2022 - IndoCet Meeting report



## INDOCET CONSORTIUM MEETING

## Promoting collaboration among cetacean researchers

in the south-western Indian Ocean



## Special Session of the WIOMSA Symposium

Nelson Mandela University – Port Elizabeth – South Africa

October 14<sup>th</sup>, 2022



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# 1. CONTEXT AND OBJECTIVES OF THE MEETING

The IndoCet meeting was held on Friday 14 October 2022, as part of a special session of the <u>WIOMSA</u> <u>Symposium</u>. The meeting was a full day workshop which offered an opportunity to reinforce contact among regional cetacean researchers, discuss progress on IndoCet activities, identify priority actions and inspire new collaborative initiatives. The Special Session was open to all IndoCet members and any cetacean researchers from the SWIO that might be interested in joining the network.

The general goal of the meeting was to increase regional collaborations on cetaceans. More specifically, the objectives of the session were to:

**1**. Present, discuss and foster further development of IndoCet tools and regional research programs;

**2.** Set priorities and identify collaborative actions that could be implemented in the future, together with identified or potential funding opportunities;

**3.** Discuss governance, seek involvement from IndoCet members and share ideas on how to improve communication and networking.

The agenda of the meeting is presented in Appendix 1.

The workshop participants represented different organizations involved in cetacean research and conservation in the following countries: Madagascar, Mauritius, Mozambique, Kenya, Tanzania, Reunion, Mayotte, South Africa. The list of participants is provided in Table 1 below.

Last name	First Name	Affiliation	Country
Andrianarivelo	Norbert	Institut de l'Enseignement Supérieur d'Anosy (IESA)	Madagascar
Atkins	Shanan	University of the Witwatersrand	South Africa
Barteneva	Svetlana	Marine Megafauna Conservation Organization (MMCO)	Mauritius
Boyd	Charlotte	Conservation International	Kenya
Braulik	Gill	University of St. Andrews	UK
Cerchio	Salvatore	African Aquatic Conservation Funds (AACF)	Madagascar
Collins	Tim	Wildlife Conservation Society (WCS)	Kenya
Dulau	Violaine	Globice	Reunion
Estrade	Vanessa	Globice	Reunion
Fajeau	Adrian	Globice	Reunion
Fisseau	Charline	Centre d'Etude des Tortues Marines (CEDTM)	Reunion
Gancille	Jean-Marc	Globice	Reunion
Kalashnikova	Ekatarina	Under the Wave	Zanzibar
Leroy	Emmanuelle	Globice	Reunion
Mwango'mbe	Michael	Watamu Marine Association	Kenya
Penry	Gwen	Institute for Coastal and Marine Research	South Africa
Plön	Stephanie	Stellenbosch University	South Africa

### **Table 1.** List of participants (alphabetical)

Randrianarivony	Cyrielle	Ceta'Maore	Mayotte
Rasoloarijao	Tahina	IESA/AACF	Madagascar
Saloma	Anjara	Cetamada	Madagascar
Sanders	Yvonne	Port Elizabeth Museum	South Africa
Shabangu	Fannie	SA Department of Forestry, Fisheries & the Environment	South Africa
Terrapon	Maeva	University of St. Andrews	UK

Christopher Johnson (WWF-Australia) and Ted Cheeseman (Happy Whales - USA) also participated as invited speakers.

## 2. GENERAL PRESENTATION OF INDOCET

General information about the IndoCet Consortium was provided by Violaine Dulau (Globice), together with an up-date on recent activities.

Initiated in 2014, the network currently comprises 40 members, all of whom are actively involved in cetacean research in seven countries of the region (Kenya, Tanzania, Mozambique, South-Africa, Madagascar, Reunion/Mayotte, Mauritius) as well as ten associate members. The Consortium is dedicated to all cetacean species across the South Western Indian Ocean (SWIO). Its primary goals are to improve knowledge on and promote conservation of cetaceans in the SWIO; to facilitate communication and foster collaboration between research groups and to develop capacity in the region. Several activities have been implemented since the creation of the Consortium, including the creation of an interactive



website and a newsletter reporting on in-progress research programs and recent publications, to establish communication within the group and serve as the public forum for the Consortium. Extensive effort has been put into the development of a regional database to facilitate data sharing and matching of humpback whale photo-identification data. The network has also been actively involved in collating existing data on cetacean stranding events and in coordinating stranding responses.

To date, the Consortium does not have a status as a formal legal organization but rather works as a network of individual researchers and/or people actively involved in cetacean conservation in the SWIO. The structure and operating rules of the Consortium are described in a Memorandum of Understanding (MoU), agreed upon by the members, to ensure that all members are guided by the same goals and wish to work together under a common understanding.

The Consortium is led by an Executive Committee (EC), initially elected by the founding members and currently comprises 7 members. The role of the EC is to coordinate and plan the activities of the network, communicate the activities of the Consortium, facilitate communication among members, review membership applications and plan and convene regular meetings.

# 3. UPDATE ON THE INDOCET ACTIVITIES

## 3.1. INDOCET MEETINGS

The IndoCet Consortium has managed to meet in person 5 times over the last 8 years since its conception in 2014 (2015 in Madagascar, 2017 in Reunion, 2019 in Reunion and Barcelona and 2022 in South-Africa), a very satisfying frequency. The 2022 meeting was held as part of the WIOMSA Symposium as several members were already attending the Symposium on their own funds or were funded as part of regional programs such as COMBAVA, led by Globice and funded by the European Union, and QWIO, led by WCS and funded by FFEM. The WIOMSA Scientific Symposium also offered an opportunity for members of the Consortium to present some of their work during the Cetacean sessions, either as <u>oral</u> or <u>poster</u> presentations.

It was agreed that organizing the IndoCet meeting as part of the WIOMSA Symposium was generally a good idea. It was thus proposed that the consortium uses future WIOMSA Symposia, which take place every two years in different countries of the SWIO, to try and convene future IndoCet meetings. Grouping these events might encourage more people to submit and present their work at the WIOMSA Symposium, resulting in a higher representation during the marine mammal session. An interest has been expressed by the Executive Secretary of WIOMSA for more cetacean representation in the WIOMSA; a discussion between IndoCet and the organizers can be launched about WIOMSA support to IndoCet for the next Symposium.

## 3.2. INDOCET WEBSITE

The website creation was funded by the Indian Ocean Commission in 2015. Since then, the maintenance and further developments of the website have been undertaken and funded by Globice. The intention is to design an interactive website that allows IndoCet members to have their own user account and login through which they can share and access information.



- Publication page: this section aims to centralise cetacean publications from the region. To date, 77 publications have been up-loaded, mostly peer-reviewed papers but also IWC papers and reports. IndoCet members are kindly invited to complete the table with their own publications and unpublished reports. This is a good source of information for the network and the people visiting the website. The general public can see the list of publications and the link to the journal, whereas IndoCet members can have direct access to the paper (provided that the authors uploaded the pdf version of it) when logged in to their account. During the discussion the need to add a new column in the table to indicate the region / country of the study was identified. This will be completed in the near future.
- <u>Metadata page</u>: this section gives information on existing data. As with the publications page, the members are invited to fill the metadata tables. There are different tables for each data type: satellite tracking; photo-ID; biopsy; acoustics etc. A new column could be added to be able to provide a D.O.I for existing datasets, if they exist. It was suggested that the Executive Committee chair or co-chair send regular reminders (one or twice a year) to invite the members to update their metadata.
- <u>Report a stranding</u>: this new page provides a way to report and centralize information on stranding events. It indicates the places, the people to contact, the species, etc. The public can see part of the table and the members can see all. It is possible to edit the entries, but not to erase them. Care is required to not create duplicates. The strandings reported before 2020 have been compiled for the purpose of the publication led by Stephanie Plön. This historical data will be either imported into the online table, or as a downloadable spreadsheet. Therefore, IndoCet members are invited to report strandings data after 2020 in the online table. An interactive map has been created to visualize stranding data, with a possibility to filter the data by family. The map is created

using Google Maps, limiting the number of layers to 10, so strandings are grouped by family and not by species. This map does not update automatically and will thus be updated once (or twice) a year. To date, the section "report stranding" falls under the "research" menu, and there is a dedicated "stranding network" page under the "collaboration" menu. More thought is needed to see how to best organize the information (including creation of links between the two sections).



 Collaboration/Regional projects page: the "Collaboration" page presents the activities that are led by IndoCet and coordinated by the Executive Committee. The "regional project" page presents the regional projects or initiatives based on collaboration between IndoCet members but not implemented by IndoCet. For now, two regional projects are presented but additional projects can be added. Resources: IndoCet is a network of individuals, but many members belong to and represent organizations, so a "main organisations" page has been create under the "resources" menu to provide information on the organizations currently working on cetaceans in the SWIO (contact, logo, etc.). The logos need to be updated and members are invited to send their logo in high resolution (by e-mail at: info@indocet.org). Other pages have been created under the resources menu, which allow access to previous newsletters, species identification cards and links to the Important Marine Mammals (IMMA) identified in the region.

The ambition is to further develop in IndoCet website to make it a repository that allows centralization and visualization of the cetacean data available from the region. This includes:

- An interactive map of available satellite telemetry data. During the tagging workshop that initiated the creation of IndoCet, humpback whale tagging datasets from the SWIO were grouped together and an animation was created. This animation is currently available on the IndoCet website, but the intention is to create an interactive map where users could select particular tracks and have information about the owner of the dataset and other metadata. Ideally a DOI could also be provided, so that the data are appropriately referenced. Violaine Dulau will be contacting the group to gather the available data for this purpose. Different mapping tools will be explored to create this map. If Google Map does not allow it, an option could be to use the portal <u>SIMM-OI</u> (Systeme d'Information Milieu Marin Océans Indien et Austral), implemented by Ifremer.
- An interactive map of cetacean sightings data collected by Marine Mammal Observers (MMO) on platforms of opportunities across the SWIO and associated survey effort. A partnership has already been developed between Nelson Mandela University and Globice (RESILIENCE oceanographic survey, on board research vessel *Marion Dufresne*), and between the Watamu Marine Association (Kenya), MMCO and Drop of Blue (Mauritius) and Globice (surveys onboard the French patrol vessel *OSIRIS II*). The organizations provided MMOs, worked with standardized protocols and have centralized data within a common GIS database. To date, the database includes the results of five surveys, and two surveys are ongoing at the time of writing a survey around the Eparses Islands onboard the *OSIRIS II* and during the Monaco expedition onboard the *SA Agulhas II*-these will be added to the database. The members are invited to share information about existing datasets that could be added to the database/interactive map. The ambition is to develop a network of MMOs to survey the SWIO onboard platforms of opportunity, to build up a long-term dataset repository.

This initiative was welcomed by the participants, and it was proposed that standardized protocol and spreadsheet could be shared on the website. It was suggested that the interactive map would allow a user to filter the data by species. This possibility will be investigated, when identifying the mapping tools (the SIMM-OI might offer the opportunity to create such interactive maps).



## 3.3. OTHER COMMUNICATION TOOLS

Several communication tools have been developed, in addition to the website:

- Newsletter: Initiated in 2020, we have managed to issue two newsletters per year, thanks to the contributions of IndoCet members. <u>Newsletters</u> are available to download on the IndoCet website and the articles also inform the <u>News</u> section of the website. The objective is to foster communication between members by sharing information about current and future project being developed in the region. Thanks for contributing!
- Whatsapp group: to share instant news, request advice or expertise from the network.
- Facebook page: the page is currently not very active and there is a need for a FB community manager volunteers welcome!
- Recently, a mailing list has been created: <u>indocet@framalistes.org</u>. Members can use this e-mail address to communicate and send info to all IndoCet members.

## 3.4. STRANDINGS NETWORK

Stephanie Plön provided a presentation of the work on SWIO stranding data that has been compiled and analyzed over the last 2 years. Between 2000-2020, 396 stranding events were reported, representing 1,258 individual animals, 17 genera, and 28 species This work has led to a publication submitted to the Journal of Cetacean Research and Management and is currently in review. The results were also presented during the WIOMSA Symposium.

Currently the "stranding network" page includes a link to a resources page, providing links to existing protocols for responding to both dead and live animals. These are



publications from different sources, and it was proposed that a simplified standardized spreadsheet and protocol to collect samples (tissue, tooth...) on stranded animals be made available. A hands-on manual that provides basic guidance and instructions for sampling is available on the Stranding page of the IndoCet website (see Plön et al., 2015, Supp. Mat.). A guide produced by Pelagis, the coordinator of the French stranding network, to assess the possible anthropogenic causes of death could also be a useful source of information. They will be contacted to see if they can be shared on the IndoCet website.

Stephanie Plön invited the members to contact her for capacity building and training needs. IndoCet members were also invited to systematically report stranding events on the "report a stranding" page of the website.

Discussion regarding the "report a stranding" page: only verified data (species, etc.) should be reported in the table. Indocet membership is a first "filter" to ensure data quality, and limits a user ability to report a stranding unless they are logged in. It might also be useful to identify a stranding coordinator for each country/region for reporting stranding events on the website. Stephanie Plön (as well as Stephanie Norman) can also assist with checking and assessing data quality before accessioning it on the website.

During the meeting it was proposed that another table be created that facilitates reporting of live entanglements or interactions with other human activities (for instance ship strikes and hunting). Causes of death (strikes, hunting...) can be reported in the field "cause of death". Again, this information needs to be double checked and provided with some further information.

It was discussed whether it would be relevant to add the contact list of the local stranding coordinators and networks existing in the region to help communication of citizen reports.

It was proposed that IndoCet could get involved in the bycatch working group of the Indian Ocean Tuna Commission.

Discussion on the mass stranding of melon-headed whale that occurred in August 2021 concurrent with the Wakashio grounding ("Wakashio event"): the IWC has not yet received any veterinary report, only photos. A discussion is ongoing with the Mauritian government to conduct a necropsy workshop, but reaching a comprehensive understanding of what happened using the remaining frozen carcasses will be hard. The workshop would thus be more of a training and capacity building exercise led by the IWC for Mauritian veterinarians. Svetlana Barteneva, from MMCO, mentioned that it should be organised within the next six months, as the carcasses need to be removed.

Globice is currently planning a training workshop in Reunion to be delivered by IWC experts on disentanglements in 2023. A similar training is also being organized in Mayotte. Some consideration was given to organizing a regional workshop, but the advice of the was to host local workshops in order to be able to involve more people at each site. Moreover, requests for training to the IWC must be made formally from an accredited agency on behalf of the country.

## 4. REGIONAL RESEARCH PROGRAMS

Several collaborative initiatives have been conducted in the SWIO region. These regional research programs are not led by IndoCet but are based on the partnership and contribution of several IndoCet members and their institutions.

### 4.1. COMBAVA

Adrian Fajeau presented the project COMBAVA (COoperation régionale pour l'étude des Mouvements des Baleines à bosse et VAlorsation des résultats) led by GLOBICE in collaboration with Salavtore Cerchio (AACF), with the contribution of several partners from the region (Cetamada, IHSM, Watamu Marine Association, Zavora Marine Lab, Shanan Atkins, Gill Braulik, Parc Naturel Marin de Mayotte, Marine Discovery Center, WCS). The project aims at assessing temporal distribution and humpback whale song structure and provide insights in population structure and connectivity in the region. Autonomous recorders were deployed at several breeding sites, including Réunion Island, Madagascar, Tanzania, Kenya, Mozambique, South



Africa, Mayotte, Mauritius and Western Australia during the austral winters 2016-2022. Adrian presented the results for the 2016-2019 period, which indicate an eastward diffusion of the song from the SWIO to Australia. Given that the current funding (EU Funding-FEDER) terminates in March 2023, the prospective activites of the project were discussed. Some acoustic recorders will be deployed as part of the QWIO project in the Mozambique Channel, Reunion and Mauritius, which will allow continued data collection in 2023. Some partners will also be able to deploy recorders in 2023. Fannie Shabangu offered to provide recordings from Marion Island collected in 2018.

### 4.2. PROTECTING BLUE CORRIDORS

Christopher Johnson presented the Protecting Blue Corridors Project led by WWF-Australia in collaboration with multiple researchers around the world. The project is a collaborative analysis of 30 years of scientific data contributed by more than <u>50 research</u> groups, including several IndoCet members, and provides simultaneous visualization of the satellite tracks of over 1000 migratory whales worldwide. The <u>report</u> of the project provides the first comprehensive look at whale



migrations and outlines how whales are encountering multiple and growing threats in their critical ocean habitats and along migration 'superhighways', or 'blue corridors'. Further steps of the Protecting Blue Corridors initiative could include the development of an action plan for the western Indian Ocean. Within this perspective, WWF-Australia would like to plan and fund an initial workshop to bring people together to discuss the blue corridors concept, assess the need to co-develop and co-produce Indian Ocean Action Plan (marine connectivity for cetaceans), and identify research needs that WWF could support.

The participants recognized the effort and the quality of the works and the infographics that were produced as part of this project. It was asked if it could be possible to update the maps with new satellite tracking data, and also with other species, or other kinds of data (acoustics, etc.), showing IMMAs, etc. As part of the project, WWF signed MoU with multiple partners, and it was agreed that the data will only be used to create current infographics. Updating the map would require going back to every partner to get permission and new data. Until then, the infographics, and/or links to the blue corridor website could be provided on the IndoCet website.

It was suggested during the discussions that the workshop could be planned during the next SMM conference, which will be held in Nov 2024 in Perth, Australia. WWF can also fund data collection through public calls.

## 4.3. QWIO PROJECT

Simon Mahood presented the Quieter Western Indian Ocean (QWIO) project, led by WCS and funded principally by FFEM (Fond Français pour l'Environnement Mondial). The project, which will begin its work in 2023 and end in late 2025, aims to carry out a scientific assessment of underwater radiated noise generated by shipping and its effects on a suite of focal species, including large cetaceans, whale sharks and sea turtles in the Western Indian Ocean. The project also aims, in consultation with the private sector and relevant authorities, to identify and initiate



the implementation of concrete and practical measures to reduce noise and reduce vessel-wildlife collisions that are accepted by regional governments, ship owners, ports and relevant international authorities.

The geographical focus of the QWIO project includes the northern Mozambique Channel, the southern Mascarene plateau (Réunion and Mauritius) and the approaches to at least one port site (tentatively Maputo or Port Louis). The economic development plans of the countries of the region place particular emphasis on increasing port capacity and maritime trade, which will have the effect of increasing the levels of transport and maritime services and anthropogenic noise. The demand for ports and port services in East Africa will thus increase significantly in coming years and represents a considerable conservation challenge for the region. Without appropriate mitigation, the current threats to marine life that are associated with shipping will only increase.

The Project benefits from the support of FFEM, as well as the contributions (both financial and in-kind) of a suite of partners. The partners include the Wildlife Conservation Society (WCS), the African Aquatic Conservation Fund (AACF), the Armateurs de France (ADF), Bureau Veritas (BV), the Centre d'Etude et de Découverte des Tortues Marines (CEDTM), GLOBICE (Groupe Local d'OBservations et d'Identification des CEtacés), the Marine Megafauna Foundation (MMF), The L'Office Français de la Biodiversité (OFB), Quiet Oceans (QO), the University of St Andrews (UoSA) and Curtin University – Mauritius and Perth (UoC).

- 1. Field and Laboratory Based Research
  - 1. Improve the biological baseline for focal species
  - 2. Physical baseline for noise and shipping traffic
    - How much noise and how is it generated
    - How is the noise distributed
    - How is shipping distributed
- 2. Identification of mitigation options
  - 1. Management Strategies
  - 2. Technical Strategies
- 3. Improve regional capacity
  - 1. Technical capacity (governments, IGOs, NGOs and academic institutions)
  - 2. Awareness

- 4. Establish effective links to programmes that are relevant to these problems.
  - 1. French, regional and international programmes.
  - 2. Work with existing initiatives, or galvanize new initiatives, especially those involving the private sector (shipping and ports in particular).

### 4.4. INDIAN OCEAN HUMPBACK DOLPHIN CONSORTIUM

Shanan Atkins presented a recent initiative to create a dedicated consortium for the protection of the Indian Ocean humpback dolphin (Sousa plumbea), an Endangered obligate shallow water species that is distributed from India to South Africa. The primary goal of Indian Ocean Humpback the Dolphin Consortium (IOHDC) is to coordinate and galvanize action to improve the conservation of the species throughout its range, and thus this effort will extend beyond the boundaries of IndoCet. The IOHDC was developed by Gill Braulik, Els Vermeulen and Ada Natoli and some funding has already been secured to pay for a



coordinator (Shanan), establish a steering committee, set up a website and to start identifying and implementing research and conservation actions. First steps are planned for early 2023.

Although the IOHDC has not yet been officially launched, it was presented at the IndoCet workshop with the intention of introducing the initiative to the IndoCet membership and to see who would be interested in contributing. The idea was welcomed by the participants, and even though the IOHDC goes beyond the region covered by Indocet, a connection can be created between the initiative and IndoCet. As a start, a link to an IOHDC website could be added on the IndoCet website.

Tim Collins provided some information on the Consortium for the Conservation of the Atlantic Humpback Dolphin (<u>CCAHD</u>) that could serve as a model. This consortium has already raised significant funding to support its effort with projects launched in several AHD range states. Work has included the creation of thematic working groups, each led by a volunteer with relevant expertise. These include working groups on education, genetics, sampling of live and dead animals and implementation of the CMS Concerted Action for the species. Working groups have identified priorities and budgets that have contributed to masterplan.

Ekatarina Kalashnikova expressed her interest in the IOHDC and proposed to collect data in Tanzania and Bazaruto, Mozambique.

Cyrielle Randrianarivony was interested as well and mentioned that only 1 or 2 individuals are spotted in Mayotte. They are seen with spinner and bottlenose dolphins. She will be consulting the Marine Park of Mayotte and try to gather more information to share with the IOHD.

Norbert Andrianarivelo and Salvatore Cerchio also expressed interest. There are existing datasets in Madagascar, where in some parts of the country humpback dolphins used to be or still are hunted. The

community of Anakao have been involved in the protection of cetaceans since 2008, and some IOHD are now being sighted again in areas where they used to be hunted.

### 4.5. DECLIC PROGRAM

Emmanuelle Leroy presented the project DECLIC (DEveloppement d'un CLassificateur pour l'Identification des Cétacés), led by Globice, and which aim at developing an acoustic classifier for odontocete from Reunion, and by extension the SWIO. To date, the classifier is based on the repertoire of 6 species (Indo-Pacific and common bottlenose dolphin, spinner dolphin, pantropical spotted dolphin, melon-headed whales and false killer whales) and several species, including the blackfish, are missing. She invited members to contribute their recordings of known species in order to improve and develop the classifier. Members were invited to share their recording data of odontocetes such as Risso's dolphins, pilot whales, pygmy killer whales, killer whales, etc. Fannie Shabangu provided a new dataset with killer whales from



Marion Island. Maeva Terrapon mentioned that she will be able to provide killer whale recordings from Bazaruto, Mozambique. Humpback dolphins are not present in Reunion, but could also be added to the catalogue of species.

The classifier is being developed using the open-source software Pamguard and machine learning algorithms. The ambition is to make the final version available on the Pamguard website so that it can be freely available to researchers from the region. To date, the classifier focuses on whistles. Clicks could be added at a later stage (would require more funding).

### 4.6. KILLER WHALE STUDY

Maeva Terrapon provided a presentation of her PhD thesis, focusing on killer whales in the SWIO. She will be looking at the species distribution, based in the analysis of sighting data and acoustic detections, feeding ecology (through stable isotopes), predation pressure on humpback whales via playback experiments and tooth rakes on humpback whale flukes. She is interested in establishing collaborations with partners from the region that might have biological samples, sightings and acoustic data. More



precisely, she would be interested in getting the following information /data from IndoCet members:

- Being informed of any killer whale sightings from the region in order to improve the existing dataset.
- Being informed of killer whale strandings from the region and any sample collection
- Long term acoustic data (QWIO)

- Access to humpback whale fluke catalogues to assess the incidence of killer whale tooth rakes. That could be done via Flukebook (but needs prior agreement from the data owners) and HappyWhale.
- Any other information on killer whales.

The thesis was motivated by the fact that killer whales are not well-studied in tropical regions but may have an effect on the ecological context of other species.

# 5. PHOTO-IDENTIFICATION TOOLS

### 5.1. FLUKEBOOK

Violaine Dulau presented the Flukebook platform developed for IndoCet. Flukebook is an online data sharing platform that automatic matching includes tools for humpback whales and other cetacean species (bottlenose dolphin, spermwhales, 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.

Over the last 4 years, improvements have been made to customize the platform to the needs of the researchers from the region. Most of the effort was dedicated to:

- standardizing data, by creating a standardized spreadsheet for bulk imports of the data, creating drop-down menus specific to IndoCet and that match the bulk import;
- creating standardize categories and "labeled keywords" that allow images to be scored by quality, distinctiveness, feature and Fluke type;
- improving the process for establishing collaborations and setting different levels of access (readonly or edit);
- creating a fluke-matching workflow that allows the selection and matching of a given dataset and the creation of a specific catalogue for that dataset (with catalogue-specific names for the individuals being integrated to that catalogue). The objective of this matching process is to allow for systematic matching to be undertaken with tracking of matching history, as opposed to haphazard matching of images.
- Export of the data for further mark-recapture analysis.

The development of these features was a long process and explains why the matching of data already imported into Flukebook by Cetamada (1576 encounters), Megatera (951 encounters) and Globice (2651 encounters) has not yet been undertaken.

### 5.2. HAPPY WHALE

Happywhale is a web-based automated-matching platform for humpback whale fluke photographs, developed and managed by Ted Cheeseman, who provided a virtual presentation on the platform and his project. Ted is conducting a PhD thesis based on humpback whale fluke data submitted to Happywhale, focusing mainly on the North Pacific (using the historical SPLASH dataset in addition to more recent data). Happywhale also contains data from around the globe. Although in the other regions of the world the data collected is more opportunistic, several matches between different breeding populations, and between breeding and feeding grounds, have been revealed. The platform is based on image recognition algorithms and has been very successful, with a reported 97% to 99% success rate of matching known matches. Anecdotal difficult matches were presented, involving



photos of calves and some juveniles, and highly rotated pictures. An important case study was conducted in the North Pacific (SPLASH).

Several key features of Happywhale were presented and came up in discussion:

- The matching process involves matching to the whole catalogue, it is much more difficult to match against subsets. However, it seems that there is no loss of accuracy in comparing to the whole dataset rather than a subset. Also, the processing time is so fats (average 0.1 seconds/fluke) that it might not be an issue to run matches against the whole catalogue.
- Regarding distinctiveness: there appears to be no variation in matching success associated with distinctiveness when using good / very good quality photographs; the algorithm is using large scale patterns of both surface features and edge shape and contour.
- The algorithm does not perform well with partial flukes in which the fluke is rotated and only a portion of it is above the waterline.
- Regarding assumption of equal probability of recapture: when there are large discrepancies between the number of photographs of different individuals, it was noted that this may introduce heterogeneity. However, it appears that only one good photo is sufficient to make a match. Moreover, the algorithm is using the top 5 high quality photos (manually scored by an operator) to build the reference description of the individual, which reduces the potential for heterogeneity.
- Regarding quality: the pictures are scored from 0 to 5 for a general overall quality range (i.e., not specifically or separately for photo quality, fluke orientation, or fluke distinctiveness). Scoring is done on post processing by the person in charge of matching the images.
- Every match is visually confirmed. There are potential matches and confirmed matches.
- There is a large degree of data management (e.g., assigning quality scores) that occurs after submission of photographs and is currently conducted by Ted and Happywhale data managers. Matching can be implemented by other individuals that are given access to the operation of the algorithm, but currently most of it is conducted centrally by Happywhale. In this sense, Happywhale operates more under a citizen science and matching service paradigm, as opposed to

as a platform that is easily exported for use by independent researchers or groups except where researchers have undertaken training efforts to use the system internally.

- Images are uploaded as an encounter of a single individual. Encounters are not grouped in sightings and thus information about groups (i.e., group size, composition, behavior, associated individuals, etc....) are not stored in separate data fields but can be accommodated in text fields. Individual encounters are associated to a "journey", which can be a daily trip or a multiple day survey. GPS track can be uploaded, allowing automated encounter location lookup based on photo time stamps. A recently developed module to link genetic data to encounter records now exists based on a pilot study in Southeast Alaska.
- Researchers that have submitted photographs can decide to restrict access to their data.

## 5.3. DISCUSSION FLUKEBOOK VS HAPPY WHALE

After the separate presentations on Flukebook and Happywhale, the meeting participants discussed the differences between the platforms, weighing the pros and cons with the intention to decide whether either platform may be more suited for IndoCet objectives:

- Flukebook and Happywhale are two different entities that serve different purposes
- Happywhale is very effective for matching humpback whale fluke photographs across a large collection of datasets, and therefore for defining connections between sites and regions on a global scale. This is a tool created to produce fast results, initially for the specific purposes of Ted's thesis. It was initially developed as a citizen science tool to collect opportunistic data, so images are reported with little associated data, although GPS track can be uploaded. Data contributors submit data which are then managed and compared by Happywhale team, or someone who has been given advanced access level to the platform.
- The matching step for any given fluke is very rapid with an almost immediate return of candidate matching photographs, making it very efficient for moving through a large dataset. This is in part due to a large learning dataset upon which the algorithm has been trained.
- When submitting images to Happywhale, by default unless otherwise specified, a Creative Commons Public Domain license is applied to the data, but users can set, in account settings, a more restrictive license to be applied to their data. Specific collaborations among Happywhale users can be set, with limitations.
- Happywhale is also currently heavily dependent on data management by Ted, or a single skilled operator, and is not designed to be an independent tool for researchers. Ted acknowledged this as a vulnerability and expressed his intention to develop Happywhale in the future to be less dependent on his involvement and skillset. Over recent years, data upload and matching of the flukes from the Eastern Atlantic Ocean, South Africa (both west and east), and Gabon have been done on a voluntary base by Alexander Vogel, who is offering to upload pictures on behalf of scientists, whale watching organisations and the general public. Ted oversees this process and still conducts some of the data management (e.g., verifying matches and assigning quality).
- WildMe conversely has spent extensive effort in the development of Flukebook, as an open access, not for profit project, and is designed to be used for research by diverse independent research groups. Flukebook has more flexibility, allows to associate different type of data to each individual encounter (sighting info, sample, satellite tracks, etc...), provide multiple options for data filtering and is thus a more comprehensive database. It has the ability to conduct systematic matching by projects with subsets of photographs, allows users to set collaborations among contributors with

different access levels (read-only or edit), and allows users to label individual photographs with Indocet specific menus and offers a variety of options to filter the data. Flukebook also includes matching algorithms for different cetacean species and identification features (e.g. dorsal fins).

- Flukebook is consequently much more complex, has had a long development period and remains somewhat 'buggy', delaying the full implementation of the platform during the same period while Ted has been successfully using Happywhale to conduct extensive matching.
- In our experience Flukebook appears to take much longer than Happywhale in conducting any individual comparison of a photograph with the larger dataset, and it is unclear whether this is due to the speed of the algorithms, the use of multiple algorithms, the speed of the server, or some other reason. A comparison of matching efficacy between the two platforms has not yet been conducted.

In conclusion, the two platforms could be useful for IndoCet and would serve different needs. Happywhale may be useful for fast results and establishing connections between sites within as well as outside the region, in a nonsystematic approach. Flukebook is the better option for specific designed comparisons to be conducted by researchers within the consortium that require greater control over the process and data. However, there is a need for some coordination among researchers from the region, especially if both platforms are to be used as IndoCet initiatives. We need to try Happywhale to better understand how it works and see how it could become a tool for IndoCet. Violaine is voluntarily planning on testing it. It is proposed that we form a working group to further advance the discussion about the use of these photo-identification tools and propose a strategy for matching humpback whales within the framework of IndoCet.

# 6. GOVERNANCE

Finally, Salvatore Cerchio presented on some governance issues after an Executive Committee (EC) meeting prior to the IndoCet Member meeting, and a proposal for changes in the MoU specifically related to the structure and formation of the EC. During the inception of IndoCet, the idea was to create a formal structure to the EC and Consortium governance, with a MoU that provides for elections of the Executive Committee every two years (and thus rotation of EC responsibilities) and attribution to roles within the EC. But in the current operation of the network, it has appeared that this was not realistic, due to the challenges in organizing virtual elections for each representative of the EC (founding member, student, associate, etc....). Also, it seems that the 2-year term of the EC was too short compared to the longer timeframe at which IndoCet activities occur. The current EC recognized that there is a need for a renewal of the EC, but proposed that this process be simplified and the composition of the EC be based on the good-will of its members to lead Consortium activities. Changes to the MoU have thus been proposed in that sense to adapt to the current organization of the Consortium.

Since the meeting had overrun its allotted time, and we were very short on time at the end of the meeting for these important deliberations, we decided to simply present the issue to the meeting participants and follow up virtually to all IndoCet members with details of the proposed changes. The EC will send to the members a revised version of the MoU with tracked changes, basically to make it simpler and clearer. The

members will be invited to provide comment if desired and vote online on the proposed changes to the MoU.

# 7. PERSPECTIVES & PRIORITY ACTIONS

Several needs and avenues for the development of the IndoCet activities were identified during the meeting and constitute the road map for the Consortium for the coming year:

- Seek the contributions of IndoCet members, by encouraging them to share their publications on the IndoCet website, update their metadata, report stranding events and contribute to the Newsletter;

- Advance the development of the website to include interactive maps to present existing datasets, including (1) cetacean distribution data collected by MMO onboard platforms of opportunity in off-shore waters of the SWIO; and (2) satellite tracking data;

- Further develop the stranding network within IndoCet and systematic data collection on stranded animals, but also on cetacean/human interactions;

- Encourage and coordinate the use of platforms of opportunity to collect cetacean distribution data in oceanic waters by marine mammal observers;

- Define a strategy and workflow for matching humpback whale's photo-identification data within the SWIO and beyond;

- Encourage researchers to launch new regional initiatives in concertation with other researchers from the region, with the aim of centralizing and analyzing the data under a common framework.

- Modify the MoU to reflect the current organization of the Consortium and simplify the appointment of the Executive Committee, based on the principle that members who are actively involved in leading Consortium activities should be part of the Executive Committee.

- Approach the WIOMSA Secretariat to establish a more formal link between IndoCet and WIOMSA and plan to convene future IndoCet meetings as part of the WIOMSA Scientific Symposium.

## 8. VIDEO SESSION

The meeting ended with a presentation of the CRITTER CAM video footage made by Cetamada in Saint Marie, Madagascar, and showing amazing images of humpback whale suckling behavior. Globice also presented the 360° video footage of several different cetacean species encountered around Reunion.





And a drink at the City Lodge!



### ANNEXE 1. AGENDA

### 8:30-9:00: Welcome, Introduction to the IndoCet Consortium

9:00-10:30: Presentation of IndoCet activities

- Indocet interactive website and further developments (database)
- The IndoCet stranding network: common publication, online database, further developments
- #WhereAreTheWhales (cancelled)

### 10:30-11:00 Coffee break

### 11:00-12:30 Regional research programs

- COMBAVA (COopertation pour l'étude des Mouvements des Baleines à bosse et Valorisation des connaissances) project (Adrian Fajeau, Globice)
- QWIO (Quieter Western Indian Ocean) project (Simon Mahood, WCS)
- Protecting Blue Corridors (Chris Jonhson, WWF, remotely)

### 12:30-14:00 Lunch break

### 14:00-15:00 Regional research programs (continue)

- Sousa Consortium initiative (Shanan Atkins)
- DeCLIC (DEveloppement d'un CLassificateur pour l'Identification des Cétacés) project, (Emmanuelle Leroy, Globice)
- Killer whale study in the SWIO (Maeva Terrapon, Univ. St Andrews)

### 15:00-15:30 PhotoID tools

- Introduction to the IndoCet *Flukebook* platform (Violaine Dulau & Salvatore Cerchio)

### 15:30-16:00 Coffee break

### 16:00-17:00 Photo ID tools (continue)

- Introduction to Happy whale (Ted Cheeseman, remotely)
- Group Discussion

**17:00-17:30**: Governance, MoU modification and identification of priority actions for the Consortium