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The Kenya Marine Mammal Network: cetacean research and citizen science

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Abstract

Until recently, the abundance and distribution of marine mammals in Kenya coastal waters was not well understood. Prior to 2011, research was mostly limited to a wide coastal aerial survey in 1996 conducted by the Kenya Wildlife Service, which reported the presence of 8 species of dolphin and whale. In 2011, in order to fill the data gaps, Global Vision International partnered with Watamu Marine Association and Kenya Wildlife Service to set up a multi sector coalition - the Kenya Marine Mammal Network (KMMN), a new platform to collect nationwide data through designated surveys, opportunistic sightings and citizen science. From 2011 – 2018 KMMN efforts have recorded and compiled data on 24 species of marine mammals inshore and offshore, with a total of 1,406 reported sightings, and determined preferred 'hotspots' for inshore (resident and migratory) populations in the Malindi - Watamu Marine Protected Area and Kisite - Mpunguti Marine Protected Area.
KMMN effort and data has helped in increasing public awareness of marine mammals in Kenya and the growth and popularity of dolphin and whale watching, resulting in economic benefits to both the coast tourism industry and to impoverished coastal communities. The KMMN demonstrates the value of a coalition of organizations working together to develop national conservation management strategies for marine mammals, to boost eco-tourism activities and to address the increased anthropological threats in Kenya waters and the Western Indian Ocean. It also highlights the value of data collected through citizen science which brings the public and science closer together, promoting marine mammal research and effective conservation efforts in Kenya.

1. Introduction

Prior to 2011 scant information existed about the population of marine mammals in Kenya waters to enable government organizations, researchers and conservation groups to evaluate species occurrence, distribution, abundance or migration routes. Consequently, little was known about the effect of increasing anthropogenic threats on marine mammals as a result of human population growth along the Kenya coast from 727,844 in 1962 to 3,325,307 people

in 2009 (State of Coast Report for Kenya, 2017) Poverty increase in coastal communities reliant on artisanal fishing as a main livelihood, and an increase in marine pollution were identified as the main threats to marine life. Accidental capture in gill nets and pollution were considered the main cause of marine mammal mortalities (Wamukoya, 1996). Dolphin watching, from an eco-tourism perspective, was recognized as one alternative to the increase in unsustainable fishing activities; however, it can also pose a potential threat to inshore species if not regulated (Wamukoya, 1996) (Perez S, 2017)

The lack of baseline information made it difficult to plan conservation actions for marine mammals in Kenya and an even greater challenge to develop a national marine mammal conservation strategy. Currently, many of the species inhabiting Kenya waters are listed as data deficient by the IUCN due to the lack of information on population abundance, habitat use, genetic diversity and population structure (Hammond, et al., 2012) Moreover, there was a poor public knowledge of marine mammals in Kenya with many Kenyan's perceptions on these animals limited to biblical references. Even though local communities operated dolphin watching excursions in two Kenyan Marine Protected Areas since the mid1990's, it was generally believed by the public that dolphins and whales were not found in Kenya.

The first effort to collect baseline information on marine mammals was carried out by the Kenya Wildlife Service (KWS) in 1996, through their marine aerial survey covering the entire Kenya coast to identify species occurrence, distribution and main threats. Ten years passed from this first study until the start of a new initiative on marine mammal research with the establishment of a marine research program run by Global Vision International (GVI) in 2006. This NGO, with KWS as partners, established the first consistent marine mammal research and conservation program on the south coast of Kenya (based in Shimoni) over 8 consecutive years (2006 to 2014). By 2010, a project led by the marine conservation organization Watamu Marine Association (WMA), also working in partnership with KWS, mirrored GVI marine mammal research activities on the north coast, launching, a north – south coast alliance to extend research and conservation efforts nationwide.

These marine mammal research efforts in Kenya resulted in some scientific publications, focusing mainly on localized surveys on marine mammals' occurrence, distribution, tourism interaction and habitat use (Pérez-Jorge et al 2017) (Pérez-Jorge S. P., 2015) (Pérez-Jorge S. G., 2016), with limited information on the overall distribution along the Kenya coast.

Given that studying cetacean populations, especially in isolated areas, can be costly, time consuming and logistically difficult (Kiszka, 2004) it was considered effective to gather opportunistic information from marine users who regularly access inshore and offshore waters. Opportunistic species data collection from non-scientific vessels and individuals who regularly frequent the sea has been undertaken in many countries throughout the world where either limited scientific research has taken place and/or to bolster data collection from a wider, often multinational area. These marine users typically include artisanal and sports fishermen, divers and other marine tour operators, who would ultimately perform the role of citizen scientists.

This way, in 2011, and in an effort "*to develop a monitoring and research program for cetaceans to collect data on species occurrence, abundance, distribution and movement, useful for the formulation of conservation management strategies*", the Kenya Marine Mammal Network (KMMN) was founded by WMA, GVI, KWS, Kenya Marine and Fisheries Research Institute (KMFRI) and Kenya Association of Sea Anglers (KASA). The network also identified and contacted various Kenyan marine science, research, tourism and

education organizations, including coastal fishing communities. As the organization grew, new organizations joined in, including World Wildlife Fund (WWF Kenya), National Environment Management Authority (NEMA), Wildlife Conservation Society (WCS) and the State Department of Fisheries (SDF). One of the primary aims of the network is to contribute to the conservation of marine mammal species in Kenya, as well as developing activities to maximize marine mammals' potential as an economic resource in an impoverished coastal community environment by developing regulated dolphin and whale watching. The overarching purpose is to increase public awareness from both an educational and tourism perspective contributing to the welfare of dolphins and whales in the face of growing threats. Currently, the network collects regular sightings, reported by fishermen, tour operators and sailing vessels, via the KMMN website, email, mobile phone or WhatsApp group. The network also produced several marine mammal dissemination articles, newsletters, articles in national and African magazines and newspapers and social media.

KMMN promotional poster

In this sense, the KMMN provides a low cost alternative to marine mammal research, contributing to the first consistent data on occurrence and abundance of marine mammals

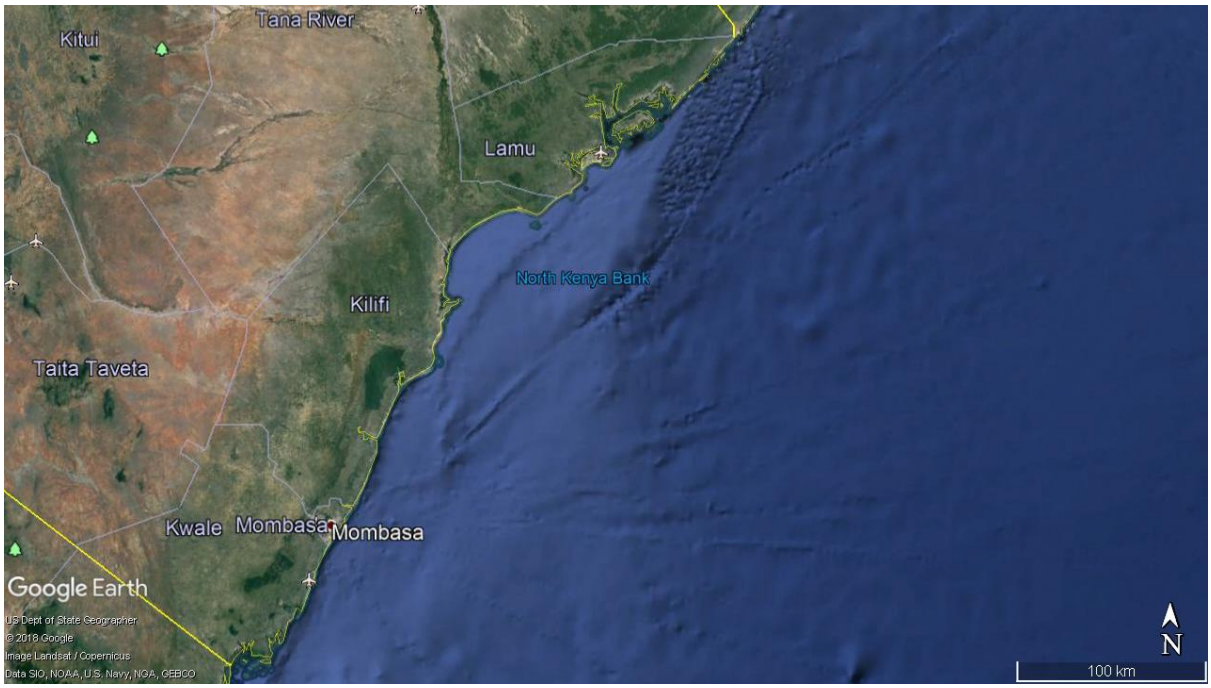
along the Kenya coast and assisting marine mammal conservation and management strategies in Kenya. It identifies areas of "High Importance" for marine mammals and improves local understanding and popularity of these species on a broader spatial and temporal scale. At the same time, the data collected can be used as a baseline for further conservation studies concerning contemporary threats such as fisheries by-catch, loss of habitat, oil and gas seismic surveys, coastal development, overfishing and unregulated whale/dolphin-watching activities.

KMMN also brings the public and science closer together, for a more active "scientific citizenship" to improve conservation outcomes by building scientific knowledge, informing policy formulation, and inspiring public action (Irwin, 1995) (McKinley, 2017). Citizen science benefits research and conservation efforts by engaging numerous people and different organizations in science partnerships, including general public perspectives and local knowledge, to find culturally and politically feasible solutions to problems.

2. Methods and Materials

Study area

Kenya has a coastline of 536km which stretches from the Kenya-Somalia border at Ishakani in the north (1.7°S; 41.5°E) to the Kenya-Tanzania border at Vanga in the south (4.7°S; 39.2°E).



Map 1: Kenya coastline and KMMN area of operation

The Kenya coastal region is generally low-lying and characterized by an extensive fringing reef. The coast is endowed with biologically rich coastal and marine ecosystems ranging from terrestrial forests, mangroves, coral reefs, seagrass beds, estuaries and sand dunes. The hydrology of the coastal region of Kenya is based on the drainage patterns of perennial and seasonal rivers into the Indian Ocean basin, the Tana and Sabaki Rivers. Kenya experiences

two distinct seasonal monsoons, with the NE from November to March and the SE from April to October. The former is the drier period with calmer sea conditions, and the latter is characterized by the 'long rains' and rougher sea conditions (State of Coast Report for Kenya, 2017)

Whilst the KMMN study area encompasses the entire Kenya coast, the main research areas were determined by the tourism activities, which include fishing, diving and marine excursions for tourists provided by local boat operators. These activities are seasonal and dependent on the monsoon weather conditions. As the effort is determined largely by tourism activities there are two main areas from where most reports originate which include the Kisite-Mpunguti Marine Protected Area (KMMPA) and the Malindi-Watamu Marine Protected Area (MWMPA), located on the south and north coast respectively. These Marine Protected Areas (MPA) are managed by KWS and were the main focus area for designated marine mammal research survey teams. Other areas of research included the Watamu Banks, Kilifi, Diani, Lamu and Ngomeni.

Marine User Reports

Marine users report opportunistic sightings from ocean locations in fishing, diving and local tourism boats. The main period for sports and pelagic fishing are all year round except for May to July when sea conditions do not permit. Fishing activities of this nature take place between 1 to 30km offshore with main effort occurring in and around the KMMPA and MWMPA and also the Lamu Archipelago, which also provides extensive opportunities for marine mammal sightings. Inshore tourism activities include marine safaris, snorkeling, standup paddle and diving. These are generally dependent on calm seas and occur between 0.5 and 2km from shore throughout the year apart from May to August, and mainly in the MPA. The KMMN require the reporter to record sightings, providing where possible, specific information including the Global Position System (GPS) points, the species, number of animals and any other relevant information such as behavior or other species present. If possible, videos and photographs are also requested. Personal cameras are used by reporters and quality varies widely, from mobile phone to digital single-lens reflex cameras. Reporters are expected to produce an image to enable a positive identification of the species of marine mammal sighted, and where possible a fin identification photograph. Marine mammals live and dead sightings are reported to the KMMN data center at the WMA office in Watamu via mobile phone calls, social media or the KMMN WhatsApp group and recorded in an excel database. The KMMN WhatsApp group comprises of over 100 members from within Kenya and also marine mammal scientists from overseas with specific expertise.

Seismic Survey Marine Mammal Observer Reports

Occasional reports are received through by Marine Mammal Observers (MMO's) working onboard oil and gas seismic survey vessels in Kenya offshore waters (Barber, 2016) (Burns, 2016)**.**

Dedicated Surveys

Dedicated marine mammal research teams in the MWMPA conducted surveys from 2011 to 2017. WMA surveys continue to date but 2018 data has not yet been analyzed at the time of writing this paper.

WMA dedicated boat-based surveys were conducted on dolphin species seasonally between November and April during the northeast monsoon season (Meyler SV, 2012) (Kiszka, 2004). A 3-6 member research team, consisting of a WMA and KWS crew, scanned the water surface over 180º field of vision from the two perpendiculars to the front of the boat. Each observer covered a 45º subset of the field vision. Team members rotate every 15 minutes during the survey. Non-systematic transects were carried out during the surveys, covering a total area of 71km2 with frequency of surveys dependent on the climate and sea state conditions (Pérez-Jorge S. P., 2015). Searching effort was conducted with Beaufort Sea state 3, low swells and good visibility (≥ 1 km), reducing the probability of missing dolphins. Once dolphins were sighted, the research vessel approached them at low speed to identify species and to collect information on location, group size and group composition (Braulik, 2018).

The research team would further observe the animals to identify composition, behavior and reaction to other boats and especially dolphin watching tour boats. Photos of their dorsal fins were taken using Cannon E05 550D digital camera with emphasis on capturing high quality photos (Meyler SV, 2012)). The team remained with the pod for a minimum of one hour depending on weather conditions and sea state. During the surveys the positions of the animals were recorded at 15-minute intervals and subsequently mapped using GPS. (Pérez-Jorge S. P., 2015) (Pérez-Jorge S. G., 2016).

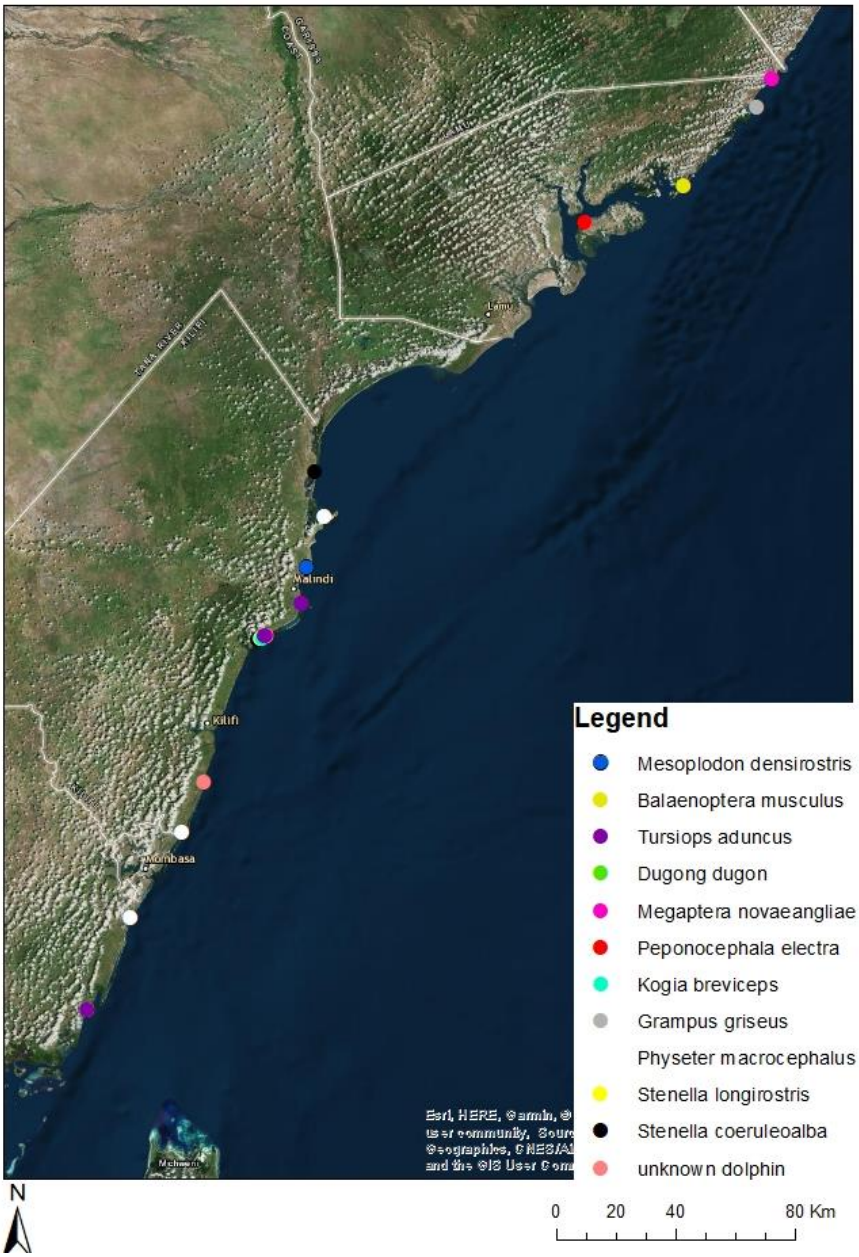
3. Results

To date a total of 24 marine mammal species have been reported in inshore and off shore waters of Kenya. These reports were mostly from marine users, seismic survey vessels and WMA dedicated surveys. Reporting effort has varied along the coast and this is reflected in sighting records. The most concentrated sighting locations were in the MWMPA and KMMPA due to the high intensity of the dedicated surveys from the WMA/KWS/GVI teams.

Since the formation of the KMMN in 2011 and up to 2018, we have received a total of 1,406 sighting reports; the combination of MMO, marine users and the WMA dedicated surveys. The most frequently reported species are humpback whale during their peak migration period, July to September and the Indo-Pacific bottlenose dolphin from November – April. Humpback whale sightings are higher because of increased observer effort during the migration period.

Stranding records

Using data collected between 2004 and 2018, the KMMN has recorded 21 reports of dolphin and whale mortalities along the Kenya coast. In September 2018 the first necropsies were performed on two animals from different locations; a partial necropsy of a sperm whale (*Physeter catodon)* and a full necropsy of a pygmy sperm whale (*Kogia breviceps*). The cause of death was not identified but tissue samples were preserved and yet to be taken for laboratory analysis.



Map 2: Dolphin and whale stranding report sites along the Kenya coast

Entanglement records

Historically, entanglements of humpback whales in fishing gears during their migration period have been reported in the region, but those cases were never documented in detail and with no rescues attempted until 2009.

In June 2009 in the MWMPA, a multi stakeholder team was involved in the disentanglement of a female humpback whale accompanied by her calf (Malindi Kenya Blue Fin Diving Salvataggio Balene , 2009). However, this team was not trained and cetacean rescue training is planned for the KMMN.

In 2017, two entangled humpback whales were reported to the KMMN. In August a female humpback whale was reported in the MWMPA, entangled in a gillnet. She was accompanied by her calf. Sports fishermen and a diver effected a partial disentanglement but abandoned the rescue. The whale swam away from the area with part of the net remaining around her rostrum; the whereabouts of the calf was unknown.

In September in Ngomeni, north of the MWMPA a mother and a calf were reported by local fishermen trapped in a gillnet for nine hours, before the whale could be located. When the fishermen encountered the mother, the calf was already dead, and both mother and calf were entangled. Due to poor sea conditions the rescue had to be abandoned, but the fishermen succeeded in disentangling the majority of the net with remaining pieces of gillnet attached to the mother's fluke as she swam away.

The KMMN received anecdotal reports of frequent whale entanglements in Ngomeni, but have not been substantiated.

Image 1: Humpback whale female and calf entangled in a gillnet in Ngomeni, 2017

Marine user sightings and records

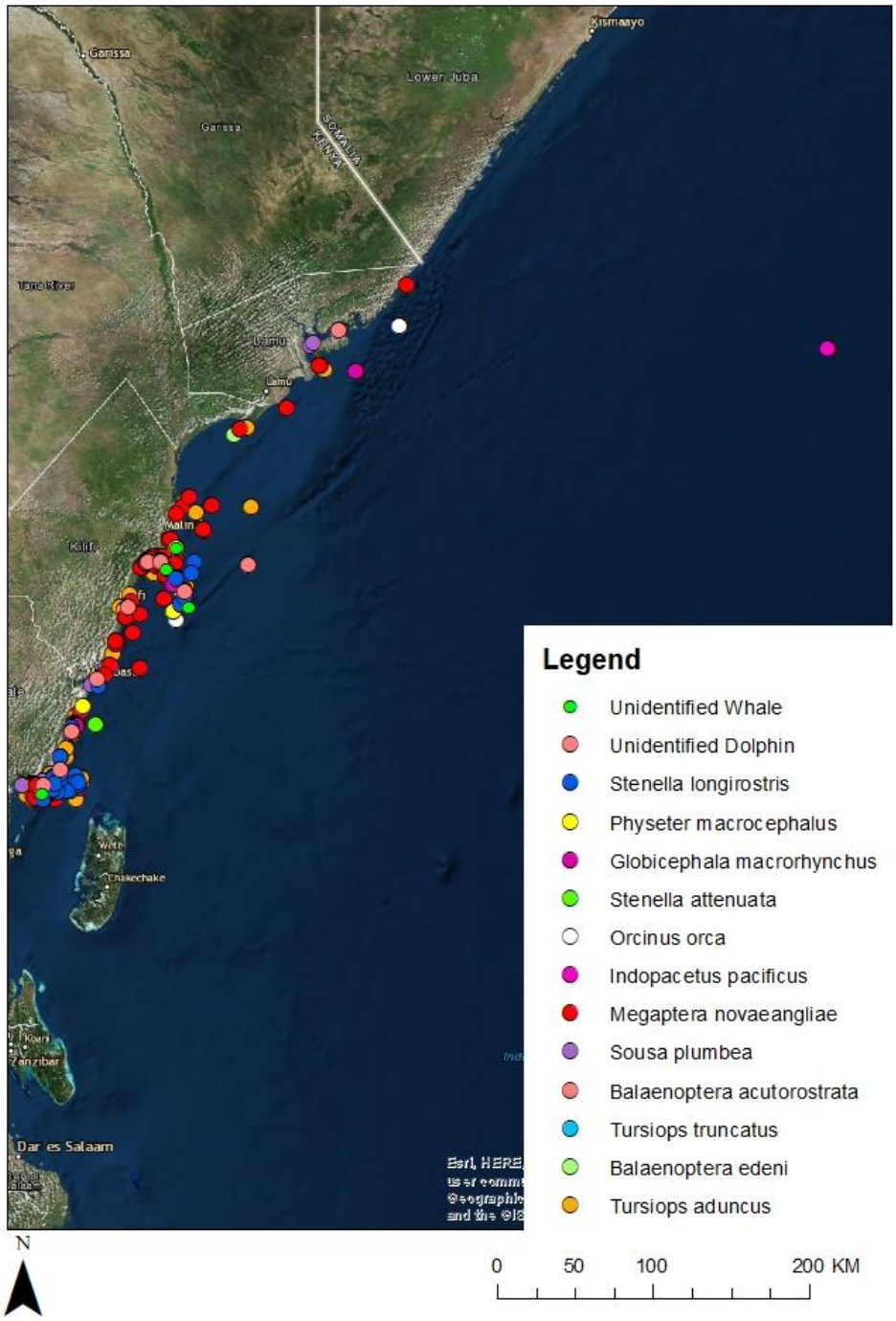
Between 2011 and 2018, a total of 1093 sightings were reported to the KMMN by marine users (fishermen, tour operators, divers). Indo-Pacific bottlenose dolphins (from November – April) and humpback whales (from June to November) are by far, the most reported species in the region. Due to logistical problems, few sightings have been recorded in 2014-2017, but KMMN activity picked up again in 2018, mainly because of the creation of a KMMN WhatsApp group.

Humpback whale sightings are higher because of increased observer effort during the migration period, with most of the sightings reported to the KMMN happening during their peak migration period from July to September.

Since the majority of the reports are given by frequent and local marine users, few species were unidentified.

Species	2011	2012	2013	2014	2015	2016	2017	2018	Total
Tursiops aduncus	63	154	107	0	0	1	0	50	375
Balaenoptera edeni	0	0	2	0	0	0	1	0	3
Tursiops truncatus	1	0	0	0	0	0	0	0	1
Balaenoptera acutorostrata	0	0	2	0	0	0	0	0	2
Sousa plumbea	3	7	14	0	0	0	1	1	26
Megaptera novaeangliae	1	78	114	43	35	66	70	198	605
Indopacetus pacificus	0	0	0	1	0	0	0	0	1
Orcinus orca	4	1	0	0	0	0	1	2	8
Stenella attenuata	0	0	0	0	0	0	0	1	1
Globicephala macrorhynchus	0	5	1	1	0	2	1	0	10
Physeter macrocephalus	1	0	0	0	1	0	0	1	3
Stenella longirostris	2	22	7	0	0	0	0	1	32
Unidentified dolphin	0	18	0	0	0	2	0	2	22
Unidentified whale	0	0	0	0	0	0	0	3	3
	75	**285**	**247**	**45**	**36**	**71**	**74**	**260**	**1093**

Table 1: Marine user sightings reported by year



Map 3: Marine mammal reporting sites by marine users along the Kenya coast

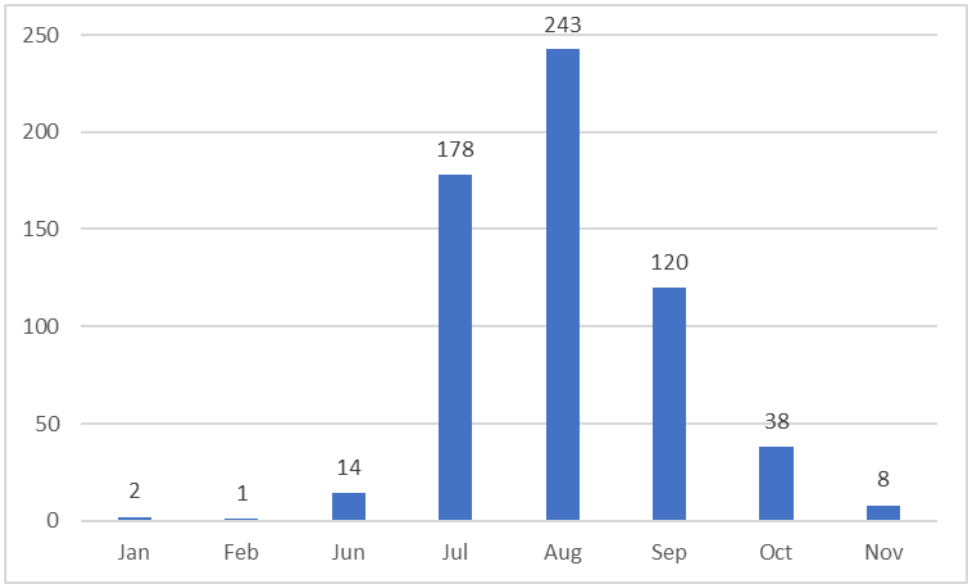


Fig 1: Humpback whale sightings per month from 2011 – 2018 from marine users

Seismic Survey Marine Mammal Observer (MMO) Reports

Due to the characteristics and operation activities of these vessels, several sightings resulted as unidentified animals. However, this data is also very important, as these boats operate further from the coast, expanding the reporting area offshore (Gordon Jonathan C.D, 2003).

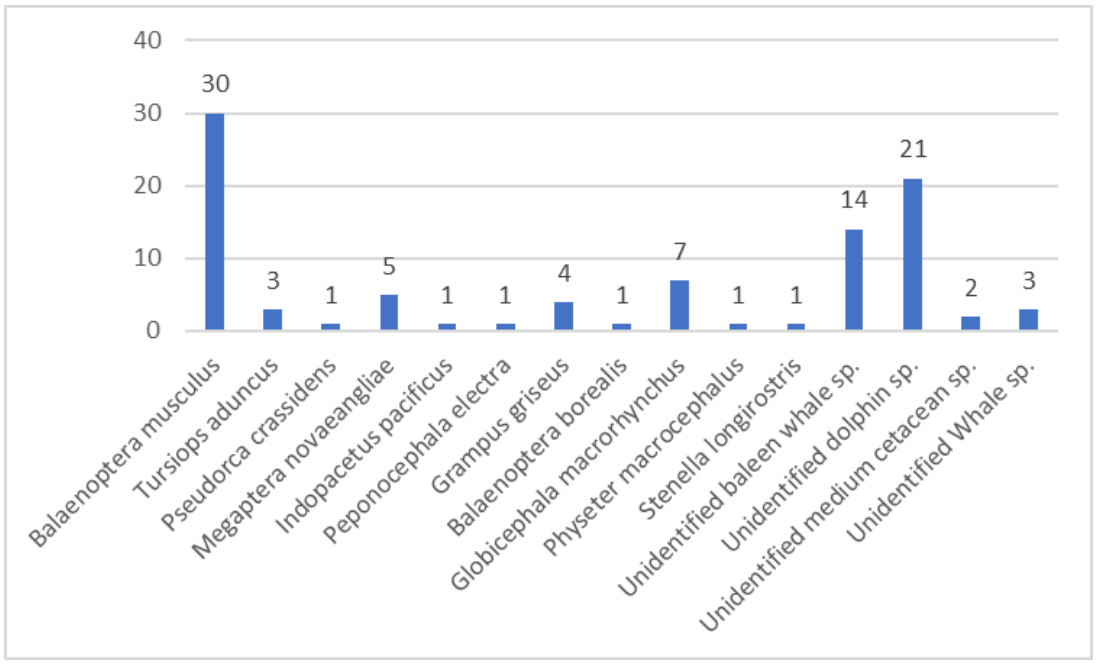


Fig 2: MMO sightings in offshore waters in 2014

Dedicated Surveys

WMA dedicated surveys in the MWMPA and adjacent waters resulted in a total of 218 marine mammal sightings, mostly of Indo Pacific bottlenose dolphins and the endangered Indian Ocean humpback dolphin.

Species	2011	2012	2013	2014	2015	2016	2017	Total
Tursiops aduncus	8	24	14	47	31	40	38	202
Sousa plumbea	0	3	0	2	3	4	3	15
Pseudorca crassidens	0	0	0	0	0	1	0	1
	8	27	14	49	34	45	41	218

Table 2. Species sightings recorded by WMA dedicated surveys 2011-2017

Common Name	**Scientific Name**	**Status**
Humpback whale	*Megaptera novaeangliae*	LC
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	DD
Indian Ocean humpback dolphin	*Sousa plumbea*	EN
False killer whale	*Pseudorca crassidens*	NT
Killer whale	*Orcinus orca*	DD
Sperm whale	*Physeter macrocephalus*	EN
Pygmy sperm whale	*Kogia breviceps*	DD
Bryde's whale	*Balaenoptera edeni*	LC
Dwarf minke whale	*Balaenoptera acutorostrata*	LC
Melon-headed whale	*Peponocephala electra*	LC
Longman's beaked whale	*Indopacetus pacificus*	DD
Striped dolphin	*Stenella coeruleoalba*	LC
Risso's dolphin	*Grampus griseus*	LC
Fraser's dolphin	*Lagenodelphis hosei*	LC
Short-finned pilot whale	*Globicephala macrorhynchus*	LC
Pantropical spotted dolphin	*Stenella attenuate*	LC
Long-beaked spinner dolphin	*Stenella longirostris*	LC

Long-beaked common dolphin	*Delphinus capensis*	DD
Blue whale	*Balaenoptera musculus*	EN
Common bottlenose dolphin	*Tursiops truncates*	LC
Blainville's beaked whale	*Mesoplodon densirostris*	DD
Rough toothed dolphin	*Steno bredanensis*	LC
Sei whale	*Balaenoptera borealis*	EN
Dugong	*Dugon dugon*	VU

Table 3. Complete list of marine mammal species recorded in Kenya waters with IUCN Red List classification.

4. Discussion

Species Encountered

The most frequently reported species to the KMMN are the migratory humpback whale (*Megaptera novaeangliae*) belonging to the Breeding Stock C Southern Ocean population group (International Whaling Commission; 50th Annual Meeting, 1998), the Indo - Pacific bottlenose dolphin (*Tursiops aduncus*) and the Indian Ocean humpback dolphin (*Sousa plumbea*). The latter two species appear to congregate for the most part in resident or semi residential populations, although some individuals are known to travel between the KMMPA and the MWMPA. These species are sighted during dedicated surveys mainly in these MPA within 5km of the coast at ≤ 200m depth and where most anthropological activities occur. The KMMN reports have especially contributed to improving knowledge on the humpback whale migration and their calving and behavior, particularly in the MWMPA. Reporters are observing mothers and calves, and also recording breeding behavior.

Offshore species reported between 15 and 40km off shore include killer whales (*Orcinus orca),* short - finned pilot whales (*Globicephala macrorhynchus)* long-beaked spinner dolphins (*Stenella longirostris),* false killer whale (*Pseudorca crassidens),* and sperm whale (*Physeter macrocephalus).* The main reporters are from deep sea and sports fishermen, who have gained experience in identifying species, with supporting evidence of photographs and videos. However, a number of species reported are unidentified.

Important records have also been provided by MMO's offshore seismic vessels, identifying previously unreported species in Kenya, such as the blue whale (*Balaenoptera musculus*) (Barber, 2016) and Longmans' beaked whale (*Indopacetus pacificus*) (Burns, 2016). Such reports are especially valuable in the north Kenya waters, since there is a data gap for the Lamu, Kiunga, and Kenya-Somalia border area which should not be excluded as an important area for marine mammals.

Reported Strandings

Live and dead strandings are important to identify species which are found off shore and are rarely seen. Also, it can give valuable information about anthropogenic pressures and impacts in the sea. The KMMN stranding reports include data collected prior to 2011, and rarely seen species such as Blainville's beaked whale (*Mesoploden densirostris*) (Valle, 2012); pygmy sperm whale *(Kogia breviceps*); Risso's dolphin (*Grampus griseus*) and melon-headed whale (*Peponocephala electra)* have been recorded.

Threats

Populations of marine mammals inshore are exposed to increased human activities, and particularly artisanal and commercial fishing entanglement, bycatch and overfishing, coastal development, plastic and marine litter pollution and nature based tourism activities (Wamukoya et al 1996; Perez et al 2016); (NEMA State of the Coast Report for Kenya)

Reports of humpback whale entanglement highlight the need to address increased fishing activities and gears which result in entanglement and bycatch. This makes disentanglement training a priority.

Performing necropsies on dead strandings will help to determine plastic pollution threats.

Additionally, the increasing activity of seismic surveys can influence feeding, orientation, migration or social behavior in marine mammals, as well cause long-term consequences due to chronic exposure and accessibility of their prey species (Gordon et al 2003).

Dolphin and whale watching is increasing in popularity and if unregulated may affect the behavior of resident and migratory populations (Pérez-Jorge S. G., 2016) (Wamukoya, 1996); (IWC Whale Watching Handbook 2018). The species of concern here are the Indo-Pacific bottlenose dolphin and humpback whale.

Recent increase in coastal and port development in Kenya poses a risk to inshore marine mammal populations and migratory species. Noise pollution from commercial and maritime traffic can interfere with marine mammal acoustics and communications and increased shipping can result in ship strikes.

Awareness

Dissemination of information is a priority for the KMMN. From 2011 to 2019 the KMMN has employed a multi marketing/awareness strategy to maximize outreach in all sectors, concentrating on tourism, education and conservation. Methods of sharing information include the creation of a website complemented by KMMN and WMA Facebook, Twitter and Instagram social media platforms. Periodic newsletters, tourism and educational articles are published to extend audience reach within Kenya and overseas. WMA has engaged with TV, radio and media companies to produce short features and documentaries (NTVWild Delightful Dolphins Youtube 2017; (CNN, 2017) highlighting community and KWS participation in marine mammal conservation. Several articles on marine mammals and WMA research have been published in the national press. WMA also runs a marine mammal education program in local schools and outreaches to fishing communities along the coast providing information on marine mammals. The KMMN network, through WMA in collaboration with KWS has also produced sustainable dolphin and whale watching guidelines and workshops for boat operators.

5. Conclusion and Future Work

Value of the KMMN

The study of marine mammals in Kenya has been hindered by lack of funding and effort since the KWS marine aerial survey in 1996. The results of that survey identified eight species, and since that time the KMMN has collected reports and data adding a further 16 species. It has acted as a low cost platform which has helped in addressing the challenge of collecting marine mammal data in Kenya waters. Over a period of eight years, the KMMN has accumulated diverse participants who reported from different Kenya coastal locations. Reports include live sightings, dead and live strandings of 24 species of marine mammals out of a total of 33 species recorded in East Africa waters (Western Indian Ocean Field Guide to Marine Mammals 2016). The combined efforts of the KMMN membership and reporters has enabled us to access previously un-surveyed Kenya waters, overcoming cost restrictions and limitations due to weather conditions and lack of human resources. Contributions have helped identify the diversity of marine mammal species and their "hotspots". In the future, this continuous information resource, in combination with standardized protocols, can contribute to marine mammal welfare to help enable quick intervention in scenarios of live strandings and entanglement with the support of local communities and governmental agencies and universities.

The rapid development of communications technology in Kenya during the past decade has undoubtedly assisted in creating an environment for citizen science to grow rapidly, not merely as an information gathering platform, but also to spread awareness and share information with the public though social media and android and iPhone Operating System (IOS) applications. The scope of this report does not extend to comparing the quality of the data collection methods, but does demonstrate the value of citizen science and how this information can be utilized across multi sectors for tourism, conservation, and education purposes.

Whale watching is now recognized as an embryonic tourism activity in Kenya by the Kenyan Ministry of Tourism and Wildlife in 2018. This was driven by collective KMMN efforts, through WMA, from 2014 to 2018 who focused on the MWMPA and promoting a wildlife tourism spectacle between the Masai Mara and the coast "The Twin Migration – Whales to Wildebeest". Whale watching visitors to the area have a positive economic impact and boost tourist numbers which also benefits local communities who rely on tourism.

Following applications from the KMMN, the IUCN Marine Mammal Protected Areas Task Force approved 4 marine areas in Kenya for further consideration to evaluate them as important for the conservation of marine mammal species, during the fifth Important Marine Mammal Area (IMMA) workshop in Oman, April 2019.

Importantly, KMMN data has been used to:

- Report species distribution, bycatch and strandings in the Kenyan National Environment Management Authority (State of Coast Report for Kenya, 2017)
- Develop management plans for Kisite and Mpunguti MPA;

- Define Ecological and Biological Significant Areas (EBSAs) in Kenya (https://www.cbd.int/marine/ebsa/booklet-03-sio-en.pdf;
- Identify Important Marine Mammal Areas (IMMAs) in Kenya (https://www.marinemammalhabitat.org/activities/immas/)
- Compile Kenya's country profile in the International Whaling Commission's Whale Watching Handbook, published 2018.
- Bring together scientific and conservation management organizations collaborating with local communities to help find solutions to the challenges and threats our marine mammals face and to work together to explore marine mammal ecotourism opportunities and potential.

Future Work

In response to increased anthropological threats, the KMMN will be pivotal to the setup of a rapid response stranding and entanglement network; to be able to document mortality rates and to better understand and help mitigate adverse human - dolphin and whale interaction in Kenya waters, and engage coastal communities in conservation efforts.

Increased focus is required on expanding and improving outreach research and awareness activities targeting key coastal community stakeholders in conservation of whales and dolphins to reduce threats and improve welfare. These efforts need to identify local user groups who interact with dolphins and whales in different ways, particularly fishermen, boat operators, maritime transport, which can result in marine mammal disturbance, injury and mortality.

As part of a long-term conservation strategy, investment and emphasis is required from the tourism sectors, public and private, to market regulated and sustainable whale and dolphin watching, which will increase public awareness. Highlighting Kenya as a key destination for observing marine mammals can potentially increase their conservation value, improve economic benefits for coastal communities and will be an integral component in national marine mammal conservation and marine spatial planning.

The Indian Ocean Cetacean Consortium (INDOCET) is a regional platform for conservation and research within Southwest Indian Ocean (SWIO). This innovative coalition mirrors the aims of the KMMN who are part of the membership of researchers, biologists, conservationists, citizen scientists and managers collaborating on trans-boundary and migratory marine mammal species. It is expected that advancements will be made in respect of data sharing and training through regular interaction.

The KMMN will also continue to actively work towards developing a National Dolphin and Whale Conservation Management Strategy.

6. Acknowledgements

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