# Workshop Report: Managing data for whale conservation in the Arabian Sea;  A practical introduction to the ASWN Flukebook online data platform. Muscat, Oman, 21-23 January 2018

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INTERNATIONAL
WHALING COMMISSION

# Workshop Report:

# Managing data for whale conservation in the Arabian Sea: A practical introduction to the ASWN Flukebook online data platform



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**Edited by:** Gianna Minton

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# Executive Summary

The Arabian Sea Whale Network was formed during a workshop held in Dubai in January 2015. One of the 11 recommendations resulting from the 2015 workshop was the creation of an online regional data platform to promote collaboration between researchers working on whale conservation issues. Research into different data platform options, resulted in a decision to collaborate with Wild Me to design a tailor-made version of their Flukebook cetacean photo-Identification platform for ASWN. In 2016 funding was obtained from the International Whaling Commission, WWF International, WWF Pakistan, EWS-WWF, and the Environment Society of Oman to engage Wild Me, and begin the project. The Terms of Reference for the ASWN Flukebook data platform included adding multiple data fields to Flukebook in order to match those used by the cetacean research team in Oman and other countries in the region. This allowed the data platform to handle photo-identification, sightings, genetic sampling and elements of satellite tracking data under one data archiving platform. As of January 2018, the beta version of this new platform had been developed and photo identification and sightings data from Oman and India had been imported into the new platform.

The main aim of the workshop was to allow the first wave of ASWN data platform users to become familiar with the new platform and experiment with its use. Additional objectives included the introduction of the data platform and the value of regional collaboration to local government stakeholders from Oman, and the discussion of ways in which fisheries stakeholders can be involved in data collection for conservation of whales in the Arabian Sea.

The first day of the workshop included a range of presentations from ASWN members who updated each other and the local government stakeholders on their most recent work in Oman, Iran, Pakistan, India and Sri Lanka. Presentations and panel discussions also focused on regional initiatives for whale conservation, including the Convention on Migratory Species' recently approved Concerted Action for Arabian Sea humpback whales, a hoped-for Conservation Management Plan through the International Whaling Commission, and the 2019 planned assessment of Important Marine Mammal Areas in the Indian Ocean and Arabian Sea. The day finished with presentations on the multiple types of data that can be collected during the course of conservation-based whale research, and a general introduction to the Flukebook Platform.

The second and third days of the workshop involved ASWN members only and were dedicated to a more technical introduction of the new Flukebook platform and practical exercises to enable new users to familiarize themselves with the user-interface. Exercises highlighted the complexity of data collection and entry, and participants provided the Flukebook developers with feedback on their perception of the new platform and its user-interface. Based on this feedback the Flukebook team will work with ASWN members to streamline data entry and import.

The fourth and final day of the workshop was dedicated to presentations and break-out groups focusing on the ways in which the fishing industry can be included in cetacean conservation efforts through collection of data and implementation of methods to reduce accidental entanglement. Examples of successful models were presented by the teams in Oman, where fishermen in Masirah are taking out tracking devices to help map their fishing effort, and Pakistan, where fishing captains trained by WWF Pakistan are recording live whale sightings and releasing whales, dolphins, turtles and sea birds from their fishing nets.

# 1. Background

The Arabian Sea Whale Network was formed during a [workshop held in Dubai in January 2015](#). One of the 11 recommendations resulting from the 2015 workshop was the creation of an online regional data platform to promote collaboration between researchers working on whale conservation issues. Following research into different data platform options, the decision was made to collaborate with Wild Me to design a tailor-made version of their Flukebook cetacean photo-Identification platform to suit the needs of the ASWN. In 2016 funding was obtained from the International Whaling Commission, WWF International, WWF Pakistan, EWS-WWF, and the Environment Society of Oman to engage Wild Me, and the project was under way.

The Terms of Reference for the ASWN Flukebook data platform included the addition of multiple data fields to match those used by the cetacean research team in Oman and other countries in the region so that the data platform can bring photo-identification, sightings, genetic sampling and elements of satellite tracking data under one data archiving platform. As of January 2018, the beta version of this new platform had been developed and photo identification and sightings data from Oman and India had been imported into the new Platform. The main aim of the workshop was to allow the first wave of ASWN data platform users to become familiar with the new platform and experiment with its use. Additional objectives included the introduction of the data platform and the value of regional collaboration to local government stakeholders from Oman, and the discussion of ways in which fisheries stakeholders can be involved in data collection for conservation of whales in the Arabian Sea.

## Welcome messages from the workshop hosts

The workshop was officially opened by Lamees Daar, Executive Director of the Environment Society of Oman (ESO). She welcomed participants and thanked them for joining the workshop from near and far. She provided a brief look back into the history of the formation of the ESO, which had its origin in the voluntary whale conservation work conducted in Oman the 1990's and early 2000's. Ms. Daar praised these early efforts, as well as the hard work that has followed to create the ESO and develop Oman's whale research and conservation programme in collaboration with government and private sector partners, including Renaissance Services SAOG and Shell Oman, who have provided significant funding for ESO's whale work in recent years. She concluded: "I hope that these discussions and ties will further strengthen our research, coordination and capacity within the region. There is much to be gained from sharing the data that has been generated and this is what we are here to achieve over the next few days. Please remember that this sharing platform will only be as strong as those who support and add to it, and that at the end of the day, the top priority is conservation of these magnificent marine mammals."

This retrospective and welcome was followed by an address from Dr. Abdul Aziz al Marzuqi, Director General of Fisheries Development, Ministry of Agriculture and Fisheries Wealth. Dr. Marzuqi welcomed participants and welcomed the opportunity for his Ministry to be working in collaboration with other partners to address whale conservation in Oman and the region. The Ministry of Agriculture and Fisheries, is the official focal point of the Sultanate of Oman within the International Whaling Commission and advocates strong conservation measures for whales and the maintenance of the IWC moratorium on commercial for as long as necessary. The Ministry also welcomes initiatives by NGOs that strengthen and complement the government conservation policy and positions both locally and regionally or internationally. Dr. Marzuqi expressed the Ministry's concern over the issue of incidental catches or entanglement of cetaceans and expressed the Ministry's intention to take all necessary measures to keep by-catch at an acceptable level that does not expose cetaceans to unnecessary risks. He ended his address by inviting the interested NGOs and parties concerned with these issues to join Oman's Ministry of Agriculture and Fisheries in initiatives to promote Wild Meconservation policy and objectives.

Muhammed Moazzam Khan then welcomed participants on behalf of WWF Pakistan. As the organization that secured the funding for this valuable meeting, as well as the first meeting of the Arabian Sea Whale Network in Dubai in 2015, WWF Pakistan was keen to promote regional collaboration and information sharing. In addition to supporting the implementation of the new ASWN data platform, WWF Pakistan is keen to see members of the network sharing experience and ideas with regards to concrete conservation measures and mitigation of threats. Threat mitigation can only be achieved through collaborative efforts — both between countries in the Arabian Sea, and between different stakeholders: Intergovernmental organizations (IGOs) international and national or local NGOs, government bodies, academic institutions and industry, including shipping and transport companies, port authorities, oil and gas companies, and fisheries. Mr. Khan thanked the workshop sponsors: the Common Oceans Tuna Project, including the United Nations Food and Agriculture Organization (FAO), International Seafood Sustainability Foundation.

## The Arabian Sea Humpback Whale: A shared regional treasure under threat

*Suaad al Harthi, Environment Society of Oman*

Early records of humpback whales from the Arabian Sea region include whaling data and observations collected from merchant vessels[1-3]. These observations perplexed early observers, who had come to understand humpback whales as a species that undertakes predictable long-range migrations between polar and sub-polar feeding grounds and tropical breeding grounds. Arabian Sea humpback whales occurred in the tropics well north of the equator, but had no feasible migration routes to northern hemisphere feeding grounds. In a review of humpback whale records in the northern Indian Ocean, Reeves et al (1991) [4] explored the hypothesis that at least some humpback whales were resident year-round. Evidence revealed in the late 1990s that 242 humpback whales had been killed illegally off Oman, India and Pakistan in November 1965 and 1966[5,6], supporting the hypothesis that high productivity associated with



Infographic depicting the conservation status and threats of Arabian Sea humpback whales.

upwelling of nutrient rich water during the Southwest monsoon enables whales to both feed and breed in the same area[7]. The whales appeared to form a resident population that adheres to a Northern Hemisphere breeding schedule[5].

Those historical data prompted a group of volunteer scientists to initiate a series of small-boat surveys between 2000 and 2004[8]. Their primary aim was to investigate the current distribution and status of humpback whales in the waters

of Oman. Humpback whales were observed during surveys in Dhofar and the Gulf of Masirah on Oman's Arabian Sea coast, but not during surveys in the Muscat region in the Sea of Oman[8,9]. The seasonality of sightings coupled with behavioural and environmental observations suggested that the Gulf of Masirah served primarily as a feeding ground, while the Dhofar region, particularly the Hallaniyat Bay functioned as a breeding area[10]. Mark-recapture estimates using photo-identification of individually recognizable whales led to a population estimate of fewer than 100 whales off the coast of Oman, and genetic studies confirmed that the population was discreet and had separated from other Indian Ocean humpback whale populations roughly 70,000 years ago[11,12]. The low population numbers, genetic distinctiveness, and documented threats in the region[13] led to the designation of the population as Endangered on the IUCN Red List of Threatened species in 2008[14].

Research methodologies in Oman from 2010 onward grew increasingly sophisticated, with the inclusion of passive acoustic monitoring and satellite tagging as methods to improve our understanding of whale behaviour and habitat use. Both the acoustic monitoring and the satellite tagging confirmed the Gulf of Masirah and the Hallaniyats Bay to be areas of importance for the whales[15,16].
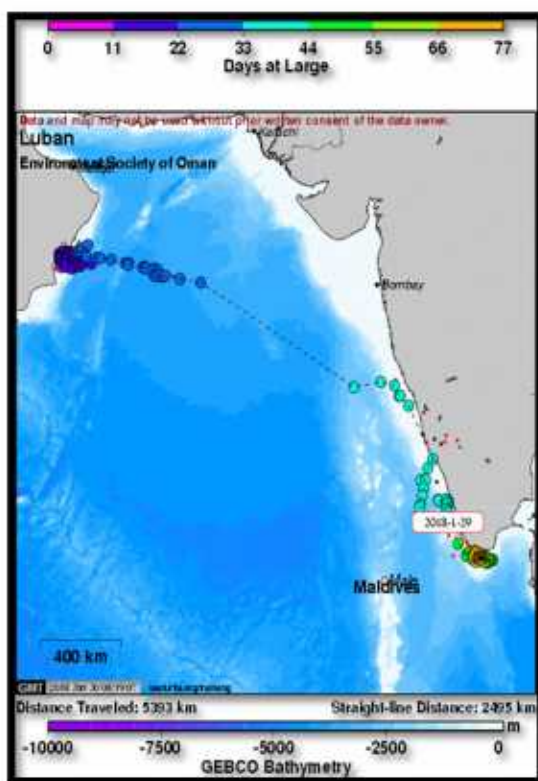


Track of Luban, the humpback whale satellite tagged in the Gulf of Masirah, Oman in November 2017, still engaged in small localized movements off the southern tip of India as of

In 2015 the first regional meeting focusing on Arabian Sea humpback whales was held in Dubai, and led to the formation of the Arabian Sea Whale Network. Since that time, members in Oman, the UAE, Iran, Pakistan, India and Sri Lanka have been engaged in a number of efforts to document the presence and possible threats to whales in their countries, as evidenced by the presentations summarized below. These efforts were spurred on further by the recent crossing of a humpback whale satellite tagged off the coast of Oman in November 2017 that then crossed the Arabian Sea to the southern coast of India. Named Luban, the Arabic word for a frankincense tree, because of the tree-shaped markings on her tail flukes, the whale has become a symbol for the need for regional collaboration to protect this remarkable and vulnerable population of whales.

Luban's crossing occurred at the perfect time to inspire participants to this workshop to collaborate in the implementation of the new ASWN regional data platform, a tool which will help ASWN members to streamline and simplify their data entry and archiving. The diagram below demonstrates how just one research project in the region can end up with multiple MS Access databases and spreadsheets to archive and analyse the multiple types of data from the same whale sightings/surveys, leading to a duplication of effort and the risk of data corruption as it is copied and transferred in several different platforms.

Differences between the data archiving tools used from one project in the Arabian Sea to another can also hinder effective collaboration. As such, the network welcomes the creation of the new Data Platform which will standardize data storage formats across the region, while allowing data contributors to maintain complete control and security of their own data.

## Why create a new database

A diagram demonstrating the different types of data that are collected and curated as a result of whale research in Oman. The aim of the ASWN regional data platform is to streamline data storage and facilitate data exchange when desired, while protecting data security for all users.

## Panel Discussion: Regional Initiatives to Promote Cetacean Conservation in the Arabian Sea

**Panel members**: *Gianna Minton, Co-Coordinator ASWN; Lyle Glowka, Convention on Migratory Species, Abu Dhabi; Mohammed Moazzam Khan, WWF Pakistan; Dr. Thuraya al Sariri, Assistant Director General of Nature Conservation, Ministry of Environment and Climate Affairs, Oman*

 The Arabian Sea Whale Network: Gianna Minton provided a brief overview of the Arabian Sea Whale Network, and the progress that it has made against the 11 recommendations made during the founding workshop in 2015. Network members in eight member countries are now regularly contributing to discussions and news items that are facilitated by an email group and a website. These members are beginning to address knowledge gaps and collect data crucial to the understanding and management of whales in the region (see country updates below). Progress has been made on the development of a regional online data platform to facilitate collaboration and management of data for conservation purposes as well as a 'glossy' proposal and an infographic that can be used for outreach and fund raising efforts. Membership also includes representatives of international NGOs and IGOs who provide support and technical advice. These members have played a crucial role in mobilizing support for the designation of Arabian Sea humpback whales as a Special Conservation Project under the IUCN's Cetacean Specialist Group and the passing of a Concerted Action for Arabian Sea humpback whales under the Convention on Migratory Species.

The network has a number of remaining challenges, including a need for more effective and substantial fund raising to support regional research and conservation initiatives, increased capacity building for early career scientists from ASWN range states, and increased government involvement in research and conservation efforts throughout the region. For this reason, the network was particularly pleased to have significant and high level participation at the workshop from relevant government bodies in Oman, and hopes that it will be followed by fruitful collaboration in the future.

Important Marine Mammal Areas, Gianna Minton briefly summarized a global effort that is under way to assess important marine mammal areas on a region-by region basis. Important Marine Mammal Areas (IMMAs) are defined as *discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation.* IMMAs are not Marine Protected Areas, but could be viewed as a marine mammal layer that can be added to a spatial analysis of biodiversity for consideration by governments, intergovernmental organisations, conservation groups, and the general public. The effort started with an assessment of IMMA's in the Mediterranean Sea (2017) and the South Pacific (2017). An assessment workshop for the western Indian Ocean and Arabian Sea is planned for 2019.
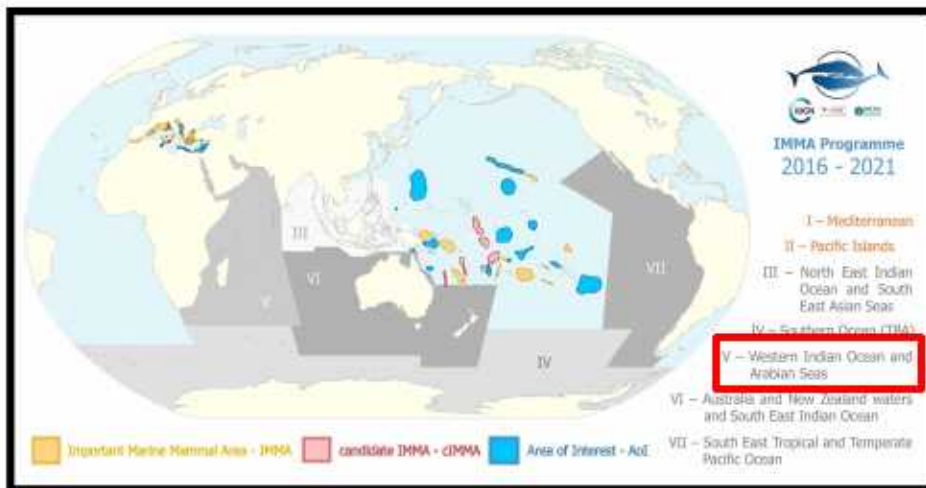


Map showing the areas that are already undergoing assessment and designation of IMMAs, and the areas planned for future assessment. A workshop for the assessment of IMMAs in the Western Indian Ocean and Arabian Seas is planned for 2019.

CMS Arabian Sea Humpback Whale Concerted Action: Lyle Glowka introduced the Convention on Migratory Species (CMS). With 126 member states, it promotes national-level actions to conserve and, where appropriate, sustainably use migratory avian, terrestrial and marine species. CMS has a number of tools to promote international cooperation and coordination between range states across a migratory range. For example, though not yet a member of CMS, Oman is a signatory to CMS's Indian Ocean and South-east Marine Turtles MoU. Along with six CMS Parties, Oman endorsed the new CMS Arabian Sea Humpback Whale Concerted Action (ASHW Concerted Action) at the 13th Meeting of the CMS Conference of Parties (Manila, 2017).

The CMS ASHW Concerted Action is a new international cooperation framework to promote urgent coordinated action amongst ASHW range states and members of the research and conservation community. It was developed by the Arabian Sea Whale Network < https://arabianseawhalenetwork.org > and endorsed by the CMS Scientific Council in 2017. By 2020 the ASHW Concerted Action aims to: (1) Fill knowledge gaps; (2) Share information and build awareness; and (3) Build capacity & develop mitigation strategies focused on: (a) Stranding and entanglement response; (b) Ship strike mitigation; (c) By-catch mitigation.

The ASHW Concerted Action may also be implemented in conjunction with a regional Conservation Management Plan (CMP) for endorsement by range state members of the International Whaling Commission (IWC) and CMS. Of the eight principle ASHW range states Oman and India are IWC members, while India, Iran, Pakistan, Saudi Arabia, Sri Lanka, United Arab Emirates and Yemen are CMS members. A fundamental principle of IWC CMPs is that they are member-driven and as such, the IWC is working with its member range states to explore the opportunity for developing a CMP. If successful, CMS would work with those range states that are CMS Parties to bring them into the IWC process.

Ecologically or Biologically Significant Marine Areas (EBSAs): The Convention on Biological Diversity (CBD) Northwest Indian Ocean Workshop to Describe Ecologically or Biologically Significant Marine Areas (Dubai, 2015) resulted in

descriptions of at least five areas which may be important for ASHW and other cetaceans. The outcomes of the EBSA and IMMA processes (see above) can be used by range states as a basis to develop area-based conservation and management measures to protect habitat and minimize threats (e.g. entanglement, ship strikes) to ASHWs and other cetacean species.. Pakistan's creation of two MPAs in early 2018 is an excellent example.

 The Indian Ocean Tuna Commission (IOTC): Muhammed Moazzam Khan described how members of the IOTC can propose and vote on Conservation and Management Measures concerning the management of tuna and tuna-like species under the IOTC mandate as well as the fisheries which target them. These decisions are passed in the form of either Resolutions or Recommendations. Resolutions are binding on the Commission Members, unless there is a specific objection on the part of a Member, and require a two-thirds majority of members present and voting. For example, IOTC Resolution 13/05 requires all fishers operating in the IOTC area of competence to report any encirclement by purse seine nets, or any other interactions with other fishing gears through logbooks and/or observers. Recommendations are not binding on the Members and rely on voluntary implementation. The IOTC also has a working Party on Ecosystems and Bycatch (WPEB), with a mandate to "review and analyse matters relevant to bycatch, byproduct and non-target species which are affected by IOTC fisheries for tuna and tuna-like species (i.e. sharks, marine turtles, seabirds, marine mammals and other fishes), as well as the ecosystems in which they operate; and to develop mechanisms which can be used to better integrate ecosystem considerations into the scientific advice provided by the Scientific Committee to the Commission". As part of their effort to better address marine mammal conservation issues in the Indian Ocean, the IOTC is currently developing a series of laminated cetacean species identification cards. These guides are designed to be used by fisheries observers, samplers, fishing masters and crew on board fishing vessels targeting tuna, tuna-like species and sharks in the Indian Ocean and to allow improved documentation of cetacean mortality in fishing operations and more sustainable management of fisheries in the region. The ID cards will be made available online through the IOTC website, and a limited number of hard copies will be distributed throughout the region.

Oman's participation in regional and international initiatives for cetacean conservation: Dr. Thuraya al Sariri described how the Ministry of Environment and Climate Affairs (MECA) plays a key role in marine mammal conservation through the management of 13 marine protected areas, and the response to and management of strandings of both live and dead marine mammals through their marine mammal stranding committee. The Ministry has trained over 120 rangers around the entire coastline of Oman in stranding response and sample collection, and has supplied them with the necessary materials to carry out this work. Collaboration between various stakeholders in Oman has led to effective marine mammal research and conservation measures in Oman and contributions to international and regional initiatives. As a participant to the CMS Convention of Parties (COP) in Manila in 2017, Oman voiced its support for the CMS ASHW concerted Action. Dr. Al Sariri emphasized that she is looking forward to continued collaboration between MECA the Ministry of Agriculture and Fisheries Wealth, the Ministry of Tourism, the Environment Society of Oman, the ASWN and other stakeholders to address whale conservation in Oman and the region.

A Question and Answer session followed the presentations above:

- Q: How do we ensure that these instruments move past paper plans/documents and result in implementation of real conservation measures? A: In the case of CMS, regional/international instruments are not enforced by sanctions in the case of non-compliance, and rely on the good faith of signatories to honour their commitments. Experience shows, however, that most signatories/participants do strive to honour their commitments once publically stated. In the case of the IOTC, WWF Pakistan noted that while no country is 100% in compliance with all resolutions and recommendations, the measures do help members to improve their practices – for example, Pakistan's compliance with the resolution requiring all parties to report their

marine megafauna bycatch increased from 10% to 64% in recent years, in large part due to the crew-based observer programme and Pakistan's participation in the WPEB.

- **Q:** Does it matter that Oman is not a signatory to CMS? **A:** While the CMS would welcome Oman as a full signatory, they are able to fully participate in, and support CMS regional intiatives, as they do with the IOSEA regional marine turtle agreement.
- **Q:** Why are there not more young local scientists involved in cetacean research in Oman? **A:** The ESO, Five Oceans, and MECA would all like to see more young Omani scientists involved in the research work. While many have been involved in single or multiple field surveys, the challenge has been finding academic institutions that have the infrastructure, funding, and facilities to support their learning throughout the longer term required for a Masters or PhD career. All of the stakeholders present agreed to collaborate to try and address this gap.

## 2. Country progress summaries

### Oman

*Part 1: The Renaissance Whale and Dolphin Project, Environment Society of Oman- Asma al Balushi, ESO*
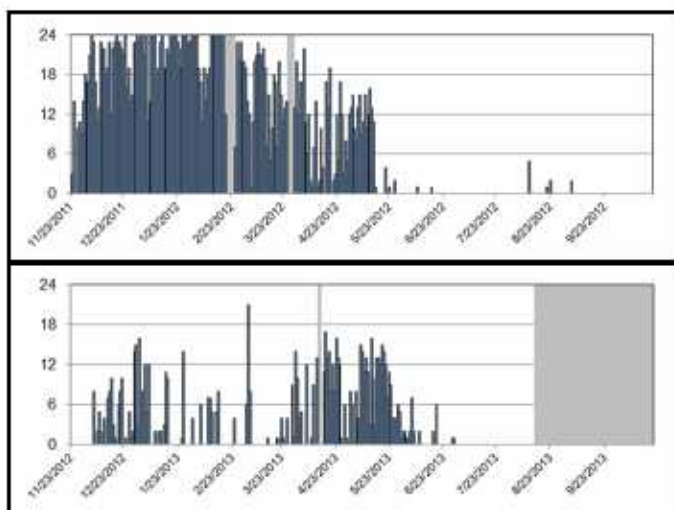


Graphs depicting detections of humpback whale song in the Hallaniyats Bay (top) and the Gulf of Masirah (bottom). These show the importance of the Hallaniyats Bay for singing, and support other evidence that Arabian Sea humpback whales adhere to a northern hemisphere breeding cycle, with peak singing activity occurring between January and April. The song detected in August 2012 was identified as Southern Indian Ocean song, suggesting that individuals from the Southern Hemisphere occasionally visit the coast of Oman during the Austral breeding season.

The Environment Society of Oman, and its pre-cursor- the volunteer Oman Whale and Dolphin Research Group have been conducting research on Oman's humpback whales since the year 2000. As Oman's first and only environmental NGO, the ESO collaborates with a range of government and local community stakeholders in Oman, and a wide network of research institutions and individual experts outside of Oman who provide technical support for research and analyses.

Recent advances in Oman since the 2015 workshop include the analysis of acoustic data collected in the Gulf of Masirah and the Hallaniyats Bay between 2011 and 2013. This was conducted in three phases, the first of which defined the spatiotemporal distribution of humpback whale singing activity. Patterns of song detection confirmed the previously described Northern Hemisphere seasonality of humpback whale breeding activity as indicated by a high prevalence of humpback whale song between December and March. It also confirmed the importance of the Hallaniyats Bay for humpback whale singing and less frequent, but persistent song was detected in the Gulf of Masirah[16].

The second phase of analysis examined the sources of other noise detected by the recorders Fish vocalizations, noise from strong current and wave action, and increased vessel noise in close proximity the Port of Duqm were documented. Higher levels of vessel noise near the port of Duqm may be associated with decreased humpback whale singing activity in comparison to other sites, warranting further assessment of potential impacts. A third phase of analysis compared song detected off the coast of Oman with humpback whale song recorded in the Southwest Indian

Ocean during the same years, and confirmed earlier anecdotal evidence that Oman song was completely distinct from that of Southern Hemisphere populations. In addition, the analysis surprisingly also detected isolated instances of Southern Hemisphere song around the Hallaniyat Islands during the months when ASHW were silent, suggesting that at least a handful of whales from the Southwest Indian Ocean have visited the coast of Oman during the Southern Hemisphere breeding season, or the Northern summer (ESO/Sal Cerchio unpublished data).

Satellite tagging of 14 whales between 2014 and 2017 has allowed the team to conduct ecological niche modeling[15], which can be applied to threat mitigation (see below). The migration of a tagged whales from Oman to the southern tip of India indicates that animals sighted in Oman may also be making use of other areas of the Arabian Sea, and is already inspiring increased research efforts in Pakistan and India. The last field survey in Oman November 2017 included the use of a 'snot-bot' drone to conduct health assessments through the collection of mucus/blow samples, and examination of aerial photos to detect net scarring, skin disease, and body condition. As a NGO, ESO helps to source funding for this valuable research, and to disseminate its results to raise awareness among a range of stakeholders, including government bodies responsible for management and decision making, as well as school and community groups.

*Part 2: Marine Mammal Stranding in Oman: Aida al Jabri, Ministry of Environment and Climate Affairs*



Aida al Jabri from the Ministry of Environment and Climate affairs investigates a Sperm whale Stranding with other Ministry officials and local community members.

In 2009 the Ministry of Environment and Climate Affairs in Oman (MECA) established the Oman Marine Mammal Stranding Committee. Through this, MECA has engaged in an active outreach and training programme throughout the country in order to improve the preparedness and effectiveness of a network of local government officials responsible for responding to strandings of both live and dead marine mammals. Following an IWC training workshop in October 2015, the Ministry has cascaded this training through a series of regional workshops involving over 120 coastal rangers. The workshops included both classroom and practical/field-based exercises and ensured that each region is equipped with stranding response tool kits. This training for official responders has been complemented by community outreach programmes in schools and coastal communities, and the establishment of a national hotline that members of the public can call to report strandings of marine mammals or turtles. MECA has been collecting samples and statistics from their stranding response programme. Analyses of strandings data collected so far indicate that the Sharquiya and Al Wusta regions of Oman experience the highest rates of strandings, echoing the trends detected in a 2002 study that also identified these regions as experiencing high densities of cetacean strandings[17]. MECA has also been working to strengthen wildlife conservation laws, and has recently facilitated the update of the royal decree (6/2013) - the law on Nature Reserves and Wildlife Conservation- and established executive government regulations for the management of whale and dolphin tourism activities. MECA is looking forward to further improving its stranding response, through the training of volunteers as well as rangers, increased awareness raising, the drafting of a response manual in English and Arabic, and the training of local veterinarians to deal with issues specific to marine mammal health and stranding.

*Part 3: ASHW data processing and applications; recent insights and implications for industry, Andrew Willson, Five Oceans Environmental Services*

Over 17 years of surveys in Gulf of Masirah, Dhofar, Muscat and 'other' areas have amounted to over 2800 hours of 'on-effort' survey. Sightings made during these surveys have allowed the research team to continually update and refine encounter rate density maps that consistently demonstrate discrete areas of the Gulf of Masirah (GoM) and Hallaniyats Bay as hotspots for humpback whales. A photo-identification database of recognizable individuals indicates that 53% of all individually identified whales in the catalogue have been encountered within the Gulf of Masirah while only 38% have been observed in the Hallaniyats Bay. Males are more likely to be encountered than females in each of the two main study areas, although they are more likely to be encountered in the Gulf of Masirah than the Hallaniyats Bay. Whales instrumented with satellite transmitters spent 83% of their time in a behavioural state referred to as 'local area search mode', and 73 % of their time in water <200m, thus indicating importance of the continental shelf habitat throughout the Arabian Sea coast of Oman.
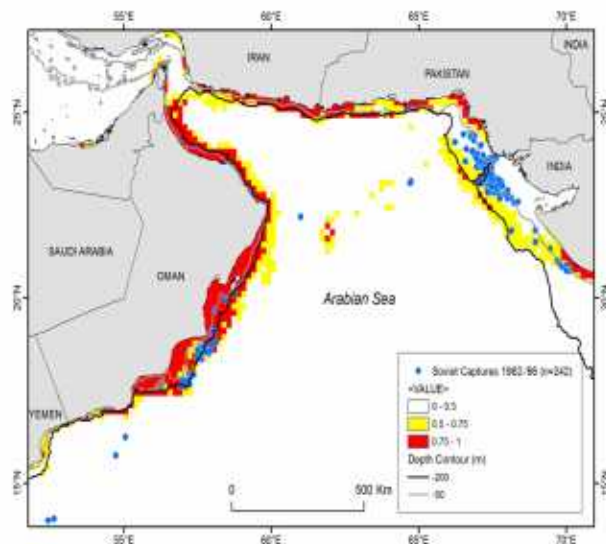


Humpback whale sightings and satellite tagging data collected in Oman has been used in an ensemble niche model that can inform environmental impact assessments and future research efforts for the whole Arabian Sea region.
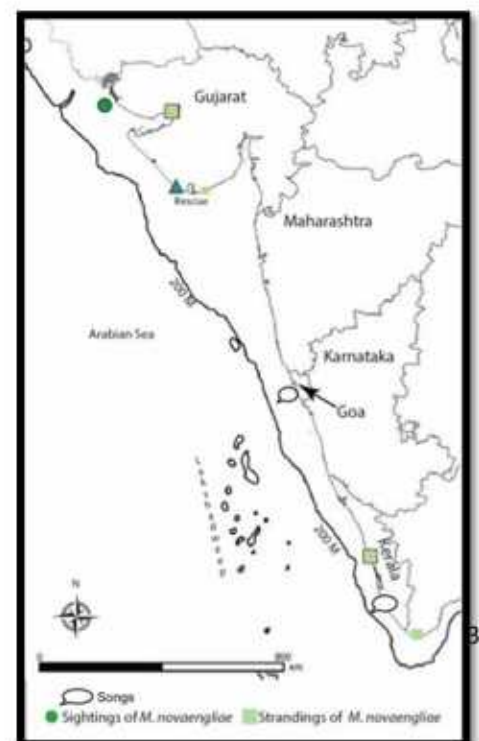
The data collected on the whales' spatial ecology, population size and sighting histories has been directly applied to several important management measures:  It has been used to inform the critical habitat assessment process of ASHWs under International Finance Corporation guidelines for projects financed in Gulf of Masirah. Published data has also supported environmental impact assessments (EIAs) for several industry project throughout Oman's coastline, including the mitigation measures implemented during a 2015 seismic survey in the Gulf of Masirah. The research and documentation of the Gulf of Masirah as 'critical habitat' for Endangered ASHW, also inspired the Port of Duqm to commission a 'Whale Mitigation and Management Plan'. The presentation concluded by emphasizing the importance of conducting fieldwork that will provide suitable results to guide management and industry impact assessments. This data can take many years to generate and threats demonstrate it urgently needs to start elsewhere in the region.

# India

*Dipani Sutaria, Independent researcher*

The marine mammal conservation landscape in India is complicated, with multiple state and local level administration departments involved in issuing research permits, policy making and implementation. India does not have a national marine mammal program or a mandatory marine mammal observer program for seismic surveys. As such, research and conservation efforts have to be tailored by small groups of individuals working at local scales. In the Arabian Sea region there are research teams carrying out vessel surveys in Maharashtra, Goa, Karnataka,

Lakshadweep and Kerala. The Marine Mammal Conservation Network of India includes a growing number of researchers spread around the country, most of whom are engaged in grass-roots conservation work with fishing community leaders, fishing vessel crew members, local government and non-governmental research institutions and tour operators. The widening network of stakeholders is resulting in an increasing number of marine mammal sighting and stranding records, which are stored in the Network's database. This is accessible to anyone, and its records have already been uploaded into the new ASWN data platform. The Network produces education and outreach materials, including a recently updated poster and guide of marine mammals of India. The Network has conducted several workshops with fishing communities, coast guard units, State Forest Department offices, and Ministries, as well and transport/cargo crews. Local fishermen generally 'revere and fear' whales, and as such, are unlikely to approach them closely enough to report species details. However, the Network's efforts are resulting in an increased number of humpback whale sightings and reports, including a live stranding that occurred in Una, Gujarat in September 2017. When funding and security conditions allow, the team also conducts vessel surveys. These have not yielded any Arabian Sea humpback whale sightings yet, despite efforts to get out on the water and look for Luban, the whale that was satellite tagged off of Oman in November 2017 and crossed to Southern India in December/early January 2018.

## Pakistan

*Muhammad Shoaib Kiani, Institute of Marine Science, University of Karachi and Muhammad Moazzam Khan, World Wide Fund for Nature (WWF-Pakistan)*

Prior to 2004, information about cetaceans in Pakistanwas limited to the work conducted on coastal and riverine species by Pilleri and Gihr in 1970s [18-22], historical information, and several scattered but mostly unconfirmed stranding records. From 2005-2008, a dedicated research project, the Cetacean Conservation Pakistan Project (CCP) included dedicated beach and vessel surveys, resulting in improved understanding of cetacean distribution and diversity in the region[23-28]. From 2008 onwards, a series of small scale cetacean


Sperm whales photographed by WWF-trained crew-based observers off the coast of Pakistan.

projects have been implemented by WWF. Pakistan with funding from a variety of different sources: a) Indus for All Programme Project for Sustainable Management of two Threatened Indus Delta Cetacean Species, the Indo-Pacific humpback (*Sousa chinensis*) and Indo-Pacific bottlenose (*Tursiops aduncus*) dolphins; b) Conservation of Cetaceans in North Arabian Sea, along the Balochistan Coast, Pakistan (with funding from the Australian Government's Indo-Pacific Cetacean Research and Conservation Foundation, Marine Mammal Centre); c) An assessment of cetacean mortality in tuna gillnet fishery of Pakistan; and d) Sustainable Management of Tuna Fisheries and Biodiversity Conservation in the Areas Beyond National Jurisdiction (ABNJ). A separate project on Marine Dolphin Conservation through Community Education and Capacity Building in MianiHor, Pakistan is being implemented by the Sonmiani Development Organization and funded by Ocean Park Conservation Foundation, Hong Kong.

In 2011a comprehensive research and consultation based National Cetacean Action Plan was prepared and shared with key stakeholders. WWF Pakistan has been working with other stakeholders to encourage its adoption and ratification by the government. In 2013 WWF-Pakistan started an Observer Program for assessment of by-catch (specifically of cetaceans and megafauna) in tuna gillnets. This initiative has significantly improved available knowledge on abundance and distribution of cetaceans and turtles in Pakistan. In 2014 data collected from this programme resulted in an extrapolated estimate that dolphin mortality in tuna gillnets of Pakistan may be as high as 12,000 both cetaceans and

fishing effort. Building on the first phase of the project, in 2016 WWF-Pakistan launched the "Sustainable Management of Tuna Fisheries and Biodiversity Conservation in the Areas Beyond National Jurisdiction (ABNJ). The project focuses on a crew-based observer programme which now includes 75 observers (and an additional 10 under another project). These WWF-trained observers report their catch data, as well as entanglement and mortality of megafauna (turtles, cetaceans, sunfish and whale sharks). To date, 9 dolphins, 1 porpoise, 3 beaked whales and 3 Arabian Sea humpback whales have been successfully released from nets. As of 2017, crew based observers had documented a total of 47 baleen whale sightings, including 12 confirmed humpback whale sightings . The programme has also led to the first confirmed live sightings of Killer whales, Sperm whales, Bryde's whales and Blue whales.

This work is leading to increased public and government sector awareness of cetaceans and their conservation needs. Prior to 2014 there was no official legal protection for cetaceans under national law, other than a ban on exporting cetaceans under Pakistan Fish Inspection and Quality Control Act, 1997. In 2014, the Balochistan Wildlife Protection, Preservation, Conservation and Management Act, was enacted which provide protection to all marine mammals. In 2016, Balochistan and Sindh Governments banned the capture of cetaceans under their fisheries law. Two marine protected areas have been declared in Pakistan. Astola Island (June 2017) and Indus River Canyon (January 2018) and both are known to be important areas for cetaceans.

## Islamic Republic of Iran

*Hamed Moshiri and Nazanin Mohsenian, Plan for the Land Society*



Whale identification poster developed by Plan for the Land and distributed to coastal communities bordering the Persian Gulf and the Sea of Oman.

Plan for the Land Society is a non-governmental nongovermental organization in Iran, and the first NGO to start working on mammal conservation since 2009. Plan for the Land established Iran's marine mammal national stranding network along the coasts of the Persian Gulf and the Sea of Oman. The network has accumulated records of live and dead cetaceans, which are archived in a dedicated database. Public awareness, empowerment of local communities and fishermen are among the most important priorities for achieving sustainable conservation of marine mammals in southern Iran. Various educational materials including posters, books, brochures and leaflets have been designed for different target groups. According observation reports, in this century, humpback whales were recorded in the Persian Gulf in 1971, 1984, 1996, 2012, and 2017[29]. The last live observation in 2012 was of a Humpback Whale entangled in a fishing net which was released by the fishermen. There are also some reports of other alive observations that have not been substantiated. Plan4theLand's latest project is called" An Investigation of distribution and populations of Indian Ocean Humpbacked dolphins in the Dayer-Nakhiloo National Park". Since 2014, 32 individual humpback dolphins have been identified through monthly boat surveys. Dedicated dolphin surveys are complemented by regular information exchange and conservation awareness-raising with local communities. Training fishermen, students and teachers in order to be able to identify Humpback dolphins is among our priorities. Several workshops for fishermen and over 2,000 students have been held in villages bordering the Dayyer Nakhiloo National Park (Bushehr Province).

## Sri Lanka

*Asha de Vos, Oceanswell*



Photo of a humpback whale taken by a diver off of Sri Lanka. The tail fluke did not match any photos in the Oman catalogue.

Sri Lankan humpback whale encounters remain few and far between and few existing anecdotal or historical records have been confirmed. However, in 2014 underwater photographer, Tony Wu, captured an image of a humpback whale off Mirissa. A MoU was signed between ESO and The Sri Lankan Blue Whale Project and the photo was compared with the Oman catalogue. Unfortunately no match was found, but this exercise demonstrated the utility of the Arabian Sea Whale Network. The Oceanswell team has also followed the progress of Luban, the satellite tagged whale from Oman that spent several weeks off the Southern tip of India. Had she crossed into Sri Lankan waters, the team was poised and ready to mobilize a survey to locate her and assess her surroundings.

The Sri Lankan blue whale project is now the flagship project of Oceanswell, Sri Lanka's first marine conservation research and education organization. The team has documented the re-sight of a photo-identified blue whale in the Northern Indian Ocean, with a sighting interval of 27 years between the original photo and the second one taken in 2011[30]. The team has also tested model transferability for predicting blue whale distribution within the Northern Indian Ocean[31]. Another research paper in review relates to the diet of blue whales within the Northern Indian Ocean[32] and another short paper describes a technique to extract ship speed data to reconstruct a ship-strike from 2012[33]. Oceanswell is currently finalizing a report titled 'Mitigating ship strike of blue whales in Sri Lankan waters' to be presented to the Sri Lankan Government.

Finally, we reported on the first record of Omura's whales in Sri Lankan waters[34]. With reports from Iran and the Andaman Islands this sighting is valuable and adds to the understanding of Omura's whale distribution in the region. The list of publications below demonstrates some of the work that has taken place in Sri Lanka since the 2015 ASWN workshop in Dubai.

## 3. Cetacean research methods, data types, and data storage needs

### Types of data collected for cetacean conservation and management applications

*Salvatore Cerchio, New England Aquarium*

To help illustrate the diversity of different data types that are collected when conducting conservation-based cetacean research, Dr. Cerchio provided an overview of different research methods and the questions that they address. He provided concrete examples and illustrations of each of the following types of research methods and resulting data:

- *Positional data* from standardized or non-standardized line transect surveys to help determine species' *Positional data* from standardized or non-standardized line transect surveys to help determine species' spatiotemporal (seasonal) distribution and habitat use. This data is more meaningful if associated with effort data (indicating where researchers looked and didn't find whales/dolphin as well as the positions of sightings themselves). This can be used to create habitat models and define areas that should be considered for

protection or management efforts, as well as assess local density and estimate population abundance for status assessment.



Individual humpback whales can be recognised by the serrations and black and white patterns on the underside of their tail flukes, through a process called photo-identification. These can be used to monitor whales' movements and behaviour over time, and to calculate population estimates. *Photos courtesy Environment Society of Oman*

- *Photo Identification data* can be used to recognize individual whales or dolphins over time, providing insight into their residency and/or migration patterns, their life history (e.g. how long they live, how many offspring they have, and at what intervals), the progression of their health and exposure to threats over time (through assessment of the individual's body condition and lesions/scarring that can be indicative of disease, entanglement in fishing gear and/or ship strikes). Photo identification data can also be used to generate population abundance estimates, survival, and population growth rates through capture-recapture techniques.

- *Genetic samples* can be collected through biopsies or opportunistic collection from stranded/entangled carcasses or sloughed skin in the water (e.g. after a whale breach). Genetic data is used at the species level to determine evolutionary relationships and species identity of unknown or unusual samples. At a population level it is used to determine populations structure and connectivity, inferring whether two populations are inter-breeding or isolated, and can even be used to calculate population size and time of divergence from other (neighbouring) populations. At the individual level, it is used to determine the sex of the sampled animal and its relationship to other sampled animals, such as parentage or relatedness.

- *Satellite tagging data* can be used to track individual whales' movements over time (for as long as the batteries and the position of the tag permit transmission of signals). These data can be used to infer how habitat is used, by distinguishing between areas where they simply transit through, versus areas where they engage in smaller-scale movements over extended periods of time, indicating possible feeding and/or socializing. Tracks can also indicate possible connectivity between whales moving between geographical areas, and assess potential exposure to known risks such as shipping traffic.

- *Acoustic data* collected passively through anchored long-term recorders or arrays towed from a moving vessel can be used to detect the diversity of cetacean species vocalizing in a particular area, and can indicate patterns of spatiotemporal (seasonal) distribution or diurnal trends. Geographic variation in recorded vocalizations (particularly whale song) can be used to detect possible exchange between, or isolation of populations. Acoustic localization techniques can indicate behavior of vocalizing individuals, and observing behavioral changes in response to anthropogenic noise can be used to assess potential impacts on individuals and populations.

- *Strandings data* can be extremely useful to provide insight into species diversity where no dedicated vessel-based surveys have been conducted. Examination of stranded carcasses can also yield information on the causes of mortality and the threats present to cetaceans in a particular area.

Researchers often have separate data archiving systems for each of these different data types, sometimes making it difficult to cohesively analyze all of the data related to an individual whale within a dataset (e.g. one that has positional data from a sighting, has been photographed, genetically sampled, satellite tagged and/or recorded singing), and moreover, difficult to compare and synthesize data from different research groups or areas that utilize different archiving tools and procedures. Yet effective conservation and management requires that all of these different data types can be considered together throughout the range of a population or species, emphasizing the importance of collaboration and coordination, and need for development of regional networks.

# Flukebook: Computer Vision, Open Science, and AI for Humpback Whales

*Drew Blount, Wild Me*
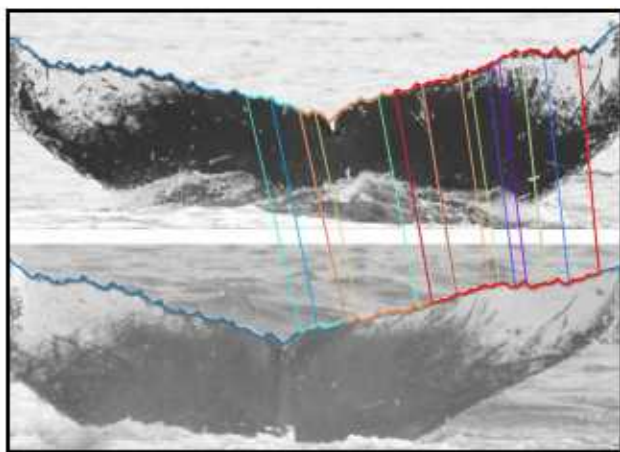


Original research by the multi-institution Wildbook team (see wildbook.org) has created multiple methods of identifying individual humpback flukes repeatedly. Shown here is the CurvRank algorithm, which matches flukes based on their unique trailing edges. CurvRank is one of two algorithms used in Flukebook. *Photos courtesy Wild Me*

Wild Me is a wildlife nonprofit organization based in Portland, Oregon, United States. Flukebook is a next-generation data platform for research and conservation of cetaceans. ASWN is joining the Flukebook network, and Drew is the lead developer on this project. Flukebook is a secure online database that researchers use to store and analyze a catalog of whale sightings. Using computer vision and artificial intelligence, Flukebook automatically identifies and finds matches between whale flukes featured in photos, in the same manner that Facebook can recognize a particular human's face. With this technology, researchers can study vulnerable populations like the Arabian Sea Humpback Whales more easily than ever before. Because Flukebook has been developed as an open-source collaboration between cetacean researchers across the globe, features that are added to the platform through investment by one research group are then made available to all other users. From viewing sightings on a map, to visualizing the co-occurrences of individuals in a population, to exporting data in standard formats, Flukebook is built for cetacean research. Flukebook features include the ability to export data to mapping and analysis software, such as Google Earth, ArcGIS, Mark (for generating mark-recapture population estimates) and SocProg (for analyzing relationships between individual whales or dolphins). Although Flukebook is a collaborative platform, researchers always own and control the data they put on Flukebook. If two Flukebook users agree to collaborate, they can engage in a two-way data sharing agreement that makes each party's data available to the other. Data collection efforts are made many times more useful when their results are shared with collaborators, for example allowing researchers in two different parts of the Arabian Sea to determine whether the same individual whales have been sighted in their survey areas, and thus better understand the population's range and conservation needs.

ASWN's contract with Wild Me is allowing Drew to add and improve features to make the Flukebook platform a better fit with the data collection and survey methods of ASWN researchers. We are streamlining the data model, importing historical catalogs of ASHW sightings, and making improvements to the user interface. Together with the ASWN, Wild Me is building the next generation of cetacean research methods. A video demonstrating how Flukebook's computer vision works can be viewed by clicking here.

## Question and Answer roundtable

The day concluded with a round table discussion during which members were encouraged to question/discuss anything that had been presented during the day:

- **Q:** Is the CMS Concerted Action likely to encourage the development of an IWC CMP? If so, who would the two initiatives co-exist/complement each other? **A:** It is very much hoped that the CMS CA will serve as a catalyst for a more comprehensive and government backed CMP. There are precedents for inter-IGO collaboration on conservation initiatives like this, and the involvement of both the IWC and CMP could be highly complementary —with the IWC providing the technical expertise and experience from other CMP's for small whale populations, such as the Western Gray Whale CMP, which was also a joint initiative between the IWC and the IUCN. CMS could complement the IWC technical expertise with regional expertise derived from other Arabian Sea/Indian Ocean initiatives like IOSEA Marine Turtle MoU.

- **Q:** How can we ensure that these instruments have practical results? **A:** Initiatives like the CMS CA or the IWC CMP can be used to gain higher level recognition for whales and their conservation needs among industry stakeholders and finance institutions as well as governments. Private sector funding – particularly from the industries that may be held accountable for some of the potential impacts on whale populations- may help to fill gaps where government funding or academic grants are lacking. This model worked well for Western Gray whales, where industry has contributed significantly to the funding and implementation of research and mitigation measures.

- **Q:** Has WWF Pakistan experienced any obstacles to collecting and/or sharing the crew-based observer data? **A:** The project was initiated as part of an effort to assist Pakistan with compliance with the IOTC resolution requiring members to have observers on 5% of their tuna fleets. Initially there was skepticism that captains/crew could provide accurate unbiased data, but there is no motivation to under-report their target catch or by-catch, and WWF's initial attempts to verify their reports indicate that the reporting is accurate. WWF Pakistan is about to begin using remote electronic monitoring (small cameras mounted on fishing vessels such as those produced by Flywire or Shellcatch) to ground truth reports from crew-based observers.

## 4. Delving into the new data platform: 2 days of practical work

The second and third days of the workshop involved a smaller group of participants and focused on practical training and exercises intended to familiarize new users with the ASWN Flukebook data platform, test its functionality, and collect feedback from participants on suggested improvements and user needs. Summaries of these two days' activities are provided below under general categories, rather than session-by-session reports.

### Introduction to Flukebook Functionality

*Drew Blount, Wild Me*



Drew Blount demonstrated the existing data fields and ran a number of searchers and mapping exercises on screen. Emphasis was placed on understanding the different levels of data that are used in Flukebook. From most specific to more general, these include:

- A *Media Asset* represents a photo or video captured in a wildlife study.
- An *Annotation* is generally a subset of a MediaAsset in which ecological information has

been detected. This can include data fields to describe the particular photo or video (e.g. 'tail fluke', 'Right Dorsal Fin', etc.).
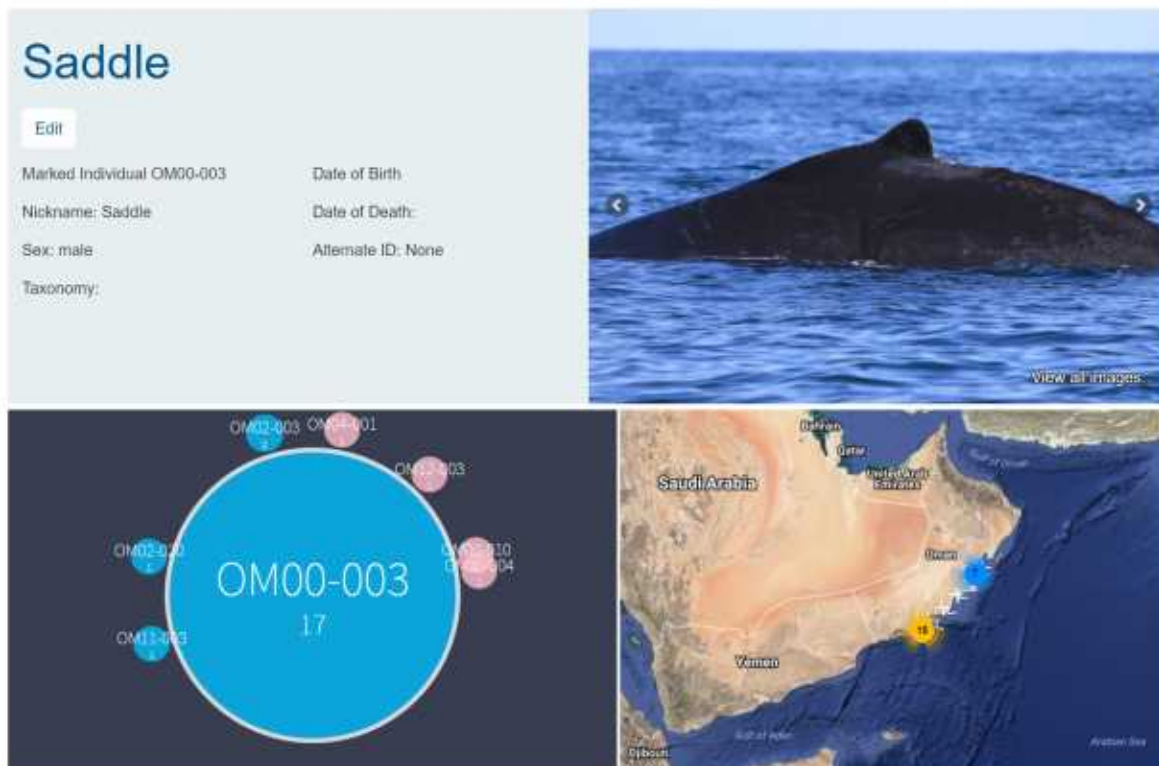
- An *Encounter* is an individual sighting of a member of a target population of a single species. Each encounter contains data that represent one individual at one point in time. For example, an Encounter may represent the photographing of a single dolphin at a specific point in time and/or the collection of a tissue sample for genetic identification later.
- A *Marked Individual* is a uniquely identified member of a population and includes one or more reported encounters. It is up to each library and its research staff to determine the minimum amount of data and procedures required for a unique identification (e.g., a distinct ear tag, a visual photo-identification, digital extraction of spot patterning, a distinct DNA pattern, etc.).
- An *Occurrence* or *Sighting* represents an observation of multiple individuals together and includes one or more encounters over a short duration of time.

Wherever possible, the data attributes recorded for an Encounter or a Marked Individual are named according to their Darwin Core equivalents. A definition of the Darwin Core can be found on the TDWG web site:

"The Darwin Core is a body of standards. It includes a glossary of terms (in other contexts these might be called properties, elements, fields, columns, attributes, or concepts) intended to facilitate the sharing of information about biological diversity by providing reference definitions, examples, and commentaries. The Darwin Core is primarily based on taxa, their occurrence in nature as documented by observations, specimens, and samples, and related information."

A more complete overview of Wildbook data structures and features can be found in the Wild Me Manual on this website: http://wildbook.org/doku.php?id=documentation

Drew demonstrated the computer vision matching of humpback whale tail flukes that combines algorithms to match the contours of the trailing edge of the tail fluke with algorithms that recognize the patterns on the ventral surface of the tail fluke to achieve over 90% accuracy in automated matching. He also demonstrated the visual/manual matching functions that can be used for features like humpback whale or dolphin dorsal fins for which computer vision/automated matching is not yet available. Participants were generally impressed with the computer vision matching, the integration of several data types into the new Platform, and the features such as the easy viewing of all the photographs associated with a particular encounter or individual, diagrams showing associations between individual whales, and the ability to export filtered data sets into mapping or mark-recapture software. However, a few glitches were noted, with promises that they would be addressed by the Wild Me team.

## Saddle

Edit

Marked Individual OM00-003
Nickname: Saddle
Sex: male
Taxonomy:

Date of Birth
Date of Death:
Alternate ID: None

OM00-003
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A selection of information that appears after conducting a search for Individual OM00-003 from Oman (only accessible to approved Oman data curators): The ability to scroll through all of the photos of that individual; a table listing all encounters with that individual, a diagram depicting the individual's associations with other known whales, and a map of locations where the individual was encountered. Not depicted - a table of all genetic samples obtained from the individual and satellite tagging information

## Experimenting with Flukebook

Participants were given temporary login ID's and passwords in order to be able to begin experimenting with the data platform. They were given exercises (e.g. conduct a search for all humpback whale encounters made in the Gulf of Masirah) as well as a sample set of data to upload into Flukebook. Participants came up with different observations and questions as they worked, providing a good opportunity for exchange of ideas and feedback.

## Comparison of data collection formats from ASWN member countries



Participants from Pakistan, India and Sri Lanka compare photographs of humpback whale tail flukes from Pakistan and India

Drew shared an Excel Spreadsheet that the Wild Me team created as an import template for existing ASWN data sets to be imported into the new ASWN Flukebook. This was based on the data fields that were used in the most complex data set that was imported to date – the Oman Cetacean Sightings Database (OMCD).

Participants from Iran, Pakistan and India shared their data collection forms and protocols, and comparisons were made between the data fields used by different ASWN members. Although some teams used certain data fields that others did not, there was a high degree of overlap

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between data collection fields, and all present felt that they would be able to use the data fields proposed in the Import Template.

While Flukebook is hoping to find funding to design a completely revised and more user-friendly data entry and interface, the Excel format Data import template was viewed by all present as a plausible "stop gap" measure to facilitate the import of large volumes of data (e.g., all of the sightings, photo, genetic sampling and tagging data from one survey) from ASWN members to the new Flukebook platform.

Andy Willson shared a presentation on the current data collection and entry workflow for the research conducted in Oman and some visualizations of how this could be adapted to streamline data collection and entry in the new ASWN Flukebook data platform. Andy and the Oman team are working on the development of a smartphone or tablet-compatible App that would eliminate or reduce the need for multiple paper data sheets in the field, and could be designed to automatically populate the key fields of Flukebook.
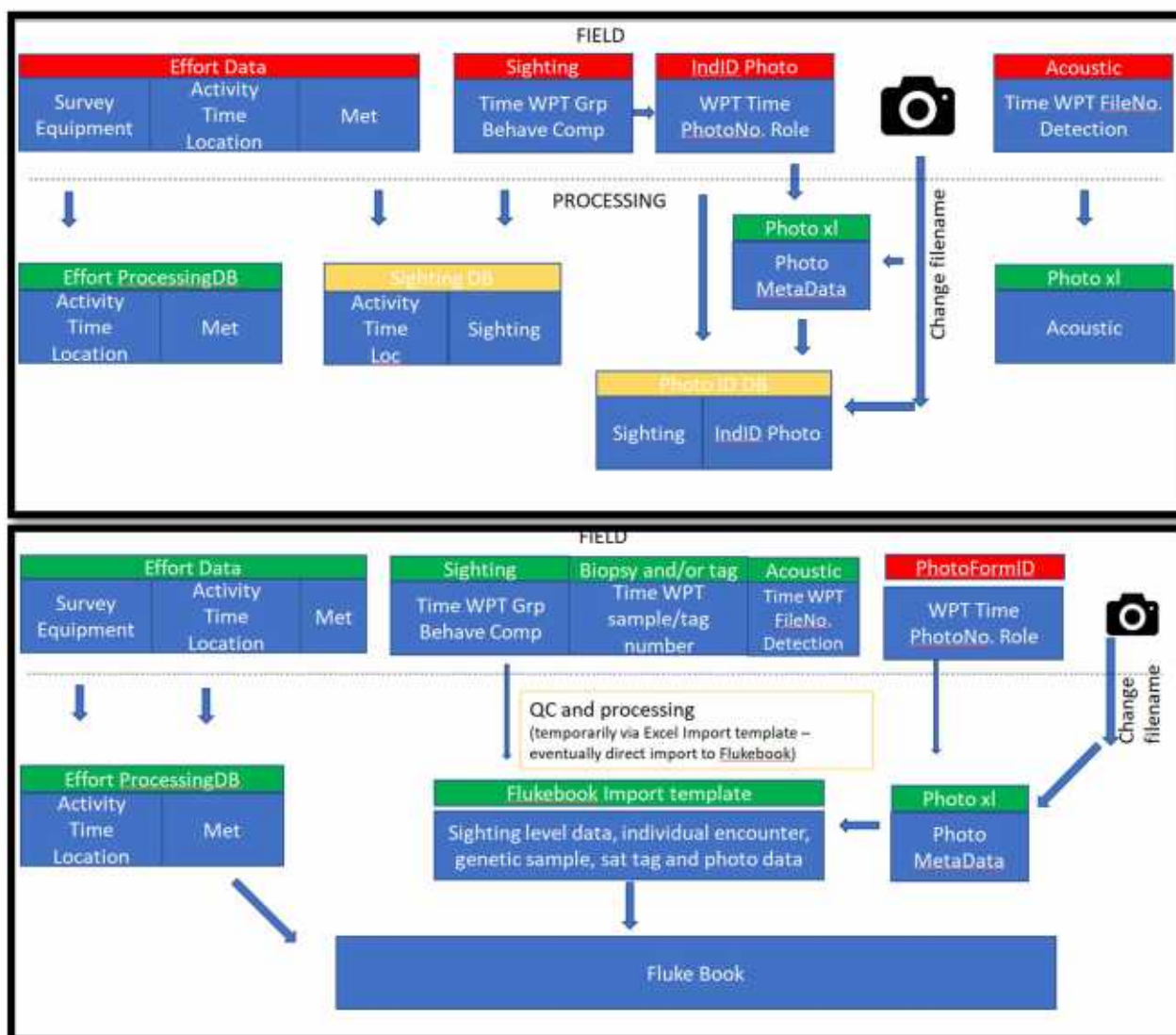


**Top:** Diagram of data collection and archiving process in Oman prior to Flukebook, and prior to the development of a tablet compatible field data collection App. Red labels represent paper data sheets, green labels represent Excel sheets, and yellow labels represent separate MS Access databases for humpback whale photo-identification and general cetacean sightings. **Bottom:** Streamlined process using an App to collect data in the field, which could then populate the Flukebook import template and facilitate bulk data upload into the new ASWN Flukebook platform.

## Virtual fieldwork:  A simulation of a survey off the coast of Gabon

On the third morning of the workshop participants engaged in a virtual survey of the coastline of Gabon.  Photos and data points from an actual survey conducted off the coast of Gamba, Gabon were projected onto the screen, and participants used paper data forms used by the team in Oman to record effort, sightings, and photo-identification data.  The simulated survey included humpback and bottlenose dolphin sightings and several humpback whale sightings with photos collected of dorsal fins and tail flukes.  The exercise proved valuable as a means of discussing the terminology, survey effort codes and practices used by different network members.  While it is not the intention of the ASWN to enforce a particular standard or protocol on all members, ensuring that we all speak a common 'language' when it comes to data entry is essential if we are all going to be able to use the new regional data platform to store and analyze data.



**Effort Codes**

Record GPS waypoint time and activity

SP = Speed (above 15knots)

WP = Waypoint – as soon as boat stopped

AC=Acoustic Station

SE = Searching 'on-effort'

CO = Confirmed Observation

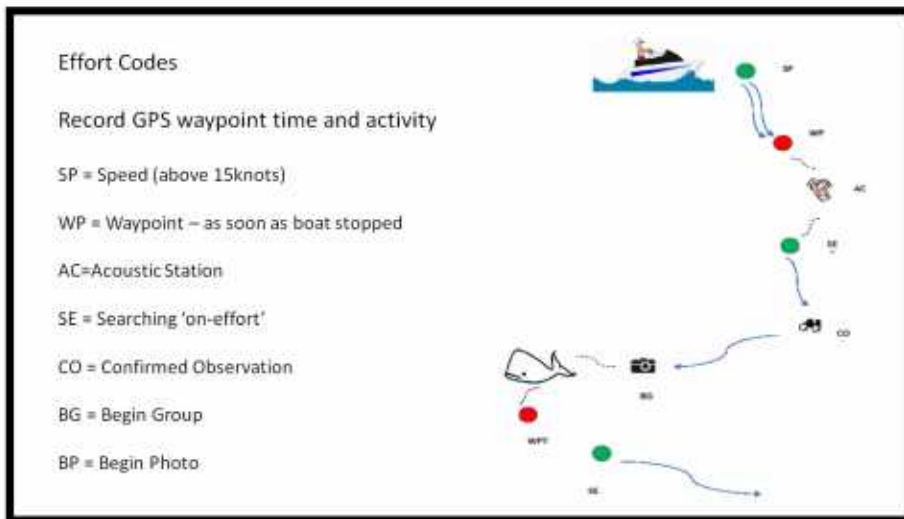BG = Begin Group

BP = Begin Photo

Diagram and definition of different codes used during collection of effort data in Oman cetacean research efforts.   While the codes may differ slightly from one project the next, the principles are the same (diagram courtesy Andy Willson).

## Data entry for ASWN Flukebook import

Following the simulation and data collection, participants transcribed their data into the Flukebook Import template. This helped users to gain an even better understanding of how the new Flukebook data fields correspond to data collected in the field.  While participants found this data entry method a little tedious and not as user friendly as they would like, it was agreed that as a stop-gap measure (i.e., for the next year or so), it was an acceptable way to start using the new data platform.

Various participants discussed ways to build more user-friendly data entry forms in Excel that would populate the Flukebook import template, including drop down menus and controls to limit the format in which certain data types are entered.

## A review of the Flukebook experience so far – User needs and suggestions

Participants provided feedback on their experience of the Flukebook data platform and their suggestions for improvements and new features that they would like to see in future iterations. Points raised included:

- The search functions and mapping functions for occurrences/sightings (not only encounters) need to be fully functional (this was not yet working during the workshop, for some reason).

- Another Flukebook user group (Duke University) is working to develop the ability to import survey track and effort data into Flukebook. Because new functions developed for Flukebook are open-access, If this proceeds as hoped, it should become possible to import and process effort data and generate survey encounter rates (with some spatial analysis?) within the next year.

- Wild Me has applied for various grants to design a completely new and more user-friendly interface that will make data entry and import more streamlined and intuitive.

- In the meantime, participants suggested upgrades to the Excel Data Import template, such as the definition of fields that are essential/required for an entry, and the development of data format/type constraints on entry for different fields/columns (e.g. Latitude and longitude – as decimal degrees only, formats for dates, etc.).

- It was agreed that separate fields would be added to define the feature of each photo (e.g. Tail Fluke, Right Dorsal Fin, Left Dorsal Fin) rather than having these as key words that could be open to miss-spelling or other irregularities.

- It was agreed that new fields would be added to define the photo quality (a numerical score from 0 – no photo or unusable photo to 4 – excellent quality photo), and distinctiveness (also a scale of 0 completely non-distinct to 4 – highly distinct).



The 'rap sheet' for Luban, the humpback whale that was satellite tagged in the Gulf of Masirah in 2017 and subsequently crossed the Arabian Sea to India. These 'rap sheets' portray the best/exemplar photo of each key feature of the whale as well as its sighting history. They can be printed and laminated or taken into field as PDF's on tablets, allowing researchers to make critical decision in the field about which whales to biopsy or tag.

- The import template will include a field to indicate whether an imported photo is the exemplar photo of an individual –and for each individual Flukebook will have a system to designate the best photo of each feature of that individual.

- These exemplar photos will ideally ultimately be used to generate printable/PDF-able catalogues of individuals that researchers can take into the field. This is critical for many research projects that need to be able to recognize individuals in the field to make decisions about biopsying or tagging certain individuals based on their sex or sighting history. The Oman MS Access database (adapted from the WCS CCRP photo-ID database) includes this function (called a 'rapsheet'), which has been critical. The Wild Me team originally promised to create this for ASWN – but it has been more challenging than initially imagined. This will require more negotiation between the Wild Me team and the ASWN team.

- Participants asked whether there will be any other way to view their data offline. Flukebook includes data export functions to CVS files and other formats that can be viewed in Excel.

- Flukebook already includes some basic data fields that can be used to record strandings data. A stranding is treated like an encounter with a dead individual but only the most basic information can be included at the moment. Although the current ASWN contract does not include the development of more detailed data fields for strandings, another Flukebook user has requested these fields, and the Wild Me team is developing additional fields (length

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measurements, evidence for cause of death, etc). Drew would welcome a list of the more detailed strandings fields that ASWN would find useful, so that these can be compared with the development that is underway.

- The Wild Me team would also welcome a discussion on what types of additional data fields could be added to be able to capture acoustic data/meta-data, as this was not included in the ToR of the current ASWN contract.

## 5. Working with Fisheries for data collection and cetacean conservation

The final day of the workshop was added to the programme to allow participants to discuss the ways in which the fisheries industry can be involved in collection of data on cetaceans with an aim toward conservation of marine mammals in the Arabian Sea. Various members presented ongoing work with fishers in their study sites. This was followed by work in break-out groups to analyze the challenges and opportunities for working with fisheries in each of the countries represented, Oman, the UAE, Iran, Pakistan, India and Sri Lanka.

### WWF Pakistan: a crew based observer programme

*Moazzam Khan, WWF Pakistan*



**Top:** Crew-based observer measuring a shark caught as bycatch during offshore tuna fisheries. **Bottom:** Young Risso's dolphin recorded as bycatch by a crew-based observer.

The WWF crew-based observer programme was initiated as an effort to help Pakistan comply with IOTC resolution 11/04, which requires that 5% of tuna fisheries operations/sets form vessels 24m or longer operating outside a country's EEZ are monitored by on-board observers. Initially there was resistance to this from both Pakistan and Iran, and no government-sponsored or industry-led observer programme was in place. With over 700 vessels operating from Pakistan, a minimum of 35 observers would be required to achieve 5% coverage. Initially, efforts were made to train and place 'external' observers with bachelor degrees in science. However, due to the length of fishing trips (about 35 days on average) and inadequate facilities and poor hygiene conditions on board, this approach was abandoned. Instead, one of the crew members (usually the skipper) is trained and given a monetary incentive to collect data on tuna catches, as well as entanglement of cetaceans and other megafauna (turtles, sunfish, mobulids etc.). Within a short time, these crew-based observers were generating an unexpected volume of useful data about various aspects of tuna gillnet operations and catches of target and non-target species.

Crew-based observers use standardized data sheets to record the quantity and species of fish that are caught. They also record information about bycatch and non-target megafauna. The observers are additionally asked to note the presence of cetaceans and are provided with digital cameras to take photographs and/or movie clips of cetaceans, especially Arabian Sea humpback whales. Following the initial success of the first two crew-based observers in 2012 (funded by the Indo-Pacific Cetacean Research and Conservation Foundation (IPCRCF) from the Australian Marine Mammal Centre (AMMC)), the number of observers was increased to four in 2013. Growing year-by-year, the programme now involves over 85 trained observers, is funded by multiple sources, and generates large volumes of data on target fish catches (measurements and weights of 3 specimens of each target species on each haul), as well as by-catch and live observations of high conservation value megafauna.

Data on bycatch of dolphins collected through the crew-based observer programme in 2013/14 and extrapolated for the entire Pakistan tuna fishery indicated that as many as 12,000 dolphins were being killed in Pakistan's tuna fisheries each year[29]. The project has now moved onto a new phase of testing mitigation methods. Due to rigorous persuasion and partly to increase market demand for yellowfin and skipjack tuna, many fishermen have switched to a sub-surface technique, where nets are hung 1.5-2m below the water surface, suspended by ropes and floats. This practice, together with the use of stiffer polyamide nets has led to an apparent 80% reduction in dolphin bycatch. The programme will soon use Remote Electronic Monitoring systems (REM) – such as those offered by Flywire or Shellcatch to ground truth the crew's self-reporting.

## Masirah Island, Oman: tracking fishing effort for conservation

*Andrew Willson, Five Oceans Environmental Services*

A number of fisheries on Masirah Island were identified by the local community as a potentially significant source of mortality to female turtles active around the island's loggerhead nesting rookery (2nd most important in the world). There is also relevance to cetaceans (and ASHW) which have overlapping habitat in waters that are within range of fishing activities conducted from the island. Three phases were detailed in the development of survey methods. The first phase (2013) characterised fishing effort through community-based questionnaire surveys (n=105). These allowed mapping of fishing distribution and bycatch estimates for turtles, and indicated that gillnet fisheries operated from dhow and skiff fleets merited concern and further action. The objective of the second phase was to produce a more robust assessment of bycatch from vessels using gillnets working towards an assessment of bycatch per unit effort. Track files generated from GPS loggers deployed on boats (for up to a month) were used to construct density maps of fishing effort derived from metrics including, length of net and time deployed. Various methods were trialled to record bycatch including logbooks, flashcards with cameras and direct camera pictures. None of these were particularly successful due to cultural, educational and motivational reasons. Due to the difficulties of manual record keeping, the third phase (2017) of the study concentrated on developing a more autonomous fishing effort and bycatch observation system. Photos from time-lapse cameras mounted to observe the deck of each vessel were used in conduction with automatically collected GPS track data. Results of this phase are still being processed, but appear to be yielding a more accurate mapping of effort and bycatch. It is hoped that this system can be replicated across more of the fishing fleet to help inform both owners and management agencies of fishing activities across Oman, as well as to improve bycatch assessment. The development of live track modelling is being investigated as a tool to provide even more accurate data on effort and offer more incentive to owners and management agencies to adopt its wider use. Replicating this model on a wider scale would require more resources as well as an appropriate entity and organisational framework within which to run the system as a fisheries management tool.

## India: a country-wide network for community engagement

*Dipani Sutaria, Independent Researcher*

Indian researchers working mainly on local coastal populations have initiated secondary data collection from fishermen, in regards to cetacean sightings and entanglement. Fishermen usually provide either photographs or videos of these events. This work has initiated in Goa, Maharashtra and Karnataka on the west coast of India. Given the vast coastline and more than 200,000 commercial fishing vessels, obtaining by catch rates has not yet been possible. Commercial fisheries consist of Mid and Bottom trawls (Steel and Wooden vessels), mini and large purse seiners, mono

and multifilament gill netters including set and drift gill nets, long liners and hand lines, A study conducted from a landing site in 2011 by Yousuf et al.[35] suggests that Purse seines and Gill nets are responsible for entanglements across 6 species of cetaceans. While cetaceans are not a target catch in any of these fisheries, varied perceptions of fishers towards different species of cetaceans exist. The large whales and dolphins, including the black fish and Killer whales are revered and feared by fishermen, the smaller pelagic delphinids are consumed if accidentally caught fresh, in most southwestern States of India; while the attitude towards humpback dolphins is conflicting all along the coast as the species causes net damage and catch loss. The Central Marine Fisheries Institute and the Centre for Fisheries Technology have initiated work in documenting by catch and in experimenting with mitigation methods to reduce by catch.

## Congo: Tracking small scale artisanal fishing effort through grass-roots engagement

*Tim Collins, Wildlife Conservation Society*

In 2012 the WCS team in Congo's coastal Conkouati-Douli National Park (CDNP) began a partnership with the Centre for Ecology and Conservation at Exeter University. The partnership had many objectives, including a project to quantify and map the parks artisanal fishery, a critical economic activity for many, but also a known killer of several threatened species, including the Critically Endangered Atlantic humpback dolphin. The project built on dolphin research and coastal community engagement work that started in 2009; researchers first identified the occurrence of the humpback dolphin in Congolese waters, and then confirmed that dolphins were occasionally caught in artisanal fishing nets. Through a combined process of beach-based dolphin research and outreach the project established an excellent relationship with the CDNP fishing community. This led to a process of voluntary bycatch reporting and even (incentivized) dolphin releases. However identifying where the greatest bycatch risks occurred became increasingly important as it became clear how significant the scale of bycatches was. With Exeters help, the project deployed small GPS loggers on many of the parks fishing boats across the course of a year. These simple units were able to demonstrate not only where fishermen were setting nets, but also a suite of other fishing related metrics. Such was the success of this project within CDNP that the team extended the GPS deployments to 23 of the 28 known artisanal fishing sites in Congo, and also a handful of landing sites in the coastal city of Pointe Noire. The data and associated analyses led to the publication of a peer-reviewed paper[36] and data are now being used in the development of a national marine spatial plan. Work to match the fisheries data to dolphin observational data is ongoing.

## International and regional initiatives to support the monitoring and mitigation of cetacean-fisheries interactions



WWF Global Cetacean Initiative: Gianna Minton briefly summarized the new global initiative and planned strategy for its delivery. The initiative has been catalyzed by WWF Netherlands and WWF Germany and focuses on three pillars/objectives:

1.     By 2020, the level of entanglement and bycatch in fishing gear is reduced by 50% for at least 3 highly threatened cetacean populations identified in the Cetacean Species Action Plan.

2.     By 2020 the risk of ship strikes and noise is reduced by 50% in at least 2 key cetacean habitats identified in the IWC Ship Strikes Mitigation Strategy.

3.     By 2020 at least 2 additional regionally important critical cetacean habitats are

protected through the establishment of MPAs and/or the introduction of (seasonal) measures to mitigate the most pressing threats.

Implementation of the first objective will focus on activities that help to scale up small scale innovative projects that show promise in reducing bycatch to other populations, helping to create incentives (e.g. preferred markets) for fisheries that collaborate with monitoring and mitigation schemes, and increased engagement with governments to incorporate bycatch reduction in their legal and political frameworks.



IWC Bycatch Mitigation Initiative: As a global inter-governmental organization with extensive focus and expertise in most aspects of the conservation and management of cetaceans, including their interactions with fisheries, the IWC endorsed a proposal for a new Bycatch Initiative in 2016. The Initiative has received support and funding from a number of member states, and in January 2017 a full-time coordinator was hired to implement the programme in collaboration with various IWC committees and an soon-to-be-appointed Expert Panel .

Building on the model of the IWC's successful Entanglement Response Programme, the Initiative will focus on four main areas of work:

- investigation of mitigation methods;
- transfer of expertise, technology and management measures;
- improved assessment of bycatch;
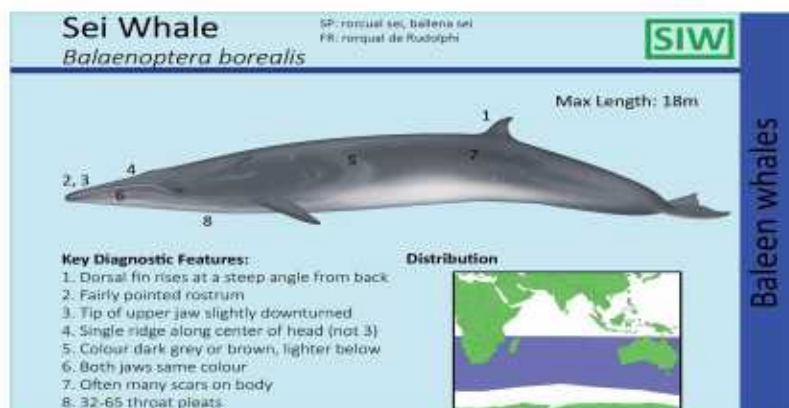- engagement with other relevant organisations.

While the programme of work is still under development, it is likely that it will aim to provide support and advice to member countries seeking to address cetacean-fisheries interactions. As with the Entanglement Response Programme, requests for engagement with and support from the IWC Mitigation Initiative will be most effective if they are made by the governments of member countries, although some tools and information developed through the programme will be freely available online.
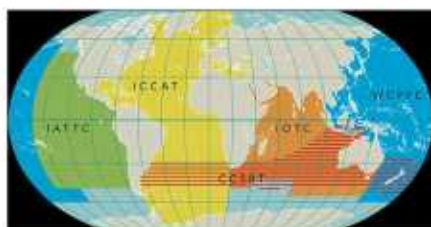


The Indian Ocean Tuna Commission (IOTC) is one of the 5 Regional Fisheries Management Organizations (RFMOs) for tuna and tuna-like species. While it has to date been more proactive on the mitigation of sea turtle, sea bird and shark bycatch than marine mammals, resolution 13/04 requires all member countries using purse seine or other types of fishing gear to report interactions with cetaceans to the relevant authority of the flag state under which they are operating. The Working Party on Ecosystem and Bycatch (WPEB) held its 13th meeting in San Sebastián, Spain on September 4-8, 2017. During this meeting a number of papers were presented, many of which are of relevance for cetacean –fisheries interactions in the Arabian Sea. Of note are the following papers presented by WWF Pakistan and other ASWN members which can be downloaded here:

- IOTC-2017-WPEB13-INF10 Arabian Humpback and Baleen Whale sighting along the Pakistan Coast: Information Generated Through WWF Pakistan's Fishing Crew Observer Programme
- IOTC-2017-WPEB13-19 - Major bycatch reduction of cetaceans and marine turtles by use of subsurface gillnets in Pakistan
- IOTC-2017-WPEB13-40 Rev_1 Cetacean bycatch in the western Indian Ocean: an updated review of available information in costal gillnets, tuna purse seine and pelagic gillnet, tuna purse seine and pelagic longline fisheries.

**Sei Whale**
*Balaenoptera borealis*

SP: rorcual sei, ballena sei
FR: rorqual de Rudolphi

SIW

Max Length: 18m

**Key Diagnostic Features:**
1. Dorsal fin rises at a steep angle from back
2. Fairly pointed rostrum
3. Tip of upper jaw slightly downturned
4. Single ridge along center of head (not 3)
5. Colour dark grey or brown, lighter below
6. Both jaws same colour
7. Often many scars on body
8. 32-65 throat pleats

**Distribution**

Baleen whales

Sample of the cetacean identification cards that will be produced and made available online by the IOTC.

The IOTC has also commissioned the production of a number of cetacean species ID cards to help improve information and statistics on cetaceans that interact with tuna fisheries in the Indian Ocean. These guides are designed to be used by fisheries observers, samplers, fishing masters and crew on board fishing vessels targeting tuna, tuna-like species and sharks in the Indian Ocean. They will be available online here: http://www.iotc.org/science/species-identification-cards

## Break-out groups – mapping challenges and opportunities for work with fisheries

Participants divided into three groups to map the challenges and opportunities for working with fisheries to learn more about cetaceans and cetacean conservation in six countries: Oman, the UAE, Iran, Pakistan, India and Sri Lanka. Participants generally agreed that working with fishing communities and industry stakeholders is challenging, and best achieved through the patient building of relationships and gaining of trust. Fishermen throughout the region are generally wary of any form of interview or intervention, particularly if they fear that information they share will result in fines or sanctions from the government. WWF Pakistan has overcome this hurdle by working with the government to promise anonymity and immunity from sanctions to the crews that participate in their crew-based programme.

Fishing crews work under difficult conditions and often have many duties related to their primary fisheries-related tasks. As such, researchers cannot expect them to take on additional tasks without some reward or incentive. In Pakistan, monetary incentives have helped catalyze the crew-based observer programme, and build enthusiasm for collaboration, with bonuses being awarded to the crew members that take responsibility for reporting duties and/or releasing entangled non-target species. However, this practice may not be sustainable in the long term if the government does not take over the programme and WWF Pakistan exhausts its funding sources. Researchers and governments interested in promoting collaboration with fisheries need to find other incentives. Examples from other parts of the world include certification schemes and/or preferential markets for fisheries products from vessels/fisheries that host observers or engage in self-reporting. Other incentives may include helping fishermen gain access to a better market for sushi/sashimi grade tuna if they use longlines rather than gillnets, as fish are not damaged/bruised.

Discussions revealed that there was no 'one-size-fits-all' method to building trust and gaining information. In Pakistan, good relationships with boat captains can result in valuable working relationships and vessel captains acting as data collectors as well as the enthusiastic freeing of entangled animals. However, in India and Pakistan, vessels are often crewed by hired hands who have no vested interest in collaborating with researchers or NGO's and will only do the bare minimum of what they are instructed to do by vessel owners. These vessel owners may be far removed from the direct fishing operations and have little interest in collaboration. In these situations the crews may have literacy or language barriers that complicate collaboration with researchers, and hinder effective data collection. Innovative methods including the use of pictorial cards and photographs with time stamps on them so that fishermen can document the times that nets are being set or hauled without having to write, have been moderately successful in some locations.

While there are many difficulties and perceived hurdles to collaboration with fisheries, participants also saw opportunities through growing regional awareness and the engagement of the IOTC and IWC in efforts to support countries wishing to work with fisheries to limit cetacean –fisheries interactions. Several small-scale pilot projects, such as those presented for India, Pakistan, Oman and Congo also provide models that can be adapted and replicated throughout the region if sufficient funding and government support is obtained.

All agreed that it would be useful to collaborate with social scientists and economists to better understand how to address the human dimension of fisheries-cetacean interactions.

## Wrap-up and conclusions

Time constraints and early flight departures prevented participants from being able to conduct some of the tasks envisaged for the final sessions of the workshop, including donor mapping and the design of a regional action plan – tasks which may have required an additional workshop in and of themselves.

Participants did, however, make a number of final recommendations and resolutions:

- To continue to collaborate to improve and finalize the Flukebook regional data platform so that it becomes an efficient and effective tool that all members can use to archive and query their cetacean data, and engage in bilateral or regional collaborations as and when desired;
- To build on and improve the tools and frequency of communication between network members and to increase general awareness of the network's profile and members' progress and achievements (e.g. through social media and other tools);
- To create another newsletter in time for the next IWC Scientific Committee meeting and to inform the CMS Scientific Council of recent progress within the network;
- To strive toward more regular (e.g. annual or biannual) meetings of the network – if possible focusing on a particular issue (like the focus on the data platform for this meeting);
- To seek funding for the core elements of the network – e.g. coordination, maintenance of the website, maintenance of the data platform, as well as cross-boundary/regional research and conservation projects.

# 6. Appendices

## Participant list

| | Full name | Organization | E-mail |
|---|---|---|---|
| | **Participant List ASWN workshop 21-24 January, 2018** | | |
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## Workshop Programme

## Sunday, January 21

**Objectives**

1) Familiarize participants with the type of research being conducted on cetaceans in the region and the data archiving needs for this research.
2) Introduce the regional Flukebook data platform as a tool that meets these needs.

| 8:00 - 8:30am | **Arrival and Registration** |
|---|---|
| 8:30 - 9:15 | **Opening and Welcome** messages:<br>• Lamees Daar, Environment Society of Oman Executive Director,<br>• Dr. Abdul Aziz Al Marzuqi, Director of Fisheries Development Ministry of Agriculture and Fisheries Wealth,<br>• Dr. Rab Nawaz, Director, WWF-Pakistan |
| 9:15 - 9:45 | **Presentation:** "The Arabian Sea Humpback Whale - A Shared Regional Treasure under Threat" - Suaad Al Harthi, Environment Society of Oman |
| 9:45-10:30 | **Panel Session:** "Regional Initiatives to promote cetacean conservation in the Arabian Sea".<br>Panel Members:<br>• Dr. Gianna Minton, Co-Coordinator Arabian Sea Whale Network<br>• Dr. Thuraya Al Sariri, Assistant Director General of Nature Conservation, Ministry of Environment and Climate Affairs Oman<br>• Lyle Glowka, Executive Coordinator Convention on Migratory Species - Abu Dhabi Office,<br>• Moazzam Khan, WWF Pakistan |
| 10:30 - 11:00 | Coffee Break |
| 11:00 - 11:30 | **Summary of Research in Oman** - Asma Al Bulushi, Aida Al Jabri, Andy Wilson |
| 11:30 - 1:00 | **Summary of Research** and data from ASWN member countries:<br>• **India,** Dipani Sutaria, Independent Reseracher<br>• **Pakistan**, Moazzam Khan, WWF Pakistan<br>• **Iran**, Hamed Moshiri and Nazanin Mohsenian, Plan4theLand<br>• **Sri Lanka**, Asha de Vos, OceansWell |
| 1:00 - 2:00pm | Lunch |
| 2:00 - 3:00pm | **Presentation**: Types of data collected for cetacean conservation and management applications - brief summary of research methods and data - Sal Cerchio, New England Aquarium |
| 3:00 - 3:30 | Coffee Break |
| 3:30 - 4:30 | **Presentation**: Introduction to Flukebook regional data platform as an integrated tool to archive multiplel types of data - Drew Blount, Wild Me |
| 4:30 - 5:00pm | **Q&A Panel Session**<br>Panel Members: Drew Blount, Gianna Minton, Tim Collins, Suaad Al Harthi, Moazzam Khan, Dipani Sutaria |

| Time block | Monday 22 January | Tuesday 23 January | Wednesday 24 January |
|---|---|---|---|
| . | **Objectives:** Introduce new users to the ASWN data Platform and begin training for application **Facilitator:** Drew Blount, Flukebook | **Objectives:** Provide practical training and practice with implementation of new data archiving platform **Facilitator:** Drew Blount, Flukebook | **Objectives:** How to incorporate fishing vessels and crews as sources of data on cetacean distribution and threats throughout the Arabian Sea **Facilitator:** Moazzam Khan - WWF Pakistan |
| 8:30-9:15 | More detailed and technical introduction to new ASWN Flukebook data platform - Drew Blount | Practical: Power point presentation simulation of fieldwork transect- and photo-Identification - use cameras and data sheets or Tablet-based data collection forms | More technical presentation on WWF Pakistan crew-baed observer scheme (Moazzam Khan - 20 mins); presentation on Masirah fisheries community engagement (Andrew Willson - 20 mins) |
| 9:15-9:45 | Session 1 continued | Session 1 continued | Presentations on Community based work with fisheries in India (Dipani Sutaria- 20 mins) and Congo (Tim Collins - 20 mins) |
| 9:45-10:30 | Entering/uploading data cont - each with own laptop -entering Flukebook team generated dummy data set | Practical: Work in teams to process and enter collected "field data" from power point simulation | Overview of fisheries-cetacean initiatives from regional and international organisations - WWF Cetacean Initiative, IWC Bycatch Mitigation Initiative, IOTC (emphasis on IOTC - Rab Nawaz, WWF Pakistan) |
| 10:30-11:00 | Coffee Break | Coffee Break | Coffee Break |
| 11:-11:30 | Practical session: each with own laptop - querying Flukebook prepared dummy dataset in new platform | Practical: Work in teams to conduct quality control, matching and simple queries on the new dataset | Break out groups to discuss different elements of fisheries-cetacean data collection opportunities - for structure see second Excel sheet |
| 11:30-1:00 | Practical: exporting for mapping applications | Previous session continued | Break-out groups continued |
| 13:00-14:00 | Lunch | Lunch | Lunch |
| 14:00-15:00 | Practical: exporting for mark-recapture | Export dummy data set to mapping software and run a simple mark-recapture model using dummy data set | Report back from Break-out groups with suggestions of possible elements of a region-wide cetacean-fisheries data collection action plan and completion of matrix with actions targeted for each member location |
| 15:00-15:30 | Tea Break | Tea Break | Tea Break |
| 15:30-16:30 | Inventory of how teams are currently collecting data - data forms/tablet based - each participant provide 5 ppt slides/forms ahead of time | Assessing potential additional user needs/modifications that need to be made to data platform | Donor mapping, evaluating species at risk, how ASWN can best support local and regional initiatives addressing cetaceans-fisheries interactions |
| 16:30-17:00 | Discussion of tablet digital data collection and upload options | Feedback and way forward with data platform | Drafting of Action Plan linking ASWN initiatives to WWF Cetacean Initiative, IWC initiatives, IOTC and others. |

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