IndoCet Indian Ocean Network for Cetacean Research

2019 Indocet meeting

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MEETING REPORT - September 2019

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1. Background

The IndoCet Consortium is a regional network of researchers and organizations striving to increase the knowledge and protection of cetaceans in the Western Indian Ocean. Initiated in 2014, the Consortium formalized its objectives and organization in a Memorandum of Understanding in 2015, developed a website in 2016 and was officially launched during an inception workshop that was held during the Humpback Whales World Congress in Reunion in 2017.

The 2019 IndoCet meeting took place on Reunion Island on 10-12 July, at the University of Reunion, Saint-Denis. The meeting was organized by the University of Reunion and Globice as a side event of the Island Biology Conference (https://ib2019.sciencesconf.org/). The meeting was funded thanks to a European Union grant.

At the time of the meeting, the Indocet Consortium comprised 23 active members, conducting cetacean research in seven countries of the western Indian Ocean (Kenya, Tanzania, Mozambique, South-Africa, Madagascar, Reunion/Mayotte, Mauritius) and seven associate members. All Indocet members were invited to attend the meeting, together with researchers actively involved in cetacean research in the region and that might be interested in joining.

2. Objectives of the meeting and Participants

The meeting had a general goal of creating links, sharing knowledge and increasing regional collaborations on cetacean research and conservation within the western Indian Ocean.

More specifically, the goals of the meeting were to:

- foster communication and partnership among researchers within the western Indian Ocean.

- provide an overview of the different organizations involved in cetacean research in the region

- present on-going research and future projects

- provide a training session on the regional photo-identification platform *Flukebook*.

The agenda of the meeting is presented in Appendix 1.

The participants of the workshop included representatives from different organizations from the following countries: Madagascar, Mauritius, Seychelles, Mozambique, Kenya, Reunion, Mayotte and South Africa. The list of participants and their contact is provided in Table 1 below.

Table 1. Contact details of the Workshop Participants (alphabetical)

LAST NAME	FIRST NAME	EMAIL ADDRESS	AFFILIATION
ANDRIANARIVELO	Norbert	andnorb@yahoo.fr	ISHM, Madagascar
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CULLAIN	Nakia	nakia@zavoralab.com	Zavora, Mozambique
BLOUNT	Andrew	drew@wildme.org	Wild Me, US
DUBOIS	Nina	ninasdubois@gmail.com	Drop of Blue, Mauritius
DULAU	Violaine	violaine.dulau@globice.org	Globice, Reunion
ESTRADE	Vanessa	Vanessa.estrade@globice.org	Globice, Reunion
KRAMER	Rachel	RachelK@wildtrust.co.za	Wildlands Conservation Trust
MAYER	Francois-Xavier	fifou@cetamada.org	Cétamada, Madagascar
MARTIN	Julie	Julie.martin@globice.org	Globice, Reunion
MINTON	Gianna	gianna.minton@gmail.com	Arabian Sea Whale Network
MWANG'OMBE	Michael Gilbert	michaelgilbert.geo4@yahoo.com	Watamu Marine Association, Kenya
Plön	Stephanie	stephanie.ploen@gmail.com	South Africa
RASOLOARIJAO	Tahina	tmagics@gmail.com	ISHM, Madagascar
SALOMA	Anjara	anjara@cetamada.org	Cétamada, Madagascar
WAGNER	Jeanne	jeanne.wagner@afbiodiversite.fr	Parc Marin de Mayotte

The following partners and observers also attended one or more sessions:

- Alexandre Modi, Globice
- Sara Viera, Globice
- Océane Schott, Globice
- Jean-Marc Gancille, Globice
- Valérie Jouannet, Globice
- Stephanie Sorby, University of Reunion
- Jennifer Appoo, Seychelles
- Mayeul Dalleau, CEDTM
- Ludovic Hoarau, CEDTM
- Sylvain Delaspre, CEDTM

3. Wednesday 10th July - Flukebook training session

The session commenced with a round table of introductions and a presentation from Violaine Dulau covering the background and history of the Indian Ocean network for Cetacean Research (www.indocet.org), the general objectives of the meeting and the Agenda.

Following this short introduction, the entire day was dedicated to the Flukebook training session, led by Drew Blount and facilitated by Gianna Minton.

Flukebook is an online data sharing platform that includes automatic matching tools for humpback whales and other cetacean species (bottlenose dolphin, sperm-whales, right whales). It is developed by WildMe under the Wildbook platform (wildbook.org) and uses computer vision and machine learning to facilitate automated identification of individual animals. In recent years, Indocet has worked in close collaboration with WildMe to create a customised Flukebook platform for Indocet, in order to facilitate data sharing among members and to develop features specific to the data-management needs of the consortium.

The objectives of the Flukebook training session were to:

- Introduce Flukebook to new Indocet users - including an overview and background to Flukebook and specific features of the Indocet platform
- Teach new users how to use the platform for the most important functions at the project level (data entry, labelling, internal matching)
- Teach users how to engage in collaborations and matching
- Inform users about possibilities offered with other species (Bottlenose dolphin, right whales, maybe Sousa in the near future?)

During the first part of the training sessions, Drew gave a presentation with detailed information about Flukebook, its 'parent' organisation – WildMe, Computer vision, and the new features developed within Flukebook for Indocet.

The second part of the day was devoted to practical exercises designed to help users become familiar with the Indocet Flukebook Platform and its many functions.

Questions and Answers arising during the session:

How can users get the Indocet standard import format and make sure it is the last version?

➔ Drew will send out an email with new standard format upload Excel template (bulk uploader). The final version of the template file will be downloadable from the Indocet website

Is it possible for users to upload our data directly, without having to send the file to WildMe?

➔ WildMe expects that by the end of 2019 it will be possible for users to do their own bulk uploads. The user interface will have a feedback loop that will check data for formatting errors and highlight these to the user before accepting/uploading the data.

How does Flukebook differ from other automatized/computer assisted matching software that is currently available (e.g. FinBase, Darwin)?

➔ The algorithms are generally more advanced, but Flukebook is the only platform that facilitates online comparison and collaboration. With respect to the first point, a study conducted by Sarasota Dolphin Project established that FinFindR was more effective at finding matches for bottlenose dolphin dorsal fins than the newly developed Flukebook algorithm. WildMe approached the developer of FinFindR and the team are working to incorporate the FinFindR algorithm in Flukebook as well.

Can Flukebook export to R?

➔ Yes. Flukebook has a large range of export possibilities, including MARK, ArcGIS, Google Earth, R, and RMatch. There is even an R package called RWildbook, which can be used to link directly to Flukebook.

What should you do if you have photo-ID or other data for multiple species in different formats?

➔ Many research groups find themselves in situations like this. The new Standard Bulk import file (an Excel sheet with multiple columns that correspond to the data field names in Flukebook) allows users to transform their own historical data into a format that can be easily uploaded to Flukebook.

How difficult would it be to adapt the bottlenose dorsal fin algorithm to use with another dolphin species (e.g. humpback dolphins)?

➔ It would not be difficult, but it would take a sizeable catalogue (ideally a few hundred individuals) that is already reconciled and could be used to re-train the algorithms for the specific shape, curve, etc. of that species fin. The more photos that represent the range of variation in that species, the better. It would also require some financial investment to accomplish (around 1000€).

How do you define 'an encounter'?

➔ An encounter is an event/observation of one individual at one place in one point of time, but the length of that event is defined by the researcher/user – it could be the whole period that you are following that individual, or (as is often the protocol with humpback whales) could be re-defined each time there is a change in the composition of the group in which that whale is observed. The important detail is for researchers to be consistent and clear in their protocol.

How is Survey effort recorded – and how can this feature be used?

➔ For the moment, this feature is still very much in beta/testing mode. A grant from NOAA will allow the Whale-Alert App to be linked to Flukebook, and once this is completed, survey effort in the form of GPS track data can be more easily stored in Flukebook.

Will there be a phone App for Flukebook?

➔ Although this would be ideal in the long run, there are no immediate funds or plans to do this; although the WhaleAlert App, once linked to Flukebook will provide some link.

What do you do with a photo that has more than one individual in it?

➔ Although Flukebook is working toward the ability to isolate individual photos from groups/herds for identification, this feature is not yet available. For the time being, it is up to researchers to manually crop (and likely re-label) photos so that they include the identifying feature of only one individual.

Can Flukebook read the EXIF data from photos?

➔ Yes. It already does this on 'Tweet-a-whale', where citizen scientists can tweet a photo of a whale.

How does one initiate a match to a photo?

➔ Matching is initiated from the ENCOUNTER page, using the hamburger symbol and dropdown menu on the photo to match to the catalogue.

Do the matching algorithms look at previously assigned individual IDs and take these into account?

➔ No. It assumes that if you are running a match you are trying to confirm IDs matches, so it will include comparisons against images of the same individual from different encounters.

Do all Wildbooks have the same options for granting collaborations and different levels of permissions (editing vs. viewing)?

➔ Not yet. This is a feature that has just been developed for IndoCet, but it will be rolled out to other Wildbooks as well.

If an organisation would like a volunteer/member to upload or edit data for the data that they own/hold, is it better for that person to be logged into the official organisation account, or in their own account with full edit privileges granted by the main organisation account?

➔ That is up to the organisation to decide. It may be better to create separate accounts for interns/volunteers so that their affiliation/account/permissions can end when they leave the organisation; but if they are submitting data using the 'Report an Encounter' option rather than the standard format bulk upload, they will be listed as the data owner, so this is something to consider. The ability to 'assign an encounter's ownership to an organisation rather than an individual' is a function that is being considered in the next round of development.

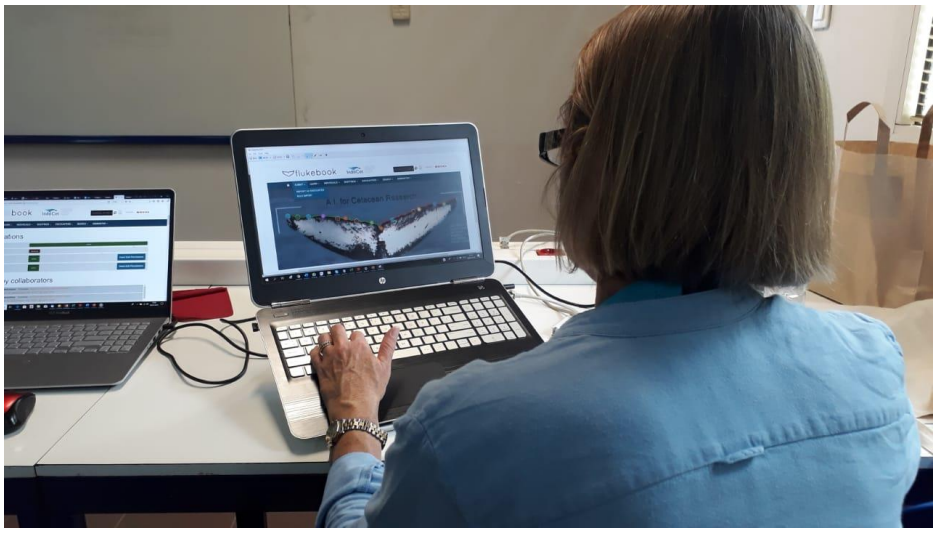
Is there a way to search for a map of collaborations/contributors?

➔ Not yet. Users need to remember that Flukebook is a relatively small organisation working to develop new features from one project budget/collaboration to the next, and to date there has not been enough spare time or budget to step back and simply review, refine, and develop aspects of user interface that would be more for user's convenience than the necessity of what is needed to allow matching, data storage, querying and collaboration. It would be ideal if collaborators could help to find grants to do more User Interface improvement.

What are the advantages of using the Individual score mode of matching vs. the Image score?

➔ The Individual score mode of matching will scan all the marked individuals that have been identified in Flukebook and choose the individual whose collective photo scores provide the best match to the photo that you are matching to. Returns will include the most representative photo of each individual whale, and no whale will be represented twice.

The Image score mode will treat every photo in Flukebook individually, and return a specified number of photos that best match your photo, and may include multiple photos of the same individual (in fact it should, if you have a good photo and multiple other good photos have been uploaded of the same individual from other encounters).



What do you do if your matching results yield two matches?

➔ Currently it is only possible to merge two individuals at a time, so you would first merge with one individual and then conduct the match again and merge with the second individual.

Is there a dedicated split tool that can be used to separate two individuals who have mistakenly been assigned the same ID?

➔ No. But you can edit encounters on the individual page and re-assign them to other whales or assign them new IDs.

Is there a way to identify individuals offline or in the field?

➔ There is an option to export a PDF catalogue from the Individual search export options. If you have designated 'profile photos' for an individual (a single best fluke, right and left dorsal fin), it will display these profile photos and a brief capture history on one A4 page for each individual.

4. Thursday 11th July – Organizations involved in cetacean research in the region and on-going projects

4.1. Presentation of organisations

This ssession aimed at introducing each participant and their organization (background, area of expertise, species studies, data available, etc…), to provide a general overview of Indocet members and actions being undertaken in the region and to enhance networking.

All attendees were invited to provide a 5-10min presentation of their organization and for ideas and suggestions for how Indocet may be able to strengthen their work

The following organizations and their respective actions were presented:

- Drop of Blue, by Nina Dubois
- Centre d'Etude des Tortues Marines (CEDTM), by Mayeul Dalleau
- Cetamada, by François-Xavier Mayer
- Globice-Reunion, by Violaine Dulau
- Institut Halieutique des Sciences Marines (IHSM), by Norbert Andrianarivelo
- Marine National Park of Mayotte (PNMM), by Jeanne Wagner
- Nelson Mandela University, by Stephanie Plön
- Seychelles Island Foundation (SIF), by Jennifer Appoo
- Society for Dolphin Conservation, by Shanan Atkins
- Watamu Marine Association, Michael Mwang'ombe
- Wildlife Conservation Society (WCS), by Tim Collins
- WildOceans, by Rachel Kramer
- Zavora Marine Lab, Nakia Cullain

4.2. Cetacean Research and Conservation within the western Indian Ocean

This session was dedicated to cetacean research and conservation actions being conducted in the western Indian Ocean. Participants were invited to present on- going research, scientific results or any topic that may be of relevance to Indocet.

The abstract of each presentation is presented below.

- **"The protection of humpback whales in the Western Indian ocean through a legal approach", presented by Stephanie Sorby (University of Reunion)**

The protection of whales reveals a multitude of legal and institutional frameworks. At international level, trade is regulated through the CITES, whaling is framed by the Whaling Convention, sanctuaries were established to protect whales from commercial whaling (e.g. Indian Ocean Sanctuary). At the national level, marine protected areas (MPA) could be one of the most interesting legal tools for whale protection and conservation: MPA categories display operational regulations which can improve whale conservation. However, these international and national binding laws reflect a fragmented landscape by the multitude of existing norms and by unequal involvement of States to protect whales. In the context of this fragmentation, focusing on other tools like soft law, to protect whales in the Western Indian Ocean is necessary. Soft law is already used for whale-watching activities (charter, label) or for the creation of important marine mammal areas (IMMAs). Soft law plays a major role in the protection of whales as it favors an ecological approach (by exceeding the consideration of specific legal order), for a global phenomenon like whale conservation. To develop a regional cooperation around the protection of whales, it is thus necessary to include soft law into the existing legal frameworks and to reveal the potential of these norms to create links between various "functional regimes" and/or "territories" for an effective regional "whale route". Understanding such normative interactions associated with various stakeholders, institutions and networks of States in the Western Indian Ocean are key conditions for conservation success.

- **"Assessment of cetacean diversity, hunting, by-catch and strandings in the South of Madagascar", presented by Norbert Andranarivelo (IHSM)**

Several studies have been conducted to assess cetacean diversity, dolphin hunting and fisheries bycatch off ten villages in the southwest (Toliara) and southeast (Fort Dauphin) of Madagascar, reporting on socio-ecological interview data covering the period 1975-1999, and a combination of both boat-based surveys and interview data collected during 2000-2018. The boat-based surveys and interviews indicated that 18 species of cetacean (5 species of whales and 13 species of dolphins) have been observed in the waters in the southwest region, and interview surveys indicate that 14 species (6 species of whales and 8 species of dolphins) have been reported in the waters of the southeast off Fort Dauphin. The socio-ecological surveys revealed the identification of several stresses on the cetacean population, including hunting, stranding and fisheries by-catch on seven species of cetacean: bottlenose, spinner, and Indo-Pacific humpback, pilot whale, Risso's dolphin, humpback whale and sperm whale. Two types of fishing gear, harpoon and gill net, are used in the two regions to hunt cetaceans, and incidental by-catch occurred in gill nets. At least 2770 cetaceans were killed between 2000 and 2018 and 25 cetaceans were reported stranded in the two regions. The whales and dolphins caught were reported used for local consumption and to sell in the region.

- **"A feedback on whale-watching management in Mayotte", presented by Jeanne Wagner (Parc National Marin de Mayotte, AFB)**

Commercial whale-watching activities have been existing in Mayotte since 1998. Whale-watching developed rapidly, with new tour operators and/or vessels arriving every year. In 2019, 10 tour operators and 20 small whale-watching vessels are active. With 25 species of marine mammals, including resident coastal dolphin population, a small endangered dugong population and breeding grounds for humpback whales, marine mammal conservation in the marine protected area of Mayotte is a challenge for environmental stakeholders. In 2000, the first code of conduct for commercial and recreational marine mammal watching has been developed to guaranty sustainable growth of this activity. Whale-watching management tools evaluated over time to become more efficient in order to reduce human disturbance on marine mammals. In 2018, a new local regulation is restricting whale-watching in Mayotte. Additionally, a code of conduct for recreational whale-watching and a collective mark for professionals allows whale-watchers to go even further in preserving marine mammals.

- **"Whale-watching in Reunion Island", presented by Ludovic Hoarau (CEDTM)**

The whale watching industry has grown rapidly worldwide over the last decade. Reunion Island (South west Indian Ocean) is no exception to the rule, its coasts attract a growing number of humpback whales *Megaptera novaeangliae* during the austral winter breeding season, a few nautical miles away from seaside resorts. Therefore, whale watching (WW) and swim-with whales (SW) activities are developing tremendously. This recent and growing industry has raised concerns about the behavioral responses of breeding humpback whales to WW and SW disturbances and challenges the sustainability of these activities. A responsible observation of cetaceans was recently encouraged through a charter code-of-conduct under the initiative of many stakeholders including WW operators, governmental and non-governmental organizations, as well as through a respectful label dedicated for commercial whale-watching in Reunion Island. In early 2017, the "Team Quietude" began a projectto observe, monitor and sensitize both commercial and recreational whale watchers at sea to ensure compliance with the Charter's guidelines. In this context, we assessed WW and SW activities between June and October at Reunion Island during two humpback whale breeding seasons, 2017 and 2018.

We recorded behavioral data of humpback whales using focal follow sampling in the presence and absence of vessels and in situations of compliance or non-compliance with the charter. This study aimed at understanding the behavioral reactions of humpback whales to vessels and swimmers' interactions by calculating transition probabilities of passing from one behavior to another using Markov chain model. We further investigated the circumstances leading to avoidance, neutral or approach responses of humpback whales to WW and SW activities. A total of 411 hours over 103 days was spent collecting data, 105 hours of which included recording of humpback whales behavioral data. From the 716 sightings, groups were mostly composed of mother/calf pairs spending most of their time resting and nursing near or at the surface. Vessels were present in 85 % of our sightings corresponding to a total of 1978 vessels recorded during 2017-2018 breeding seasons. Recreative WW vessels accounting for 68.4% of vessels and SW activities were frequently observed (*i.e.,* 42% of sightings). General compliance to the charter was high as 71.2 % of our observations were in line with the charter's recommendations. However, poor compliance exists (*i.e.,* < 38%) on the specific recommendations on SW activities. Swimmers were reported on active groups of whales and some agonistic behaviors towards them were revealed, leading to challenging safety issues for this activity.

Resting along with nursing, surface active and travelling behaviors of humpback whales were disrupted by interactions with vessels and SW to a level that raises concern. In particular, groups composed with mother and calf were significantly less likely to rest and nurse with the presence of vessels and swimmers. Humpback whales tend to vertically and horizontally avoid WW vessels and

SW encounters, especially when the behavior of vessels and SW encounters is intrusive or not compliant with charter's guidelines.
Repeated disturbances to cetaceans can have a significant effect on energy expenditure, in particular for mothers and calves. Indeed, during the reproductive season lactating humpback whales keep their energy expenditure low by devoting a significant amount of time to rest. If disturbed during these critical times, the frequency of calf suckling events can be reduced and therefore their energy acquisition. It is important to quantify these effects which may have an impact on a successful migration and survival of calves. Our results advocate for reinforcing tourism education, WW management and regulations with an emphasis on SW activities. This could be efficiently achieved by engaging all stakeholders with the existing charter, the label and the permanent at-sea presence of the "Team Quietude" to enhance dissemination of best practices and sensitize on sustainable values of implemented regulations.

- **"Environmental influences and coastal zone usage of humpback whales (*Megaptera novaeangliae)* in Zavora, Mozambique", presented by Nakia Cullain (Marine Action Research - Zavora Marine Lab)**

Humpback whales (*Megaptera novaeangliae)* migrate annually to the coastal waters of Mozambique, however there is limited scientific information on their populations in the region. We examined the distribution and habitat use of humpback whales in Zavora Bay, Mozambique and identified key factors influencing their choice of habitat. Over a period of ten years, from 2010 to the present, a number of continuous sighting surveys were conducted. A photo-identification catalogue was built, and a combination of spatial planning and habitat modelling completed. Results demonstrate the significance of the area as part of the larger scale breeding ground of Southern Africa and Madagascar. Making use of an integrated GIS approach, spatial patterns of habitat stratification were investigated and core areas for the humpback whales within the study area were identified. Using an adjusted occupancy model, the driving factors that make an area suitable for humpback whale presence were found. These were mostly related to the depth of the bay and the distance from shore, with mother-calf pairs clearly spending more time in shallower waters closer to shore. This study is the first to compile the available information on humpback whale distribution on this part of the southern African coastline. Results therefore provide key insights for management and policy advisement for humpback whales in South-eastern Africa.

- **"Using environmental parameters in feeding grounds to understand variations in humpback whale sighting frequency in La Réunion Island" , presented by Alexandre Modi (Globice)**

Humpback whales typically undertake annual migrations from feeding areas in the higher latitudes to breeding areas in lower latitudes. Humpback whales breeding in the western Indian Ocean migrate from Antarctica, but their main feeding areas and migration patterns remain largely unknown. In the last decade, variations in humpback whale occurrence within the western Indian ocean breeding range have been observed, suggesting changes in migration behavior between years. Distribution surveys conducted over 14 years (2004-2018) in Reunion Island indicated significant variations in sighting frequency between-years, in consistency with observations at other breeding sites.

In order to better understand the factors that might influence humpback whale occurrence in Reunion, several environmental parameters were downloaded from remote sensing data available in their potential Antarctic feeding areas (sea surface temperature, chlorophyll a concentration, sea-ice coverage and salinity). Index of Southern annular mode and El Nino were also obtained. For each

variable, the mean value was calculated between December and March at different time-lags (6, 18 and 30 months) and within 3 main areas, from 0° to 90° of longitude (i.e. 0°-30°, 30°-60° and 60°-90°) off Antarctica. A smaller region that encompassed Prydz Bay was also investigated. Linear regression models were used to assess the effect of environmental features on humpback whale sighting frequency. Results revealed a significant and positive influence of sea surface temperature with a time-lag of 6 months and a significant positive effect of chlorophyll a with a time-lag of 30-months for the 0-90° area. SST and chlorophyll a concentration may have an impact on biological maturation of krill at different time scale affecting abundance of food resources for humpback whales. This study provides a first approach to link environmental parameters in potential feeding areas of humpback whales to their occurrence in a western Indian Ocean breeding area.

- **"The Kenya Marine Mammal Network: Research and Citizen Science 2011 - 2018 - Large whale and baleen whale findings" , presented by Michael Mwang'ombe (Watamu)**

The Kenya Marine Mammal Network was set up in 2011 as a citizen science coalition to collect information from along the Kenya coast to fill a data gap with respect to marine mammal populations and distribution. From 2011 to 2018 historic and current information was collected from marine users, MMO's, and dedicated surveys, including live and dead standings and fishing gear entanglements. Humpback whales from IWC Breeding Stock C population migrate to winter breeding grounds in south and east Africa waters, and occur in Kenya waters between June and November. Total sightings recorded between 2011 - 2018 were 609 with July and August being peak months. The Watamu Marine Association started humpback whale watching tours in the Malindi-Watamu MPA in 2012 and has since promoted the area as "East Africa's number one whale watching hotspot." Several small whale watching boats (maximum eight guests) are in operation and whale watching guidelines have been introduced by WMA. This is a growing tourist activity with potential for expansion to other coastal areas where humpback whales are known to congregate. Recent observations of note include 30 blue whale sightings recorded by MMO's in 2014 within the EEZ near the Kenya/Somalia border.

- **"The Kenya Marine Mammal Network: Research and Citizen Science 2011 – 2018 - Small Cetaceans in Kenya" , presented by Michael Mwang'ombe (Watamu)**

The Kenya Marine Mammal Network was set up in 2011 as a citizen science coalition to collect information from along the Kenya coast to fill a data gap with respect to marine mammal populations and their distribution. From 2011 to 2018 historic and current information was collected from marine users, MMO's, and dedicated surveys, including live and dead standings and fishing gear entanglements. A total of 17 species of small cetaceans have been recorded in Kenya so far, with the most frequently recorded inshore species being Indo Pacific bottlenose dolphins and Indian Ocean humpback dolphins. Offshore, killer whales, short fin pilot whale and long snouted spinner dolphins are often sighted. In EEZ waters near the Kenya/Somalia border Longman's beaked whales have been reported by MMO's. Stranding reports provide valuable information on other offshore species.

- **"Photo-identification of *Tursiops sp* of Nosy Be region between 2007 and 2014", presented by Tahina RASOLOARIJAO (IHSM)**

A High density of cetaceans has been reported in the northwestern region of Madagascar, including the recently discovered Omura's whales and coastal dolphin species, such as the Indo-Pacific humpback dolphin (*Sousa plumbea*) and bottlenose dolphin (*Turiops aduncus*). In 2007-2014, photo-identification monitoring dedicated to T. *aduncus* and *S. plumbea* was conducted in three study sites, around the islands of Nosy Mitsio, Nosy Be, and Nosy Iranja / Ampasindava Penisula. The objectives

of the study were to produce abundance estimates and to assess population structure. To meet the assumptions of the mark-recapture models, data was processed using a custom database allowing for systematic comparisons based on photo quality and dorsal fin distinctiveness. Individual identification was based on photographs from both sides of the dorsal fin. All photographs were manually labelled and compared to detect within and between years recaptures and build up a catalogue for the population. During 167 days of survey effort, 167 *T.aduncus* groups were sighted, resulting in 792 dorsal fin photographs. After filtering for quality ("Fair", "Good" and "Excellent") and distinctiveness ("Not Useable" excluded), the catalogue included 173 left- and 162 right-dorsal fins. The total number of between-year recaptures was 40 and 33 for left and right dorsal fin respectively. The recapture history of each individual will be used in the near future to run population models and produce reliable abundance estimates for the region. Similar work will also be conducted for *S.plumbea.*

- **"Abundance estimation of two species of coastal dolphins: the Indo-Pacific and the common bottlenose dolphins" , presented by Vanessa Estrade (Globice)**

Abundance estimates of two Tursiops species inhabiting Reunion Island waters were calculated using 2009-2015 photo-identification data and two types of mark-recapture models: Robust Design models for the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) and Jolly-Seber open population models for the common bottlenose dolphin (*Tursiops truncatus*). The population of Indo-Pacific bottlenose dolphins is small,totalling 71 individuals (CI = 60.2-84.0). Due to its high site fidelity, coastal habitat and genetic isolation, this species is highly vulnerable, in particular in the context of growing urbanization. The common bottlenose dolphin's population is larger (254 individuals, CI=191-337), exhibits a larger home range and is less impacted by interactions with human activities.

- **"Halting humpback dolphin bycatch in the shark nets in KwaZulu-Natal, South Africa" , presented by Shanan Atkins (University of Witwatersrand, SA)**

Endangered Indian Ocean humpback dolphins *Sousa plumbea* are bycaught in shark nets in KwaZulu-Natal, South Africa. Shark nets are gillnets set to intentionally lower the population size of sharks to lower the probability of shark attacks. An average of 6.7 humpback dolphins were caught per year at 46 beaches between 1980 and 2009, with a strong spatial bias towards one beach, Richards Bay. Annual catch rate fluctuated drastically at Richards Bay but was consistently low at the other beaches. The sex ratio was skewed to males (2:1), and adolescents were more prone to entanglement than adults or calves. Using photo-id, we discovered residency was low, yet site fidelity was high. Only a few dolphins could be considered resident, but many individuals return year after year. Lagged identification rates decreased over time: in the long run, there was a permanent loss of individuals from the population. Ten percent of our distinctive individuals were identified among the bycatch, evidence that a significant portion of the loss was to the shark nets. Richards Bay may be an attractive sink or ecological trap, i.e. an area of high habitat suitability and high anthropogenic mortality.

As such, the effects of the shark nets on the wider population could be quite serious. Changing gear from gillnets to baited hooks has resulted in some mitigation of the bycatch but 700m of shark nets remain at Richards Bay and further substitutions are unlikely. Recently, we have changed our focus and are now viewing the bycatch problem as part of a human-wildlife conflict. Current work includes investigating stakeholders' attitudes to sharks, shark attack and shark nets. We envision a program to identify and test a greater variety of alternatives to shark nets.

- **"Protection and valuation of whales and dolphins by the local community in the municipalities of Anakao, Soalara Sud and Saint Augustin, Toliara, South west of Madagascar" , presented by Norbert Andrianarivelo (IHSM)**

For decades, the communities of fishers of the three municipalities of Anakao, Soalara Sud and Saint Augustin in the Southwest region of Madagascar, were hunters of cetaceans. Socioecological interviews indicated that thousands of cetaceans were caught there for local consumption and sale between 1970 and 2000. In 2008, the Fikambanana Miaro ny Trozona sy Fesotra (F.M.T.F), or Association for the Protection of Whales and Dolphins, was created after a series of workshops on the conservation of marine mammals that we carried out jointly with the Madagascar National Parks. The goal of this association is to protect and to valorize marine mammals through community-based whale watching and the application of the local laws. Since 2010, the hunters of the cetaceans have been trained to become tourist guides and take whale and dolphin watchers on the water using traditional and motorized dugout canoes. As a result, the number of the guides rose from 6 in 2010 to 27 in 2018, and the number of the whale watcher tourists from 143 in 2010 to 1568 in 2018. The price varies from 40,000 Ariary (11.76 Euros) to 60,000 Ariary (17.65 Euros) per tourist according to the location and the duration of the excursion. All local laws related to hunting and codes of good conduct for whale watching are written using the local laws or 'Dina' that are strongly respected by the local communities. Recognizing the advantages of these activities, the local communities which previously were cetacean hunters, are now becoming strictly protectors of cetaceans.

- **"What whales and dolphins can tell us about the health of our oceans- an overview of marine mammal research in the Eastern Cape, South Africa" , presented by Stephanie Plön (Nelson Mandela University, SA)**

Cetaceans are recognized as sentinels of ocean health yet are inherently difficult to study. Thus, the combination of different aspects of cetacean biology is needed to gain a good understanding of their ecology and health status. Applying a range of research techniques assists us in determining the health of both individuals as well as populations, both in the veterinary and in the ecological sense.
Cetacean research in the Eastern Cape, South Africa, was re-started in 2006. Initial investigations included detailed necropsies of dolphins incidentally caught in shark nets off KwaZulu-Natal. The development of a veterinary-pathology protocol allowed more systematic investigations of carcasses, including diet analyses and the determination of other biological parameters, and was later expanded to animals stranded along the Eastern Cape coastline. In addition, boat-based surveys were initiated in Algoa Bay to determine spatio-temporal distribution of cetaceans in light of numerous pending anthropogenic developments; the results are now being used to inform marine spatial planning exercises for the bay. Follow-on studies include investigations of baleen whale (both humpback and southern right) mother-calf pairs in Algoa Bay and potential impact from shipping due to a new deep-water port development. Furthermore, population structure and connectivity of delphinids found along the Wildcoast is being investigated and continued monitoring is being carried out along that coastline.
An important development was the formation of the SouSA Consortium in 2016 between 18 partners from 15 different institutions with the aim to address the conservation biology of humpback dolphins at a national scale due to a national red list assessment from 2014/15, which evaluated the species as 'endangered' in South African waters. Several projects are currently being carried out under the Consortium in an effort to develop a conservation and management plan for the species in South African waters.

- **"WCS in Africa. Current projects and future plans" , presented by Tim Collins (WCS)**

WCS has an extensive history of cetacean work in the Western Indian Ocean. Initiated in 1996 in Madagascar, early work focused on the population biology of Southern Hemisphere humpback whales, that visit Malagasy and Comoros Archipelago waters during the austral winter. Work included development of estimates of population size, population identity (using genetics), assessments of habitat use (particularly mothers and calves), migratory pathways (using satellite tagging as well as regional photographic and genotypic matching) and the development of national whale watching guidelines and an associated law. The work expanded in the early 2000s' and included a new focus on dolphin hunting in the southwest of Madagascar as well as surveys for other marine mammal taxa at new sites, including an extensive line transect and interview survey of the west coast. These and other new research efforts continue under the direction of other programs (New England Aquarium and IHSM). Line transect and interview surveys were completed in Tanzania, including identification of cetacean and dynamite fishing hotspots. These are the focus of current marine spatial planning work by WCS and continued surveys (Gill Braulik).

Current WCS work focuses on improving the available data for marine spatial planning efforts in Kenya, Tanzania and Madagascar. This includes compiling existing data for MSP analyses, as well as initiating new surveys where essential gaps have been identified. New fieldwork includes a humpback whale satellite tagging campaign in Kenya and a plan to complete a line transect survey for cetaceans off the southern tip of Madagascar (a putative MPA) in May/June 2020. WCS is also leading a concerted effort to develop a large-scale regional project that addresses shipping, its associated threats (noise and ship strike) and the lack of regional capacity for related analyses and threat mitigation. This is linked directly to a regional push to develop the Blue Economy, particularly maritime trade (increased shipping and new ports). The hope is that such a project will help fill both biological and management gaps for cetaceans in the Mozambique Channel in its first phase, although the ambition is to expand the project regionally in future as capacity and funding permit.

- **"Humpback whale mother-calf interactions", presented by Anjara Saloma (Cetamada)**

Humpback whales use vocalizations during diverse social interactions or to organize activity such as foraging or mating. Unlike songs, which are confined to males, social calls are involved in social interactions, and have been reported to be produced by all types of individuals, adult males and females, juveniles and calves alike. Recent studies have described these social calls in different geographic areas; however, the context and biological functions of these social calls remains unknown. This study aims to investigate the vocal repertoire of humpback whale calves during interactions with their mothers. We recorded mother-calf vocal activity during the breeding season in Madagascar by using Acousondes tags (Cetacean Research Technology) attached to mother-calf pairs (either mother or calf or both). Based on a previous description of the vocal repertoire of social sounds in the study area, we were able to identify nine types of calls by calves, varying from low to mid-frequency, including one call presenting amplitude modulation. Two of the calves' vocalizations reported in this study were similar to calves' vocalizations described in the literature of other geographic areas, and four call types appeared to be group specific. Though humpback whale calves' vocalizations are in general relatively simple in structure, we found that calves are also able to produce combined calls, composite calls and sequenced calls. Such diversity in call production may be part of the vocal ontogeny of humpback whales and could lead to a more stable and complex vocal repertoire at adulthood.

Videos of deployments and those from deployed tags, including calf suckling, were presented.

- **"Regional variation in humpback whale song within the western Indian Ocean" , presented by Adrian Fajeau (Globice)**

The humpback whale is one of the best-studied mysticete species, but its movement patterns within the southwestern Indian Ocean (SWIO) breeding ground are complex and yet poorly understood. Photographic identification, genetic and satellite tracking data have revealed some population structure between different sub-regions. Male humpback whales sing a song shared at the population level that is useful for defining population structure and connectivity, and thus we might expect some differentiation in SWIO song structure based upon population subdivisions. To assess this, autonomous recorders were deployed at four sites in the SWIO, off Réunion Island, northeast and northwest Madagascar, and Tanzania, during austral winter 2018 in order to define spatiotemporal patterns of song occurrence and compare song structure among sub-regions. Quality of recording and presence of songs were noted for the first 20 minutes of each hour (8083 spectrograms manually reviewed, for a total of 2694 hours of recording for the first three sites, with Tanzania currently under analysis). The daily occurrence of songs was assessed for each site to describe the temporal distribution pattern of whales. Songs were recorded from late June to early October, with higher occurrence observed in NE Madagascar. High quality samples of song sequences were selected from all sites, defining early, mid and late season periods. All phrase types recorded in Reunion were shared with Madagascar, and there also appears evident temporal variation that may be distinct to the different sub-regions. Results suggested a high connectivity between Reunion and Madagascar during the breeding season as would be expected from previous photographic and satellite telemetry data, but also the potential for introduction of novel song material into Madagascar, possibly from another population. Adding data from Tanzania, as well as further quantitative analysis will provide a better understanding of humpback whale population connectivity within the western Indian Ocean.

5. Friday 12th July - Perspectives for Indocet

The purpose of this session will be to present the way Indocet operates, share ideas on how to improve communication and networking and identify regional actions that could be implemented regionally.

It started with the presentation of the IndoCet Consortium by Violaine Dulau, chair of the Executive Committee:

- Background to IndoCet (origin, conception etc.)
- Roles of the Executive Committee:
    - Membership review
    - Coordination of Consortium Activities
    - Convene meetings, etc.
- Informal status (no membership fees)
- Purpose: increase communication between regional researchers
- Once a year, members provide a summary of their activities, metadata and publications
- Membership rights
    - Indocet Flukebook access
    - Indocet website access
        - Metadata access
        - Publication upload/download

- Membership applications encouraged to coincide with the next meeting of the Executive committee
  - Membership Term of Reference provided on website
  - Active members are actively engaged in cetacean research
  - Associate members are from other regions

A brief report of the Important Marine Mammal Areas (IMMA) workshop for the western Indian Ocean and the Arabian Seas was also provided to the group. The IMMA is a global initiative developed by the IUCN Marine Mammal Protected Areas Task force (www.marinemammalhabitat.org) aiming to define discrete portions of habitat important for one or several marine mammal species. IMMAs have no legal standing as Marine Protected Areas, but are rather an advisory, expert-driven classification based on existing scientific data. The IMMA process for the Western Indian Ocean and Arabian Seas was launched in 2019. A regional workshop took place on March 4th-8th 2019, in Salalah, Oman, and involved 38 marine mammal scientists and observers from 15 countries, with several more scientists contributing to assessments and proposals remotely. During that workshop, a total of 55 candidate important marine mammal areas (cIMMAs) were identified and 13 areas of interest (AoI) were proposed as locations where further research is merited. The cIMMA proposals are now undergoing peer review by an expert panel.

After the presentation on Indocet and IMMA, several topics were addressed and discussed by the attendees:

- **1. Improving communication**

The group discussed the best strategies for network communication. To date most Indocet communication is conducted through the Facebook page and the website.

- **IndoCet Facebook page** offers an opportunity for members to share news and comment on events. To date, the page is managed by Globice, but inputs from other members are needed to boost the page. Members are welcome to contribute by sending posts to be published on the Indocet page. It was also proposed that several members (rather than only one) could manage the page, to publish more accurate information from the region.

- **Indocet website** (www.indocet.org) was designed to be an interactive tool, whereby members can upload their publications and share information about their available data (metadata related to Tracking, Photo-ID, Biological Samples, and Acoustic recordings) in order to facilitate collaboration. The website also allows to apply for membership online. At the time of the meeting, a new version of the website was being developed to improve some of the functionalities. In the new version Indocet members will have a password protected user account to enter and edit their own data (publication, metadata). Participants interested in requesting membership were invited to wait until the end of September to apply online on the new website version.

The creation of a Google group was proposed to facilitate communication among members. Creating a Facebook group might also be useful. A newsletter would also help increase communication.

- **2. Fundraising**

The general issue of fundraising for Indocet activities was discussed. To date, IndoCet cannot raise funds, because it is an informal network and not a NGO. Collaborative projects have to be led and funded by existing organizations. The participant recognized that there are essential network funding needs, including website maintenance and network coordination. The website is currently maintained by Globice, but dedicated funds will be needed to maintain the website in future. One potential option is to include a website overhead for IndoCet linked projects. This will need coordination and encouragement.

- **3. IndoCet internal organization and coordination**

Although the group recognized the need for an Indocet coordinator, inputs and motivation from active members are essential and greater involvement of the Executive committee is encouraged. Active members can help create a dynamic where all members participate in maintaining the momentum of the website and group. To keep the network active, it was proposed that the members should be encouraged to commit to the following tasks:

- **Submission of annual reports on project activities**. This requires members to provide reports on regional partnership in place and coordination, perhaps by a member of the Executive Committee.
- **Annual updates of publications and metadata on the website.** Founding Indocet members have already entered their data, but updates are needed and new members should be encouraged to also provide this information. It was proposed to make it a condition of membership.
- **IndoCet meeting organization and funding**: dedicated meetings are expensive, and likely to be rare, requiring dedicated funds from appropriate donors. Consideration should be given to meeting informally and opportunistically around the edges of other meetings, including the upcoming WMMC in Barcelona, WIOMSA, HWWC etc. Members are also encouraged to raise funds for other types of IndoCet meetings (e.g stranding workshops or other capacity building workshops).

- **4. Expanding network activities within Indocet**

Several ideas emerged and were proposed to be conducted under Indocet.

4.1. Flukebook

- Flukebook for humpback whales

The participants recognized the effort that was put into developing a regional data sharing platform and were motivated to upload their humpback whale photo-ID data into the standard Indocet format. Some organizations committed to it by the 5th of November:

- Reunion – Globice (Violaine Dulau)
- Madagascar – Cetamada (Anjara Saloma),
- WCS (Tim Collins)
- Mayotte – Tsiono (Jeanne Wagner)
- Kenya – WMA/KMMN (Mike Mwang'ombe)
- Mozambique – Zavora (Nakia Cullain)
- South Africa East Coast – WildOceans (Rachel Kramer)

However, this requires updating the field "Location ID" (survey regions for each country) for South Africa, Mozambique and Kenya. Designation of location ID should be made per country, in concertation with research groups, to avoid overlaps. The names of the specific Location ID need to be sent by email to Violaine Dulau, who will update and send the properties file to WildMe.

- Flukebook for dolphin species

Participants expressed their interest in using Flukebook for other species. More specifically, the group discussed databasing and matching options for Sousa and Tursiops.

- Tursiops is already implemented within Flukebook. Although it has been initially developed for *T.truncatus*, it should work for *T.aduncus*, although this hasn't been tested yet. Steps are being taken to improve the CurvRank algorithm following a Sarasota dolphin study.
- Drew described needs for implementing a Sousa catalogue within Flukebook:
  - The programming needs might be simple if the existing CurvRank algorithm developed for Tursiops works. Testing for Sousa using the existing algorithm would need ~500 Euros worth of work that then needs testing. Possibilities for funding this work through AFB (Agence Française pour la Biodiversity) were raised.
  - If testing using the existing CurvRank algorithm it would be the responsibility of the researcher to test it. Researcher uploads their photos (a few hundred) and looks at matching accuracy relative to their own matching history.
  - If the existing CurvRank solution does not work then adapting Flukebook to also work for Sousa will be more complicated and will require:
    - Development of a new algorithm which requires 1000-5000 photos and ~$30,000. Testing needs a representative training set that contains all of the characteristics that might be seen in animals in future. If too few photos are used in the development phase it can lead to a problem known as 'overfitting' (the algorithm learns how to distinguish a few individuals very well).
    - In discussion Stephanie Plön also described the distinctive coloration that some Sousa have on the hump and flank that can also be useful for ID, and which may require additional consideration.

- A list of potential Sousa and Tursiops uploading commitments was recorded at the meeting
  - Sousa
    - Mayotte – Jeanne Wagner
    - Kenya - Mike Mwango'mbe
    - Durban/Richards Bay - Shanan Atkins
  - Tursiops
    - Madagascar (Nosy Be) - Tahina Rasoloarijao
    - Mayotte – Jeanne Wagner
    - Reunion - Globice

Drew mentioned that there is an existing manual matching tool within Flukebook that can be used to compare Sousa catalogues (or indeed any other species). The tool may need some improvement, but identifying required work requires user use and feedback.

- Flukebook for citizen science

The group also discussed how to improve the reporting of incidental encounters by opportunistic observers (public, citizen scientists etc). Facilitating incidental reporting was considered an important requirement from a public and donor-based perspective. A facility exists in Flukebook but is not yet perfect. Several modifications are needed to improve the existing workflow, which requires some funding (Euro 2000-3000). The potential advantages of these improvements include enabling data submission via the Indocet Flukebook page, and other potential modifications, including:

- Sending an automated thank you email to the data submitter, specific to Indocet;
- Approval for the submission by a local project coordinator. This would involve having an unapproved/approved status for the submitted images. Once an image has been submitted, the coordinator would receive a notification of the submission. Project coordinators would be responsible for validating and matching the images. Currently there is no way in Flukebook to easily pool unassigned or unmatched submissions.
- An automated thankyou could be sent to the submitter if a submitted fluke leads to a match
- A completely automated process from submission to matching, as being developed by NOAA-Ocean Alert

Participants provided various feed-back on citizen science:

- Jeanne Wagner described her experiences from Mayotte. Public participation is currently low, despite the popularity of whale watching etc.
- Michael Mwang'ombe described the Kenya situation – data flow is also low, which also means that local coordination is currently practical timewise and can be useful (the Kenya Marine Mammal Network experience).
- Rachel Kramer described the Durban experience – users are always thanked for submitting their whale observations.
- In Reunion, public participation is quite high, but it is done through email exchanges.
- The group agreed that providing feedback to people submitting data or information via websites was essential. This is best accomplished through the use of a

standardized form for data entry and generation of an automated "thanks for submitting" email, but the group also recognize the need for a coordinator to manage and validate opportunistic data.

4.2. Set up an IndoCet stranding network

There are opportunities to coordinate some stranding activities through IndoCet, although the extent of this coordination remains to be established. These activities could include:

- **Identifying stranding capacity within IndoCet**

  Stephanie Plön offered to complete a review of existing capacity, including generating a list of first responders. It was noted that a list of strandings capacity globally was available on the IWC stranding website. Stranding network, with local coordinator, exist in Reunion, Mayotte, South Africa.

- **Reviewing existing strandings datasheets and other materials**
  Part of this could be the creation of an online IndoCet hub for datasheets and other useful stranding resources (images, videos etc.). Recent events highlight the need, including
  - Mauritius beaked whales (April 2019) - limited response, opportunity lost
  - Mozambique beaked whales (May 2019, Tofu) – Some response, but chaotic and opportunities missed

- **Stranding reports**
  A new page could be added on the Indocet website to centralize stranding reports.

- **Identifying a stranding coordinator within IndoCet**

  The coordinator would identify capacity building opportunities for IndoCet members, sources of rapid reaction funding and perhaps develop suitable proposals in partnership with IndoCet members. Stephanie Plön volunteered to coordinate stranding related activities.

- **Coordinating some of the strandings activities with those of the IWC Expert Advisory Panel on Strandings**

- **Capacity building**

  Some participants expressed the need for capacity building for dis-entanglement response. Entanglement is an issue in the region, and incidents were described for Madagascar, Mayotte, Reunion and Kenya. Workshops and disentanglement trainings can be facilitated by the IWC, and a skilled trainer available in South Africa (Mike Meyer). The IWC most recently conducted a training in Kenya. It is essential that the training is requested by a government agency of the country where the training is needed. The IWC has a standard funding template and proposal (David Mattila can provide). There was considerable interest in trying to expand the disentanglement training to other areas. Tim proposed to send emails to relevant people by way of introduction and Jeanne Wagner proposed to enquire about funding opportunity from AFB (Agence Française pour la Biodiversité).

There was also a brief discussion on **capacity building needs for ambient noise threat assessments** and earbone analysis. It was agreed that tympanic extractions and subsequent assessments can be linked to a strandings workshop(s), and that there was a need to complete a baseline assessment (normal vs abnormal) of hair cells in order to measure deterioration. This would have helped (potentially) during the recent beaked whale strandings in Mauritius and Mozambique. Tympanic extraction has already been conducted in Reunion.

4.3. Discussion on directed hunts and other bycatches

Norbert Andrianarivelo raised the issue of directed hunts in Southern Madagascar and asked if this was a widespread regional concern, and whether data collection and reporting across the network could or should be coordinated. Incidental captures and/or directed hunting and the subsequent use of carcasses for either bait (particularly in shark fisheries) or food (described variously as 'marine bushmeat' or 'aquatic wildmeat') appears to happen in several places in the western Indian Ocean. These include Madagascar, Mozambique, Tanzania and Kenya. It may occur more widely across the region. The consumption of cetaceans, particularly small cetaceans, is a growing concern for small cetaceans globally. However, some of this use is clearly opportunistic (as in the case of the Tofu beaked whales). Considerations should be given on how to facilitate reporting of these events. In discussion it was agreed that this could be a challenging network activity, and it might be sufficient to collate metadata in the first instance, perhaps as part of the annual reports.

Discussion of hunting then extended to bycatches (in fisheries in general) and entanglements. IndoCet could help with the coordination of records with a view to having them accessible in a central location (such as the website). The group agreed that it would be worth coordinating with this action with the Indian Ocean Tuna Commission.

4.4. Whale-watching

A short discussion was held on whale-watching and opportunities for cooperation between members on this issue. The simplest activity identified was to share rules and guidelines from each region, acknowledging that the IWC whale-watching handbook already exists. Opportunities for cross pollination could be found, and the data on the IWC site could be improved.

The meeting ended after brief closing statements and thanks to all participants for their attendance and contributions. Overall the participants felt that the meeting has been beneficial to increase networking and collaboration in the western Indian Ocean and expressed their interest to contribute to the Consortium activities as active members.

- "It is ours to make of it what we will"-




APPENDIX 1. Agenda

INDOCET MEETING

10-12 July 2019, Reunion Island

Venue: University of Reunion, 15 avenue René Cassin, Saint-Denis, Reunion Island

Intended audience: Workshop open to Indocet members.

AGENDA

Wednesday, July10th

Opening session (8:00 -8:30)

Welcome to participants, short introduction to Indocet, round table

Session1: Flukebook training course, by Drew Blount, WildMe (all day 8:30-17:00)

Flukebook (www.flukebook.org) is an online data sharing platform developed by WildMe that include automatic matching tools for humpback whales and other species (bottlenose dolphin, sperm-whales, etcc..). Indocet has been working in close collaboration with WildMe to develop Flukebook features specific to the consortium needs. In order to conduct regional comparison within the western Indian Ocean, standardized data formats are used among Indocet members.

This session will enable participants to learn more about the functionality of the research tools, how to upload and export data under the Indocet standard format, examine and test the automated matching algorithms, learn more about how data is secured and shared online.

Thursday, July 11th

Session 2: Presentation of the organizations involved in cetacean research in the region (8:00-9:30)

This session will aim at introducing each participant and their organization (background, area of expertise, species studies, data available, etc…), to provide a general overview of the actors and actions being undertaken in the region and to enhance networking.

9:30-10:00 ***Coffee break***

Session 3: Cetacean Research and Conservation within the western Indian Ocean

This session will be dedicated to cetacean research and conservation actions being conducted in the western Indian Ocean. Participants are encouraged to present their work, scientific results or any topic that may be of relevance to Indocet.

Presentations:

- **10:00** The protection of humpback whales in the Western Indian ocean through a legal approach, by **Stephanie Sorby** (University of Reunion)
- **10:20** Assessment of cetacean diversity, hunting, by-catch and stranding in South of Madagascar, by **Norbert Andranarivelo** (IHSM)
- **10:40** A feedback on whale-watching management in Mayotte, by **Jeanne Wagner** (PNMM/AFB)
- **11:00** Whale-Watching in Reunion Island, by **Mayeul Dalleau** (CEDTM)
- **11:20** Environmental influences and coastal zone usage of humpback whales (*Megaptera novaeangliae)* in Zavora, Mozambique, by **Nakia Cullain** (Zavora Lab)
- **11:40** Using environmental parameters in feeding grounds to understand variations in humpback whale sighting frequency in La Réunion Island, **Alexandre Modi** (Globice)

12:00-13:30 Lunch break

- **13:30** The Kenya Marine Mammal Network: Research and Citizen Science 2011 - 2018 - Large whale and baleen whale findings, by **Michael Mwang'ombe** (Watamu)
- **13:50** The Kenya Marine Mammal Network: Research and Citizen Science 2011 – 2018 - Small Cetaceans in Kenya, by **Michael Mwang'ombe** (Watamu)
- **14:10** Photo-identification of *Tursiops sp* of Nosy Be region between 2007 and 2014**,** by **Tahina RASOLOARIJAO** (IHSM)
- **14:30** Abundance estimation of two species of coastal dolphins: the Indo-Pacific and the common bottlenose dolphins, by **Vanessa Estrade** (Globice)

15:00-15:30 Coffee break

- **15:00** Halting humpback dolphin bycatch in the shark nets in KwaZulu-Natal, South Africa, by **Shanan Atkins** (University of Witwatersrand, SA)
- **15:20** Protection and valuation of whales and dolphins by the local community in the municipalities of Anakao, Soalara Sud and Saint Augustin, Toliara, South west of Madagascar, by **Norbert Andrianarivelo** (IHSM)
- **15:40** What whales and dolphins can tell us about the health of our oceans- an overview of marine mammal research in the Eastern Cape, South Africa, **by Stephanie Plön** (Nelson Mandela University, SA)
- **16:00** WCS in Africa. Current projects and future plans, by **Tim Collins** (WCS)
- **16:20** Humpback whale mother-calf interactions, by **Anjara Saloma** (Cetamada)
- **16:40** Regional variation in humpback whale song within the western Indian Ocean, by **Adrian Fajeau** (Globice)

Friday, July 12th

Session 4: Perspectives for Indocet

The purpose of this session will be to present the way Indocet operates, share ideas on how to improve communication and networking and identify regional actions that could be implemented regionally.

- **8:00** Indocet governance, membership and communication

  9:30-10:00 ***Coffee break***

- **10:00** Reporting on the western Indian Ocean and Arabic Sea IMMA workshop, by **Violaine Dulau** (Globice)
- **10:20-12:00** Open discussion on regional needs and perspective for Indocet

Session 5: whale watching off the west coast of Reunion (14:00-16:00)