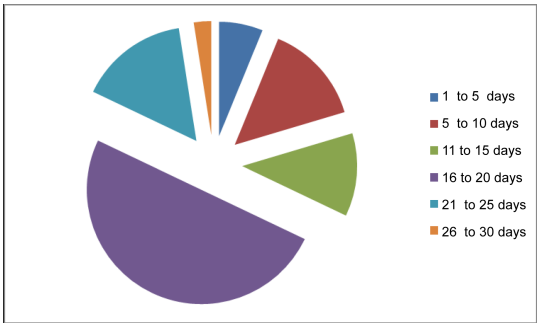

Figure 2: The distribution of the number of fishing days per month along the Cameroon Coastline

Fishing seasonal patterns

Figure 3: The seasonal distribution of fishing trips along the Cameroon Coastline

Duration of fishing trips

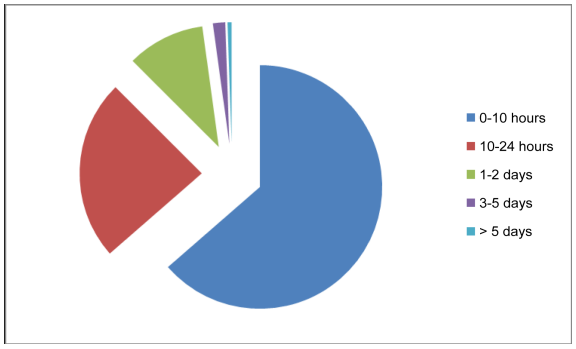

Figure 4: The timely distribution of fishing trips along Cameroon coastline

Non target species

In total we have 1241 turtles caught per year with 13 leatherback and 1228 are green, hawksbill and olive species. Turtle's meat is common in feeding habits of coastal people in Cameroon, but their catch is in majority not international. However in certain cases, these reptiles are caught internationally as in Sandje where results present 400 individuals per year by traditional fishermen.

Cetaceans are commonly caught by fishermen on the Cameroon coastline particularly in the Douala area around the Wouri estuary. But, until now, results reveal 97 individuals yearly. Most species were caught by gillnet and fishermen were not able to identify species accurately. This total may have been under estimated because most fishermen know that the caught of these species are allowed and they are afraid to give right information.

Manatee meat is common in most restaurants in Cameroon, particularly in the Sanaga estuary which can be considered as the sanctuary of this specy. This specy is either caught intentionally by nets, harpoon, trap, poison and none intentionally by gillnet around the lagoons and rovers estuaries in the Douala area.

Discussion and Recommendations

In general, this survey gave us the opportunity to collect baseline information on by-catch in Cameroon. But, it was difficult to convince certain fishermen particularly foreigners whose were afraid because most of by-catch species are not allowed by the law. In future it shall be good in each port to conduct this survey during the peak of activity, when there are many fishermen on the site and to have permanent collectors in each area that can make direct observation and involve in fishing trips for mapping. And then it shall be good before carrying this type of work to make a general census of all ports which can help to make good sampling.

Gillnet and Surround seine are common gears used in Cameroon; most national boats are none motorized while foreigners are quite organized in semi industrial companies with motorized boats. Gillnet, longline, hookline, beach seine are commonly used around sandy and rocky areas while surround seine is common in muddy areas particularly the fishing of species in Clupeidae families. It was difficult to have the exact number of boats because most are not registered in official documents, the survey was carried out at the low peak of fishing effort and also fishermen are quite mobile.

It was not easy to identify species because most fishermen are illiterates, as for the sea turtles they didn't easily identify green, hawksbill or olive, all of them were called turtle with back and leatherback turtle without back. Globally Cetaceans were rarely captured, and mortality was low essentially for whales but this study has, however, provided so far information.

- This assessment was useful to have preliminary information on by-catch in country; this survey was relevant and it could be good for the results and feedback to the Government service for instauration of scientific observers along Cameroon coast;

- In future, for good continuation of this survey it shall be good to plan activities during the fishing period and involve permanent data collectors for direct observation;

- And lastly it shall be good to involve more fishermen data collectors and to be involved in fishing trip.

Conclusion

The Impact Assessment on By-catch Artisanal Fisheries: Sea Turtles and Mammals in Cameroon, West Africa study gives us a lot of information's about the characteristics of artisanal fisheries and by catch along Cameroon coastline. This survey provides evidence of marine mammals and sea turtles by-catch in artisanal fisheries in Cameroon. But the study constitutes the basely information in the country and could be improve in future with other studies in long period according opportunity of funds available. Also other studies could be carrying out including industrial fisheries to compile more information in the thematic along the country.

Acknowledgements

Thanks are due to all who were involved in this survey particularly Dr. Minbang from Ministry of Fisheries and Livestock's in Provincial Delegation of Littoral, our data collectors Bebea Clotilde, Nking Gwendoline, Afana Dieudonne, Nga, Jiofack Bernadin, Romarius, all local Chiefs of fishing and fishers we visited. We can also thank Drs: Rebecca, Jeff Moore, Tara Cox,Sarah and Larry B. Crowder from Marine Lab in Duke University in North Carolina for the grants.

References

1. Shigueto JA, Mangel JC, Seminoff JA, Dutton PH (2008) Demography of loggerhead turtles Caretta caretta in the southeasthern Pacific Ocean: fisheries-based observations and implications for management. Endangered Species Research 5: 129-135.
2. Ayissi I, Angoni H, Amougou, et Fretey J (2007) Preliminary Assessment of the Impact of Artisanal Fishing on Sea Turtles along the Cameroon Coastline (West Africa). USA.
3. Moore JE, Cox TM, Lewison RL, Read AJ, Bjorkland R, et al. (2010) An interview-based approach to assess marine mammal and sea turtle captures in artisanal fisheries. Biological Conservation 143: 795-805.
4. Sayer JA, Harcourt CS, Collins NM (1992) The Conservation atlas of tropical forest Africa. Macmillan Publishing Ltd. London.
5. Morin MK (1989) Le Littoral Camerounais: problèmes morphologiques. Trav Labo Goegr Phys appliquée. National de Gestion de Environnement.
6. Boye M, Baltzer F, Caratini C (1974) Mangrove of the Wouri estuary. Int Symp Of biology and management of mangrove. Honolulu. 435-455.
7. Crosnier (1964) Fonds de pêche le long des côtes de la République Fédérale du Cameroun.
8. Tornier (1902) Die Crocodile Schildkroten und Eidechsen in Kamerun. Zool Jalrb 15: 163-677.
9. Loveridge A, Williams EE (1997) Revision of the African Tortoises and Turtles of the S border Cryptodira. Bull Mus Comp Zool 115: 163-557.
10. Ayissi I, van Waerebeek K, Segniagbeto G (2011) Report on the exploratory survey of cetaceans and their status in Cameroon.
11. Ajonina GN (2008) Inventory and modelling mangrove forest stand dynamics following differentlevels of wood exploitation pressures in the Douala-Edea Atlantic coast of Cameroon Central Africa. Mitteilungen der Abteilungen für Forstliche Biometrie Albert-Ludwigs- Universität Freiburg.
12. Din N (2001) Mangroves du Cameroun: statut écologique et perspectives de gestion durable.