Reporting for PTES worldwide grants

Final reports

Project title: Evaluating the distribution and conservation status of a new coastal dolphin species, the Indian Ocean humpback dolphin (*Sousa plumbea*) in Pemba Island, Tanzania.

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Institute: Wildlife Conservation Society, Tanzania Program, Stone Town, Zanzibar
Country project is based in: Tanzania
Project start and end date: August 2014- December 2016
Date of report: January 2017

Species/ habitat: Indian Ocean humpback dolphin (*Sousa plumbea*) / coastal seas around Pemba Island, Tanzania.

List and provide details on all main aims of the project and your achievements to date.

The project objectives are listed below and underneath each we provide a detailed explanation of how each has been accomplished.

Objective 1: Generate information on the presence, distribution, range and relative abundance of Indian Ocean humpback dolphins on the west coast of Pemba Island, Tanzania (including within the Pemba Channel Conservation Area) by the end of 2016.

Surveys of whales and dolphins in the Pemba Channel Conservation Area (PECCA) have been conducted by WCS and the PECCA Authorities in association with the University of Dar es Salaam, four times since October 2014. A 10 m dhow with a 40 hp outboard motor and a specially constructed 2 m viewing platform was used as the survey vessel. Visual surveys were conducted using standard line transect survey methods in closing mode so that the data could be used for abundance estimation. Line transects that ran perpendicular to the depth contours were laid out using the programme DISTANCE resulting in 40 transect lines, spaced 2 km apart. Three observers scanned continuously for cetaceans using 7 x 50 Fujinon marine binoculars with an internal compass. A central observer scanned 45 degrees either side of the trackline, and two observers scanned from the beam to the track. Survey effort and sea conditions measured by the Beaufort scale were logged at thirty minute intervals throughout the day, and when conditions changed. Surveying was suspended when sea conditions rose above Beaufort 4. When cetaceans were first sighted, the vessel's location was recorded using a GPS, the distance to the group was determined by measuring the angle between

the sighting and the horizon using the binocular's reticules, and the angle to the group determined using the internal binocular compass. Cetaceans were approached and photographed, the species identified, and group size recorded with a best, high and low estimate of numbers.

Figure 1 Observer Team on watch searching for cetaceans

Four surveys were conducted, three in October-November and one in March. A total of approximately 2500 km of on effort surveying has been conducted and 107 dolphin groups sighted (Table 1; Figure 2). The total number of species recorded during surveys is 11 (Table 2).

Table 1 - Summary of Dolphin Surveys and Results

Survey No.	**From**	**To**	**Days**	**Km of Survey**	**Dolphin Groups**	**No Species**
1	13 October 2015	24 October 2015	12	547 km	30	5
2	7 November 2015	20 November 2015	14	765 km	28	7
3	7 March 2016	18 March 2016	12	664 km	26	7
4	28 October 2016	8 November 2016	12	491 km	23	6
Total			**44**	**2,467**	**107**	**11**

Table 2 - Number of species and sightings in the Pemba Study Area

#	Species Common Name	Species Scientific Name	Number of Times Sighted	Sighting rate (groups/km)	Red List Status
1	Spinner dolphin	*Stenella longirostris*	50	0.0203	DD
2	Indian Ocean humpback dolphin	*Sousa plumbea*	24	0.0097	EN (proposed)
3	Indo-pacific bottlenose dolphin	*Tursiops aduncus*	16	0.0064	DD
4	Common bottlenose dolphin	*Tursiops truncatus*	4	0.0016	LC
5	Pan-tropical spotted dolphin	*Stenella attenuata*	3	0.0012	LC
6	Dwarf Sperm whale	*Kogia sima*	2	0.0008	DD
7	Humpback whale	*Megaptera novaeangliae*	1	0.0004	LC
8	Pilot whale	*Globicephala macrorhynchus*	1	0.0004	DD
9	False killer whale	*Pseudorca crassidens*	1	0.0004	DD
10	Blainville's beaked whale	*Mesoplodon densirostris*	1	0.0004	DD
11	Common dolphin	*Delphinus delphis*	1	0.0004	DD
	Unidentified species		3		
Total			**107**		

A population of Indian Ocean humpback dolphins (*Sousa plumbea*) was confirmed from the study area. They were the second most frequently encountered cetacean species after spinner dolphins (*Stenella longirostris*). These two cetacean species, plus Indo-pacific bottlenose dolphins (*Tursiops aduncus*), were recorded in every survey and both seasons. There was little overlap in their spatial distribution, with humpback dolphins occurring in the far east of the study area in shallow nearshore waters, spinner dolphins in the west in deeper water, and bottlenose dolphins in the centre. This is likely due to known depth preferences of each species. Humpback dolphin group size averaged (4.8, SD=3.5), and ranged from single animals to a high of 15 individuals. Many cetacean species that occur in shelf or oceanic waters occurred along the western boundary of the study area in deep waters

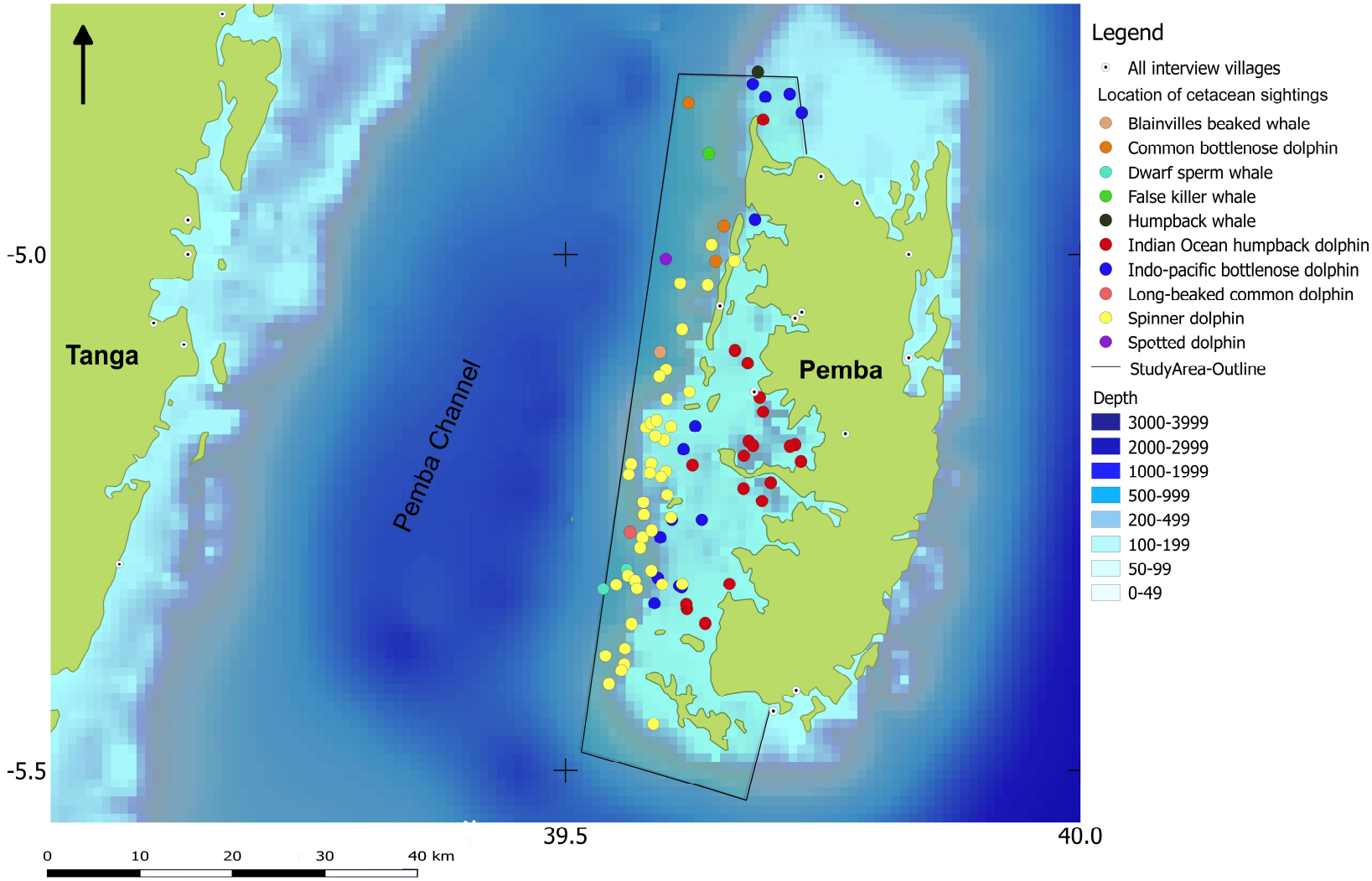

Figure 2 – Location of cetacean sightings within the Pemba Channel Conservation Area

of the Pemba Channel. These include three species never before recorded in Tanzania: Long-beaked common dolphin (*Delphinus delphis capensis*), Dwarf sperm whale (*Kogia sima*) and Blainville's beaked whale (*Mesoplodon densirostris*). Overall, cetacean sighting rates were high, especially in the central part of the study area between Mkoani in the south and Njao gap in the north. Sighting rates were consistently low around Panza Island in the south, and around the northern tip of Pemba.

Figure 3- Indian ocean humpback dolphin with a distinctive scarred fin

2. By the end of the project, describe the physical characteristics of Indian Ocean humpback dolphin habitat on the west coast of Pemba Island and using GIS identify other areas in Tanzania where, based on the presence of suitable habitat, significant populations of Indian Ocean humpback dolphins are likely to occur.

Throughout their range, Indian Ocean humpback dolphins occur around a variety of coastal habitats including mangroves, rocky reefs, coastal lagoons and shallow, protected bays. The over-riding habitat preference appears to be for water less than 25m in depth. For example, in Richards Bay, South Africa, all encounters with humpback dolphins were in water shallower than 20m. Dolphins used the area within 2 km from shore extensively and were rarely seen beyond 3km from shore (Atkins et al. 2004). In Algoa Bay, South Africa over 80% of sightings were within 400 m of the shore and there was a consistent preference for feeding over shallow rocky reefs throughout the year, despite considerable changes in dolphin abundance (Karczmarski et al. 2000). In Zanzibar, distribution of humpback dolphin groups was restricted to a median distance of 830m (min–max: 200–1,550 m) from the shore and a median water depth of 11 m (min–max: 2–26 m) (Stensland et al. 2006). Similarly in Nosy Be, Madagascar, the mean depth of sightings was 8.2 m with 95 % of sightings in water less than 20 m deep (Cerchio et al. 2016).

In Pemba, from 2015 onwards a Garmin portable echo sounder was used to measure the depth of water at cetacean sighting locations. The echo-sounder recorded water depth up to 200m. Water depth at the location of humpback dolphin groups ranged from 2-37m, and averaged 15m (SD=11m). Sightings were always nearshore, averaging 1.6km from land (max: 3.3km, min: 5m). Based on this information, we used a Geographic Information System (GIS) and the Global Bathymetric Chart of the Oceans (GEBCO) digital bathymetric dataset to select potential humpback dolphin habitat, defined as water less than 25m, across all of Tanzania (Figure 3). By far the largest area of potential habitat for this species is in the Rufiji Delta and around Mafia Island. A single sighting was confirmed from this area during WCS surveys (Braulik et al. 2016), and given the habitat, this location may be expected to harbour the largest numbers of endangered humpback dolphins in the country.

The mainland coast near Bagamoyo and the west coast of Zanzibar is a second location with significant potential habitat for this species, and there are numerous records of their occurrence in those areas. There is almost no shallow water habitat for humpback dolphins south of Rufiji to the Mozambique border and it is expected that humpback dolphins would be very rare or completely absent along that coastline. Surveys and fisher interviews along that coast also failed to find any evidence of their presence. It is possible that there is a hiatus in distribution of humpback dolphins along that 200 km stretch of exposed coast that might explain genetic differences seen between animals inhabiting southern and northern African coasts (Braulik et al. 2015).

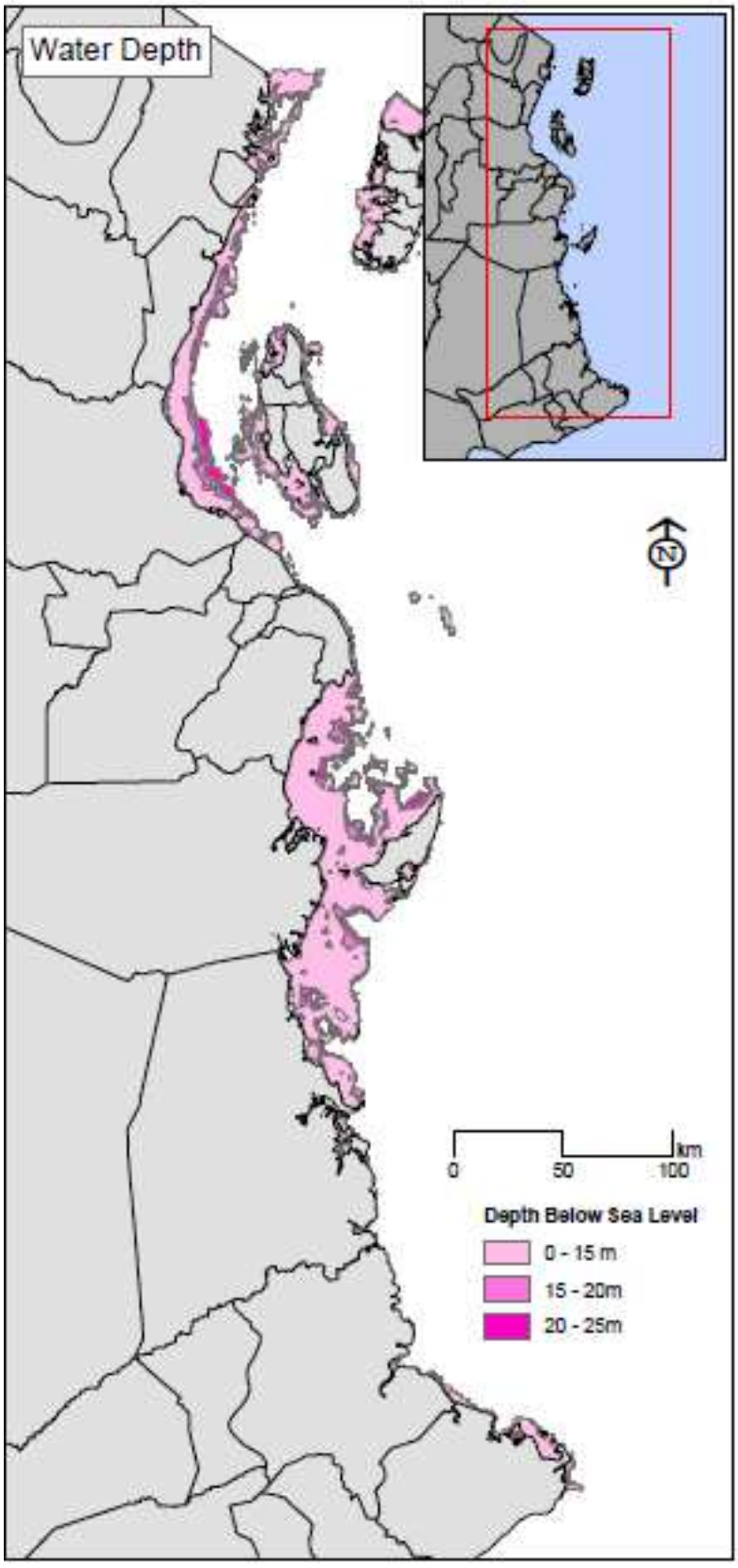

Figure 4- Potential habitat for Indian Ocean humpback dolphins in Tanzania

3. Identify, and attempt to quantify, the magnitude of cetacean bycatch and dolphin hunting in at least three fishing communities on the west coast of Pemba Island, by the end of 2015.

Fisher interviews were conducted along the entire coast of mainland Tanzania, and in Pemba and Unguja – here we present the results of the entire study. Fisher interviews were conducted to collect information on marine mammal bycatch, hunting, consumption and use. The rapid bycatch assessment questionnaire developed by Moore et al. (2010) was used, and interviews were conducted in Swahili, one-on-one with fishermen at fish landing sites. Gillnet fishers were the primary target of the interviews because this gear type has by far the highest bycatch rates for marine megafauna globally (Northridge et al. 2016) and in the Western Indian Ocean (Kiszka et al. 2009). A smaller number of fishers that used longlines and purse-seine nets were also interviewed. It was not possible to select villages randomly because in many there were no gillnetters. As recommended by Moore et al. (2010) the most experienced fishermen and captains were targeted as they were likely to have most knowledge. Only one fisher per vessel was interviewed, and it was assumed that this provided an estimate of per-boat catch. Illustration cards were shown to help fishers identify species. Marine mammals are legally protected in Tanzania so interviewees were assured anonymity, and questions regarding hunting, catch, use, consumption and sale included questions about how others in near-by communities use marine mammals to increase the chances of receiving reliable responses.

In total, 573 interviews were conducted, comprising 296 interviews from 31 villages in all four regions of the Tanzanian mainland coast and 277 interviews from 12 villages in Pemba and Unguja (Figure 1). The average age of respondents was 43 years (SD=13), and was similar (ranging between 37 and 45 years) in all regions. A total of 71% (407) of interviews were with fishermen who used gillnets as their primary gear type and another 10% used gillnets as their secondary gear type. The remaining fishers used purse-seines, hook and line, longline, and other gear types. Of those interviewed, 95% were full-time fishers, and just over half also had another source of income with agriculture the most common (37%). Boat captains constituted 63% of respondents, while the remaining 37% were crew. Outboard motors were present on 29% of the boats used by interviewees, and the remaining 71% were oar or sail powered.

Figure 5- Children looking at photos of dolphins that occur in Tanzania during fisher bycatch interviews

Close to two-thirds of fishers (59%) believed that there was only one type of dolphin in Tanzania. Due to uncertainty in species identification by fishermen an overall cetacean bycatch rate is provided rather than species specific rates.

A total of 17.4% of gillnetters reported that they had caught dolphins in the last calendar year. Based on this an estimated national bycatch rate of 0.17 dolphins / gillnet boat / year was calculated. The zone with the highest reported bycatch rate was Zone 1 - Pemba Channel, with 0.24 dolphins / gillnet boat / year, almost five times higher than the lowest reported rates in Zones 3 and 4, Dar es Salaam and Mafia/Rufiji, which were 0.05 and 0.04 dolphins / boat / year, respectively. In general, the bycatch rate on the islands of Pemba and Unguja, collectively 0.24 dolphins / gillnet boat / year, was two and half times greater than from the mainland.

Fishers were asked during interviews the fate of dolphins that were caught in a fishing net. Perhaps reflecting reluctance at admitting knowledge about an illegal activity, 50% of respondents did not answer the question. Of the remainder who did answer, 43% said the animals were either released alive or discarded dead, 37% said that dolphins were eaten, 14% that they were used as bait for sharks in the longline fishery, and 4% that the flesh was rotted and the oil then used as a wood preservative for boats. The proportion of fishers that reported eating dolphins was highest on Pemba (46%) and in Zone 4 Mafia/Rufiji (50%). Of a total of 55 fish vendors interviewed, only one, who was from Ziwani on Pemba, asserted that he had sold dolphin meat in the market recently. The meat was only rarely available and was sold for the comparatively small sum of $7.5-$10 / whole dolphin. No definitive evidence that dolphins were directly hunted was obtained.

4. Confirm the presence and conservation status of a dugong (Dugong dugon) population on the west coast of Pemba Island.

Extensive surveys across the west coast of Pemba including over sea grass beds were conducted during the surveys described above. No dugongs were sighted. Given the good weather conditions, and the intensive surveying we think it highly unlikely that any dugongs were missed during the surveys. During interviews with fishers on Pemba all fishers asserted that dugong no longer occur around Pemba. We therefore conclude that it is highly likely that dugongs are locally extinct in Pemba.

5. Build the capacity of the marine protected area managers and staff on Pemba Island so that they can take the lead on monitoring and conserving cetaceans in their protected areas.

At the onset of the project, prior to the start of the first survey a two-day training course, entitled 'Whale and Dolphin Biology and Survey Techniques', was held in Wesha, Pemba, and attended by 15 members of the Pemba Fisheries Department and Pemba Channel Conservation Area staff, including the head of the Pemba Channel Conservation Area and the head of the Fisheries Department. The activities were as follows:

Schedule of Events

Friday October 10th, 2014

08:30 - Introduction and welcome by Mr Mohammad Sharif, Fisheries Department

08:45 - Background to the current project, and the outline to the training course

08:50 - Lecture 1 – Introduction to Whales and Dolphins

10:00 – 10:20 - Tea Break

10:20 – 11:20 - Lecture 2 – Conservation and ID of Whales and Dolphins

11:20 – 12:30 - Lecture 3 – Survey Methods for Whales and Dolphins

12:30 – 14:00 - Juma Prayers and Lunch

14:00 – 15:00 Lecture 4 – Introduction to GPS

15:00- 16:00 - GPS Practical

Saturday October 11th, 2014

08:30 – 09:30 - Lecture 5 - Data collection methods and data sheets

09:30 -11:30 - Practical data collection exercises

12:00 -15:00 - Practice dolphin survey near Chake Chake

Subsequent to the training course members of the department of fisheries and the protected area staff participated in all dolphin surveys as team members, therefore continuing to learn about whales and dolphins in the field. The head of the Pemba Channel Conservation Area participated in the entire first survey, and one of the fisheries department rangers in every survey ever conducted by WCS.

Figure 6 - Fisheries Department staff undertaking practical GPS training exercises

List and provide details of any aims that haven't been achieved and why

All aims were achieved and most were far exceeded during this project.

Was your methodology sound and repeatable in other areas? Have you revised it whilst undertaking your project?

The methods employed during the survey were sound and repeatable and were not revised during the project. Line transect methodology is a standard survey technique for cetaceans and its use in complex coastal areas is precedented in many areas in Asia. Similarly, the fisher interview protocol is one that has been used and refined by the project GLOBAL (Global bycatch assessment of long-lived species) and therefore it did not require adapting for the current situation. These methods and survey techniques are now being replicated in other regions of Tanzania where we have expanded our cetacean work.

Please detail how your project has contributed to the long-term conservation of the species you are working on. If it has not, please explain.

This project far exceeded expectations. It not only confirmed the presence of a small resident population of Indian Ocean humpback dolphins, but it provided the first information on the high relative abundance and diversity of cetaceans that inhabit the waters around Pemba Island. Regular, reliable sightings of spinner dolphins and frequent encounters with less common deep water species mean that PECCA can be considered one of the most important areas for cetaceans in Tanzania. The information has been presented to the department of fisheries, and there is interest in developing whale and dolphin watching eco-tourism. The information was submitted to the scientific review of a proposed nearshore seismic survey that is planned for the study area along with recommendations for mitigation. The interviews with fishers confirmed that coastal drift gillnets are a cause of significant cetacean mortality and that cetacean mortality rates are higher on Pemba than elsewhere in Tanzania. As this was an initial exploratory study there were no objectives in the project to conduct specific conservation interventions because it was not yet known what was needed, however now that we have generated this baseline data conservation interventions will be the next step.

Has long-term monitoring been put in place to ensure the outcomes are sustainable? How will this be funded, undertaken?

The original PTES funded project was extended with funding from the US Marine Mammal Commission which allowed for two additional surveys and generation of a photo-ID catalogue of known Indian ocean humpback dolphin and Indo-pacific bottlenose dolphin individuals. At present, there are less than 50 humpback dolphins in the catalogue suggesting that the population of this

species inhabiting the coastal waters of Pemba is well under 100. At least 40% of animals bear the scars from fishing nets, which illustrates the high level of threat posed by coastal gillnets to these animals. In the coming two months the East African Cetacean Working Group will be established, an MoU signed and the first meeting held. The objective of the working group is to facilitate sharing of photo-ID catalogues of cetaceans from different parts of their range, so that questions about movements, isolation and survival can be answered. As part of this work a Tanzanian Masters student was supported. Her thesis will use mark-recapture analysis of photo-identified Indo-pacific bottlenose dolphins to estimate population abundance. Similarly, an honours student at the University of St. Andrews, Scotland will be calculating abundance of spinner dolphins in the study area using distance sampling.

Please detail how you have/ plan to disseminate your results (please include a rough timetable) e.g. giving talks, preparing papers, producing management guidelines, submitting evidence to change government policy, getting media interest, carrying out workshops for conservation officers, . Would you like to work with PTES to achieve media coverage for your project? Do you have any plans to publish the findings from your work in journals?

There has been considerable media interest in the work. A summary of newspaper articles and links is below:

The East African - Tracking whales and dolphins in Tanzania's Indian Ocean waters
http://www.theeastafrican.co.ke/magazine/Tracking-whales-and-dolphins-in-Tanzania-Indian-Ocean-waters/434746-2636460-12q7jviz/index.html

Live Science – Expedition unknown - http://www.livescience.com/54182-tanzania-is-a-hotspot-for-whale-and-dolphin-conservation.html

WCS Wild View – The most endangered dolphin in east Africa - http://blog.wcs.org/photo/2016/03/14/the-most-endangered-dolphins-in-east-africa/

All Africa Tanzania: Tracking the Rare Indian Ocean Humpback Dolphin in Pemba Waters
http://allafrica.com/stories/201604080167.html

The Citizen – Dhow and dolphins
http://www.thecitizen.co.tz/magazine/soundliving/1843780-3163314-yu3iq/index.html

The results of the surveys will be published in the Master's thesis of Magreth Kasuga, and the Undergraduate honours thesis of a student at St. Andrews University. The following scientific papers are anticipated to be completed and submitted within the next year:

1. Paper providing details of the abundance estimates of Indian Ocean humpback dolphins and Indo-pacific bottlenose dolphins inhabiting West Pemba

2. Paper providing an analysis of habitat preferences, distribution and abundance of spinner dolphins inside PECCA.

Have you succeeded in raising other funds for the project? If so, this is really good news! Please list the sources and levels of investment

We did raise additional funds for this project, specifically $30,000 was provided by the US Marine Mammal Commission for additional survey work on Indian Ocean humpback dolphins in Pemba, and to expand the work to Tanga, Unguja and Kenya. Plus, they provided funds to establish an East African Cetacean Working Group between Kenya and Tanzania to cooperate on conservation of Indian Ocean humpback dolphins.

What are the best lessons you've learned so far?

We were fortunate that this project was so successful and especially that we encountered so many cetaceans. Often marine mammal studies are hampered by low sighting rates preventing any clear conclusions to be made, but the choice of Pemba as an exploratory study site was a good one, reinforcing that examining the oceanography, human density, fisheries data etc prior to site selection is important in selecting the right site in the first place. Rapidly obtaining follow on funding for the work from the Marine Mammal Commission allowed us to build on the initial surveys to generate a strong dataset about which we can make conclusions with relative confidence. Training local students to participate in the field work alongside fisheries department staff ensured a good combination of skills were encompassed within the team.

Please provide a Project conclusion/ summary: (300 words) including objective(s) at outset, lessons learned, recommendations for future practice

Indian Ocean humpback dolphins have a discontinuous coastal distribution from South Africa to India in the Western Indian Ocean (WIO) and because they are coastally distributed, restricted to shallow-water habitat, in the developing world, they are subject to numerous human uses of the coastal zone, and they are therefore proposed as Endangered on the IUCN Red List (Braulik et al. 2015).

This project was designed to generate valuable baseline data on humpback dolphins in a previously unknown (for cetaceans) area around Pemba Island, Tanzania, and had the following specific objectives

1. Generate information on the presence, distribution, range and relative abundance of Indian Ocean humpback dolphins on the west coast of Pemba Island, Tanzania
2. Describe the physical and biological characteristics of Indian Ocean humpback dolphin habitat on the west coast of Pemba Island and using GIS identify other areas in Tanzania

where, based on the presence of suitable habitat, significant populations of Indian Ocean humpback dolphins are likely to occur.

3. Identify, and start to quantify, the magnitude of cetacean bycatch and dolphin hunting in at least three fishing communities on the west coast of Pemba Island
4. Confirm the presence and conservation status of Tanzania's most endangered marine mammal, the dugong *(Dugong dugon*), on the west coast of Pemba Island
5. Build the capacity of the marine protected area (MPA) managers and staff on Pemba Island so that they can take the lead on monitoring and conserving cetaceans in their protected areas.

Four surveys were conducted, in two seasons, including a total of approximately 2500 km of on effort surveying with 107 cetacean groups of 11 species sighted. A population of Indian Ocean humpback dolphins (*Sousa plumbea*) was confirmed from the study area that based on preliminary photo-ID analysis, is likely to be isolated, resident and to number fewer than 100 animals. The surveys added three new marine mammal species to the national checklist, and provided the first information on the high relative abundance and diversity of cetaceans that inhabit the waters around Pemba Island. GIS analysis of depth preferences of humpback dolphins indicated that by far the largest area of potential habitat for this species is in the Rufiji Delta and around Mafia Island, with a secondary area of potential habitat around Bagamoyo. Surveys and fisher interviews generated no evidence of dugongs and we therefore conclude that it is highly likely that dugongs are locally extinct in Pemba. The cetacean bycatch rate on the islands of Pemba and Unguja, collectively 0.24 dolphins / gillnet boat / year, was two and half times greater than from the mainland. Given the number of gillnetters, this would translate to several hundred animals per year which is likely to be unsustainable.

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