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IWC/66/WK-WI-Rep01. Report of the Third Workshop on Large Whale Entanglement Issues, Provincetown, MA, USA, 21-23 April 2015

International Whaling Commission

INTERNATIONAL
WHALING COMMISSION

Report of the Third Workshop On Large Whale Entanglement Issues

Contents

The Workshop was held at the Center for Coastal Studies, Provincetown, MA (USA) from 21-23 April 2015. The list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Opening remarks

Mattila welcomed the group on behalf of the IWC, who convenes the global whale entanglement response network, which is made up of affiliated national and regional response networks, who adhere to the IWC consensus principles and guidelines for whale disentanglement. In particular he welcomed the new members of the network including some who were attending as networks for the first time (Argentina, Brazil, Mexico, Panama and UK). He also thanked Egil Øen for attending, as he had provided the original inspiration for the group to be convened at IWC58 in 2006, and has played an essential role in its continued progress, assisting the group to focus on common ground and advance work on the welfare aspects of entanglement. In this spirit, Mattila encouraged the participants to undertake healthy debate, but to focus on the shared goal of easing animal suffering, and to attempt to move forward with consensus where possible.

1.2 Chair and Rapporteur(s)

Bjørge was appointed Chair. Rapporteurial duties were undertaken by Donovan, Mattila, Robbins and Simmonds.

1.3 Review and adopt Agenda and documents

The Agenda is given as Annex B and the list of documents can be found as Annex C.

2. NEW INFORMATION SINCE 2011 WORKSHOP

2.1 Aspects of reports from relevant workshops in 2011-2014

2.1.1 IWC Workshops on Marine Debris

Apparently increasing trends in interactions of cetaceans with marine debris underpinned two recent workshops held under the auspices of the IWC; clearly of most relevance to the present Workshop are the discussions they held concerning 'abandoned, lost or discarded fishing gear' or ALDFG [1]. Both workshops had noted that the available evidence strongly suggested that 'commercial and other active fishing gears' or COAFG was responsible for most large whale entanglements but that more work was needed to determine robustly the proportions of entanglements due to each (see below) in term of assessing threats at the population level.

FIRST WORKSHOP, WOODS HOLE, MAY 2013

The first workshop had focused on what was known of the effects of marine debris on cetaceans and was held at the Woods Hole Oceanographic Institution (SC/65a/Rep06). It included an overview of marine debris distribution; ingestion-related issues including microplastics; the IWC's work on disentanglement; and a number of case studies. The latter included entanglement reporting in Italy; USA west coast entanglement records; and gear recovery and modelling in Puget Sound. The workshop made many recommendations on a variety of topics. Of special relevance to the present Workshop was the highlighting of the importance of trying to distinguish whether or not entangling gear was active or derelict at the time of entanglement. It outlined some potential methods to achieve this and also pathology techniques. It called for improved data-sharing and recommended that:

(1) marine debris interactions should be reported by member nations in their IWC progress reports;
(2) debris sampling should be conducted during cetacean field studies;
(3) there should be improved efforts to work with industry and fishermen; and
(4) the IWC Scientific Committee should work to further evaluate the risks of ingestion;
(5) the desirability of working in collaboration with other intergovernmental bodies.

SECOND WORKSHOP, HONOLULU, AUGUST 2014

A second workshop on marine debris was held in Honolulu in August 2014 (IWC/65/CCRep04). This workshop attracted participants from ten countries and representatives from the United Nations Food and Agriculture

[1] This report follows the terminology agreed at the second workshop on marine debris i.e. fishing gear that is being used (operationally active) by fishermen is called 'both commercial and other active fishing gears' or COAFG to distinguish it from 'abandoned, lost or discarded fishing gear' or ALDFG.

Organisation (FAO), the United Nations Environment Programme (UNEP) and the Convention for Migratory Species (CMS) along with relevant industry bodies and a number of non-governmental organisations concerned with marine debris. Its primary objectives were to: (i) explore how the IWC can engage with the existing international and regional mitigation efforts concerning the management of marine debris; (ii) determine how best to ensure those efforts are informed by the growing understanding of the cetacean-specific impacts of marine debris; and (iii) advise on how best the IWC can lead/engage with action in regions where marine debris has the greatest potential impacts on cetacean populations.

Focal workshop topics included fishing gear marking, using practices in the USA as an example; potential gear modifications; methods for identifying debris hot spots; modelling approaches; work conducted on other species (principally the work of CSIRO in Australia on risk analysis for ingestion and entanglement in seabirds and turtles); debris ingestion; the role and responsibilities of the International Convention for the Prevention of Pollution from Ships (MARPOL); the Nofir project for recycling fishing gear in Norway and elsewhere; the NOAA Marine Debris Programme and the Hawaii Marine Debris Action Plan; the Korean Gear Buyback Programme; the European Healthy Seas Initiative; the Philippines Net-Works programme; Ghost-Nets Australia; WAP's new Sea Change initiative; and the exemplary outreach work by Northwest Straits Foundation, UNEP and NOAA.

The second workshop emphasised in its conclusions and recommendations that the issue of marine debris, while important for cetaceans, was a major environmental issue in its own right that was already the subject of a number of important international and national initiatives and that there is a need for a coordinating body to help bring these initiatives together. It was agreed that the IWC's primary contribution should be to ensure that cetacean-related issues are adequately represented within existing initiatives and that its strong scientific and other expertise is made available in collaborative efforts.

The second workshop strongly recommended as the highest priority that the IWC and its Secretariat work together with the Secretariats of the other Intergovernmental Organisations (IGOS) and Regional Fisheries Management Organisations (RFMOs) relevant to this issue to ensure consistency of approach, synergy of effort and exchange of information to develop appropriate mitigation strategies that recognise that (a) prevention is the ultimate solution but that (b) removal is important until that ideal is realised. It also recommended that individual IWC member countries collaborate with such initiatives and that the IWC continues to highlight issues surrounding marine debris and cetaceans.

It also recommended that every effort is made to work with fishing, and other relevant industries and NGOs as appropriate and that the IWC (and other IGOs) encourage their member states to review national level implementation of MARPOL Annex V and other conventions relevant to marine debris reduction. The IWC should encourage its members to prioritise the strategic use of a range of measures to improve marine and terrestrial waste management, including national legislation and policy, stakeholder partnerships, industry training schemes and economic tools aimed at reducing public consumption of key types of debris such as packaging waste.

The second workshop also made specific recommendations for collaboration and endorsed the research recommendations from the first (IWC, 2013) and the 2104 Scientific Committee meeting (IWC, 2015 in press), including incorporation of data on marine debris into IWC national progress reports in a standard format and development of a global IWC entanglement database.

In addition it recommended that:

(1) effort to collect data using a standard approach to enable better assignation of entanglements;
(2) IWC encouragement to FAO's Committee on Fisheries (COFI) to complete its work on gear marking;
(3) IWC encouragement to disentanglement and stranding teams to collect detailed information on entangling gear/material that is removed from whales, and on marine debris present in the immediate environment;
(4) the IWC Scientific Committee explores ways to identify priorities for mitigating and managing the impacts of marine debris on cetaceans;
(5) continued IWC support for the disentanglement network, consideration of incorporating all marine debris into the initial training programme, the importance of involving the local fishing communities in the training;
(6) IWC promotion of the model of expert training/capacity building into existing marine debris initiatives;
(7) IWC investigation of ways to most effectively communicate the workshop's recommendations to the relevant target audience(s), including considering highlighting the IWC's work on the impacts of marine debris on cetaceans at meetings of other IGOs e.g. the forthcoming COFI in 2016;and

(8) improved methods to encourage IWC member nations and others to provide the marine debris related data.

Finally, it endorsed the present Workshop agreeing that it should incorporate entangling debris as well as in-use gear. It encouraged all members and non-members of the IWC to take advantage of the IWC disentanglement network especially in those regions where entanglement represents a threat at the population level (e.g. Western Pacific, Eastern South Atlantic, and Arabian Sea).

DISCUSSION

On the topic of marine debris, Ledwell reported that gear is tagged in Newfoundland and so fishermen have to report when it is lost. As a result, there should be records from Canada that could be used to further understand these questions.

Mattila commented that the IWC intends to engage the FAO on questions of gear involved in whale entanglement. The IWC expert group was encouraged to put more training components on marine debris in relation to entanglement and to make use of workshop reports, other documents and outreach materials. Toole reported to the workshop that the FAO will be undertaking expert consultation on gear marking in 2016. It is likely that there will be a call for expertise and members of this group might consider participating.

2.1.2 Large whale entanglements on the U.S. west coast, Portland, November 2013

SUMMARY

A15/ER/ALL/22 reported on a workshop about large whale entanglements on the U.S. west coast, convened in Portland, Oregon. This workshop brought together experts in the fields of marine mammals, fisheries, modelling, bycatch, lost gear/marine debris, and management, to share information relevant to the issue. It also sought to identify data gaps, data needs, and research and outreach priorities. The overall goal was to better understand large whale entanglement and continue to build a strong science-based foundation for any actions that may be necessary to protect whales.

The workshop made a number of general recommendations to assist in understanding and reducing large whale entanglements. These were as follows:

(1) engage commercial fishermen and commercial fishery managers to better understand the fisheries and what measures may be taken to fill existing data gaps;
(2) address the unknowns surrounding large whale entanglement by conducting research needed to encourage or support fishery management actions or legislation changes, including
    (a) identifying the level of conservation concern surrounding population level impacts from entanglement for different whales species;
    (b) conducting fine scale research on areas identified as having high co-occurrence of fishing gear and large whales;
    (c) studying the mechanisms by which whales become entangled in gear;
(3) evaluate possible gear modifications (e.g. related to increasing the number of traps per line, which may reduce entanglement risk by reducing the number of vertical lines with which whales could interact; and
(4) support lost gear and marine debris removal efforts to reduce the risk of whale entanglements.

The workshop also received Saez *et al*. 2013 (provided to this workshop as A15/ER/ALL/21) which described the co-occurrence of large whales and fixed fisheries on the U.S. West Coast. A15/ER/ALL/24 was also provided as a guide to identifying fixed gear types off California, Oregon, and Washington.

DISCUSSION

The present Workshop **endorsed** the recommendations as summarised above

2.2 New or unusual relevant cases since 2011 (Guadalupe, Korea)

2.2.1 Guadeloupe

SUMMARY

A15/ER/ALL/12 described an unusual event in which two sperm whales, an adult female and a dead calf, were entangled together in what the authors believed to be a local artisanal fish aggregating device (FAD). The net, rope and debris were entangled around the female's jaw and the peduncle of the dead calf. The female was dragging the carcass behind her as she dove with other adults on what appeared to be foraging dives. One of the authors (R. Rinaldi) had been recently trained, and after consultation with the IWC expert group, was able to safely remove the carcass

from the entanglement. However, the risk was considered too high to try to remove the remaining entangling materials from the female's jaw.

Along with the unusual configuration and gear, the entanglement was atypical because the entangling materials were only attached to the tip of the jaw. Based on this observation and images of the drag already created by the carcass, the IWC expert group advised the responders not to add the typical "control line" and to remove what they could safely, without adding undue additional drag. The responders have seen the female a year later, and she seems healthy and behaving normally, but they could not determine how much, if any, of the entangling materials remain.

DISCUSSION

The Workshop **agreed** that it could be challenging to identify a FAD as the source of entangling material given the varied materials and haphazard construction used in many instances. In this case, identification was based on local knowledge. It was clarified, however, that large, commercial FADs used in the North Pacific tuna fishery, for example, are more likely designed in a systematic fashion incorporating guidance to minimise entanglement risk (International Seafood Sustainability Foundation Guide for Non-Entangling FADs[2],), and often have characteristic electronics attached (e.g. telemetry and sonar).

2.2.2 Korea

SUMMARY

An updated the workshop on the entanglement of a North Pacific right whale in aquaculture gear off Korea in 2015. This was the first sighting of this species in Korean waters since the last one had been landed in the East Sea in 1974. This was also the first disentanglement performed in aquaculture gear in Korea, as previous entanglements have all involved non-protected species. The young male right whale was entangled in hanging aquaculture for mussels off the island of Namhae, in the Korea Strait, on 11th February 2015. The whale was entangled by the main rope (2-cm in diameter) at the caudal peduncle. Untrained responders, including fishermen, first tried unsuccessfully to cut the ropes using poles with hooked knives. Two scuba divers then entered the water and cut two wraps with diver's knives, but they had to cease the operation due to the limited visibility in the late evening. The responders returned to resume the rescue the next morning, but found that the whale was gone. An aerial survey was conducted to find the whale, which they assumed had escaped the remaining loose rope on its own. Photos, video clips and biopsy sample of the right whale were taken during the rescue in order to identify and register the animal. An highlighted several safety issues that resulted from responders approaching the whale too closely, positioning themselves over the tail and ultimately entering the water once they were unable to cut lines from the surface.

DISCUSSION

The Workshop **concurred** with the safety concerns highlighted by An and **stressed** the value of disentanglement training to facilitate safe practice at any future events. An clarified that the main line in this case was set out horizontally in 5m segments to approximately 150m total length with anchors set at periodic intervals. It was noted that it can be difficult to manoeuvre in such an extensive surface system and so the use of small inflatables would have been preferred. Furthermore, it can be very difficult gear to work with due to its weight and the fact that the tensile strength of the rope also changes as it is manipulated. Attaching buoys to the whale during disentanglement operations can provide important support for the whale, offsetting the weight from the gear.

The Workshop discussed other instances of aquaculture entanglement and how they were resolved. Coughran described a humpback whale calf that had been disentangled from thick diameter line in mussel aquaculture off Australia. The entangling line was so tight that release required cutting into the body, but the individual was re-sighted after disentanglement. Morrissey described an entanglement in mussel aquaculture in New Zealand. In that case, the whale was released without the offered assistance of trained responders, and unfortunately this was achieved by winching the tail of the whale out of the water.

In conclusion, the Workshop **recognised** the increase in aquaculture (including expansion offshore) around the world and the particular difficulties that may entail with respect to entanglement response. It **stressed** the importance of developing prevention measures as a priority in addition to entanglement response training.

2.3 New tools or techniques

The Workshop received several presentations on specialised tools and their appropriate use in large whale entanglement response efforts.

[2] https://www.iattc.org/Meetings/Meetings2013/MaySAC/Pdfs/ISSF-Non-entangling-FADs-Revised-10-18-12.pdf

2.3.1 Gillnets

Two presentations focussed on gillnet entanglements, which can pose a high risk to the animals, as well as to responders. Gillnet entanglements are increasingly reported in some developing areas, and safely addressing gillnet disentanglements require appropriate protocols and tools.

Lyman outlined that in general he, and networks he has worked with, have used two basic types of tools for gillnet entanglements: (1) hooked knives (fixed and/or flying) to cut head and foot lines, including leadline; and (2) longer and slightly curved blades for cutting the mesh itself. He clarified that the use of hooked knives to cut head and foot ropes attached to netting is in many ways little different than cutting any line. However, leadlines, especially if multiple lines are grabbed, can be very challenging and require very strong and sharp models. In cases where the netting is open and represents only a few panes, the mesh may tear or be fairly easy to cut. However, if rolled, gillnet mesh itself is extremely strong. Lyman reviewed knives that have worked in the past, namely Spyderco's Whale Knife, bamboo knives and lawn sickles. All have long slightly curved blades to maintain contact with the mesh and provide plenty of action while at the same time limiting binding with the net. He also pointed out that with any knife how it is presented to the gear being cut (i.e. the angle of attack should maximise the knife's intended cutting surface) is critically important to the successful use of the tool.

Sandilands presented the results of a test of the ability of three different flying knives to cut a section of rolled gillnet and leadline. Flying knives are knives that can be placed from a pole and have a rope attached to keep the responder at a safe distance from an entangled whale. The test was motivated by the cow/calf sperm whale entangled together in Guadalupe in 2013 (see Item 2.2.1). The knives that were available to be tested at CCS included: (1) a welded flying knife with custom stainless blades and a 9cm opening; (2) a welded flying knife with a H1 Spyderco blade and a 4.5cm opening; and (3) a curved stock flying knife with box cutter blades and 7cm opening. Knives (2) and (3) cut easily through the gillnet and leadline (with one easy pull), however, knife (1) required significantly more effort (with three hard pulls). Tests were undertaken on 3 inch diameter rolls of gillnet because that was what had been available; Sandilands recommended that larger diameter rolls should also be evaluated.

In discussion, the Workshop highlighted the fact that gillnet is a complicated gear to cut, partially due to the range of materials involved (monofilament, rope and lead). It was **agreed** that smooth blades are more effective than serrated blades for monofilament entanglements.

2.3.2 Other tools

Lyman also introduced several other tools and their use, many of which were modification of tools used for other purposes and tools revisited from past disentanglement efforts. These included longer, lighter poles, such as those made using carbon fibre. Some poles, like simple hardware poles and those made using sailboard masts are economical. Poles help deliver the tool and do so by extending the range, and thereby increasing safety. However, a byproduct of the greater range is the difficulty in gauging the range. As a potential remedy, he introduced the use of live streaming, real-time goggles providing a vantage point at the end of the pole. Use of knives on long poles with real-time viewing could allow large whale disentanglers to cut whales free from greater and safer distances. Lyman also reviewed the use of the newer cutting grapple, an extremely dangerous tool that should be used only after careful assessment. Finally, he introduced a duel edge hooked knife, used to cut into an embedded line entangling a whale (a similar knife had been designed to disentangle a right whale #2030 in 1998). Its use was demonstrated in an event involving an entangled humpback whale calf with tight wraps of embedded line. He stressed that there are risks involved with using any tools and it essential that careful assessment and preparation are undertaken alongside training. Tools should not be used simply because they are available, but only when it is appropriate and safe to do so.

In discussion, the Workshop **noted** that knives with box cutter style blades are useful and cost-effective because the blades can be replaced as needed. However, the Workshop **stressed** that the appropriate tools to use will depend on the situation. Specialized tools can be challenging to obtain and to afford, but they are necessary in some situations, such as when it is not possible to work in close proximity to the whale. In close, controlled situations, standard knives (e.g. standard fillet knives) and tools can also be effective. The basic supply kit supplied as part of IWC trainings consists of a jam grapple, snap hooks with a remote (mooring) attachment fitting, telescoping pole, a fixed "V" knife, flying knife and safety knife.

2.3.3 Protocols for testing

Smith presented A15/ER/ALL/15, which described testing protocols for new equipment and techniques before approval for use within the Atlantic Large Whale Disentanglement Network (ALWDN).

Smith explained that these protocols were developed in response to an event that occurred during the disentanglement of a North Atlantic right whale (#3311) in which a Prusik knot (commonly used in climbing) was used to ascend additional buoys up the trailing line. This action resulted in two of the three responders being ejected into the water with a close interaction amid the gear entangling the whale. The detailed case study of this event described numerous planning calls and response debriefings. Any new tool or technique deviating from existing and approved tools and techniques must now be described to NOAA Fisheries, thoroughly tested in on-water simulations, including a recovery plan if the tool or technique fails and ultimately be approved through NOAA Fisheries permitting office prior to use on an entanglement case in the United States.

The Workshop **thanked** Smith for this information. It stressed the need for careful evaluation of new tools and techniques both in terms of safety of responders and the animals. It noted the value of a formal approval scheme in this regard and **encouraged** other groups to consider whether it was appropriate for their areas. The Workshop also **highlighted** the importance of sharing information on failure as well as success to improve safety and reduce issues in future events.

2.3.4 Protocols for sharing tools

The Workshop discussed the concept of sharing AutoCAD tool designs to allow them to be manufactured in other countries, reducing the cost of manufacture and logistics of transport. The Workshop **strongly recommends** that neither tools nor design specifications are provided to anyone who has not undergone training. The current practice for IWC trainings is to share a basic kit of tools (see Item 2.3.2) with trained teams and they are then allowed to replicate those designs from what they have in hand. However, the manufacture of those original tools is closely scrutinised and efforts to replicate those designs have not always been successful even with the tool in hand. Efforts to reproduce them in Mexico, for example, did not meet the design specifications and so some were not as effective. The group **agreed** that the AutoCAD designs might be helpful to avoid such situations, but they should only be given to the proper authority within the officially trained network.

2.4 New safety or risk assessment tools or protocols

2.4.1 Use of 'Site cams' in the USA

Lyman provided an overview and reminder of the value of small, remotely operated cameras ('site cams') towards improving both operational/response and informational/threat assessment, and thereby potentially reducing associated risk. Cameras over time have become more affordable, easier to use, of greater quality, and with better remote operation. Site cams can be (and have been) attached to helmets, poles, both the approach and support vessels, to the entangling gear, and drones or UAVs (unmanned autonomous vehicles). Video clips of recent efforts using pole cams were shown illustrating their value in both clear water low latitude breeding grounds, as well as lower visibility high latitude feeding grounds.

Lyman also referred to the value of drones (and see Item *2.4.2) to provide both aerial imagery and in-water full body assessment. In regard to response efforts, assessment could be fully obtained without even actually approaching the animal or otherwise harassing the animal. He noted that during a response, the rule of thumb is to assess fully prior to action, but there is a fine line since animals may become evasive and otherwise uncooperative after so many approaches.

Lyman cautioned that the use of site cams for general photo-documentation should not be the priority of primary responders or less experienced responders in close approach situations; site-cams can be remotely operated by other individuals and training should be required. The value of such cameras in risk assessment includes operational risk assessment of particular cases, informational and operational risk assessment of past cases, and operational examples for training. They are also valuable in drafting detailed debrief reports (one of which was provided to the workshop) and gaining information that otherwise would be lost.

With respect to training, Lyman noted that this is continuously evolving and he provided video illustrations of training exercises. The depth of training required depends on the need (likelihood of response) and capacity (personnel and resources) among other factors. In the USA, in some regions and teams, the amount of past training and participation in efforts is such that network responders have an excellent foundational experience. In such cases, training has evolved to provide hands-on experience with a variety of scenarios that may result from large whale entanglement response efforts. Some of these include: addressing different gear types and location of gear on the animals; dealing

with medical emergencies (e.g. back and neck injuries); dealing with vessel-based scenarios[3] (e.g. a capsized approach boat; responders getting caught in the gear and being pulled overboard); etc. Two teams in Hawaii have been undertaking such training exercises for 3 years now and they now have become multi-day efforts.

Lyman concluded that the development of new tools and techniques is only helpful if responders are prepared to use them and they are subject to proper assessment (and see Item 2.3.4). Otherwise their use may increase risk. Furthermore, training in the use of such tools is only advised after responders have received and mastered the basics; responders should not get ahead of themselves.

In discussion, the Workshop **thanked** Lyman for these updates and **endorsed** both the value of new technology and approaches after careful evaluation and the cautions he highlighted in their use. It also **recognised** the different local needs, resources and in some cases legislative frameworks that must be taken into account in addition to the importance of adequate training.

2.4.2 Unmanned Aerial Vehicles (UAVs) in Western Australia

The Western Australian Department of Parks and Wildlife is investigating the use of UAV's (also known as quadcopters or drones) as a useful tool in the decision making process at sea for entanglement events for large whales. In particular, this relates to assessing response related operational activity and associated risk management for human safety working around entangled stressed large whales. This method has been used successfully as a tool to locate, photograph/film and assess entangled whales to achieve a safe response by minimising risks to response teams and minimising stress and disturbance to compromised whales. A one month sea trial was undertaken during the northern migration of Breeding Stock D humpback whales in 2014 off the Western Australian Kimberley coast. 130 test flights were carried out using the '*Phantom 2'* quadcopter, a unit weighing less than 2kg. Each flight (*ca* 16 minutes) involved the use of a remote control unit with real time camera viewing throughout the flight. A *GoPro* camera unit was suspended beneath the quadcopter that had the ability to be set at tight, medium and wide angle views and image capture capacity. The unit was sent to test for behavioural stimulus by overflying all age groups of humpback whales, including nursing mother/calf pods. The testing included flights away from the vessel out to a maximum of 500m and as low as 1m above whales. This entailed the operation of a minimum of a team of two operators up to a team of four.

The test flights resulted in no obvious or apparent behavioural change with any of the focus animals throughout the testing. Most remarkable was the results associated with mother/calf pods.

There is currently much discussion by aviation regulatory authorities on their legal use, both from a licensed commercial application and private use of such units. At the time of the test the regulatory approach was still in its development stage and responsible use of such devices is being closely managed.

The Workshop **thanked** Coughran for his presentation and **commended** the thorough testing that had been undertaken. It **agreed** that this is potentially a very valuable and relatively inexpensive tool (*ca* USD 2000). It recognised that there are a number of important issues to be addressed before being used widely including proper training, consideration of legal frameworks etc.

2.4.3 Protocols for the use of telemetry packages in the USA

Smith described the development of the document, Decision Tree for Tagging (A15/ER/ALL/14) based on the objective to identify the needs of deploying and/or retaining a satellite telemetry package on an entangled whale case. The intent behind development of this decision tree was to assist Entanglement Response Program managers in conducting a cost/benefit analysis to assess the 'cost' to the welfare of the animal and cost of satellite tag package in comparison to the benefit to the individual animal welfare and overall knowledge base of health effects of entanglements on animals.

The Workshop **thanked** Smith for drawing this useful document to its attention and **endorsed** the principles therein, recognising that such decision trees will necessarily reflect local conditions and norms.

[3] A video was shown of an alternate use of the cutting grapple used by a dedicated person on the support vessel to address the possible scenario of person or approach boat caught in the entangling gear.

3. REVIEW OF IWC CAPACITY BUILDING

3.1 Summary of work since last meeting

The second (2011) IWC workshop on entanglement, also held in Provincetown, was focused on developing a strategy, curricula and advisory group to carry out the capacity building recommended at the 2010 Workshop (IWC/62/15). The result was a three-pronged training strategy comprising: (1) provision of an overview of the issue and a context for IWC-endorsed capacity building; (2) discussions with appropriate resource managers about feasible team and network structure; and (3) detailed entanglement response training by members of the IWC expert advisory group.

The two-day training consists of one day on land, largely in a classroom, where all participants are given an overview of the issue globally, with background information on how other countries are approaching this problem. In addition, the host Government is asked to provide a brief overview of what is known for the region, including: species and gear involved, examples of local events, and any local regulations. An overview of the science and methodologies used to understand the issue is also presented, and two overarching 'principles' are reiterated. Firstly, that human safety must come first, and secondly, that disentanglement is only the first step in helping whales and fishers. On the latter point it is made clear that prevention is the ultimate solution to this problem, and all responses to an entangled whale should include gathering information (safely) that will eventually lead to prevention.

The remainder of the first day is spent going over safe disentangling procedures using many images and video clips to illustrate the proper use of tools, techniques and safe decision-making procedures. The number of attendees for the first day in the class is only limited by the size of the room. However, not all of the attendees will be candidates for the hands-on training on the water, during the second day (see below).

The second day takes place on the water. Two small boats (per trainer) are used; one acting as the 'whale' and the other as the 'rescue' boat. The 'whale' boat tows a long rope with a variety of objects on the end (e.g. buoy, tangle of net….etc.), as the 'rescue' boat makes multiple approaches using various tools. As only two trainees are in the 'rescue' boat at any time, and the process is time-consuming, only 10-12 trainees can be accommodated.

Because the 'hands on' work releasing a whale can be dangerous, and the second day can only accommodate 10-12 trainees, the following consensus criteria are provided in order to identify key trainees for the second day:

- Experience with whale behaviour and driving small boats around whales
- Experience with fishing gear and with handling lines under powerful 'load' or strain
- Experience with small boat safety
- Physical fitness (does not need to be an athlete!)
- Availability for the network (there is no point training someone who will not be available to respond)
- Has appropriate insurance and authorisation of the relevant authority
- Level-headed (is able to remain calm and think clearly in stressful situations)

At the conclusion of the training, the trainees are evaluated and the trainer works with the relevant authority to identify key participants who may be able to undertake a three week apprenticeship with one of the existing networks. So far these apprenticeships have been conducted at the Center for Coastal Studies, Provincetown in the USA, as they have: rescue facilities, proximity to whales, ongoing entanglement related research and proximity to other valuable sources of related experience (e.g. necropsy and stranding, fishing gear research….etc.). This is effectively training future trainers for the country represented.

Training is only undertaken with the knowledge of the authorities of the relevant countries. In some cases, they themselves request and support the training. Requests that come through the IWC to the expert trainers are prioritised using a number of criteria and this is discussed further under Item 3.3.

A valuable approach has been to partner with regional IGOs in order to provide the training in fulfilment of regional action plans (e.g. the SPAW marine mammal action plan in the Wider Caribbean, and the SPEP whale and dolphin action plan in the South Pacific). The global entanglement response network now includes established networks from 19 countries.

Table 1 lists the training exercises that have been undertaken and the trainers involved whilst Table 2 summarises the overview seminars.

Table 1

IWC endorsed Seminars and Trainings: 2012-2014. Countries represented with numbers of trainees. Response training only in the classroom takes one day; response training takes two days.

Dates of training	Countries, Commonwealths, Territories and Organizations	Response training in Classroom only*	Response Training	Trainer(s)
17-20/3/2012	**Brazil**	3	40	Mattila
27-29/3/2012	**Argentina**	50	10	Mattila
3-6/11/2012	**United Kingdom**	11	12	Mattila
15-16/11/2012	**Mexico (Pt Vallarta)**	17	36	Mattila & Landry
28-29/11/2012	**Mexico (La Paz)****	18	20	Mattila & Lyman
	Costa Rica		3	
	Dominican Republic		2	
	Panama		3	
27-28/6/2013	**Ecuador**(Salinas)**	9	16	Mattila & Lyman
	Chile		3	
	Colombia	2	1	
	Panama		3	
	Peru	1	2	
26-27/9/2013	**Panama**	10	20	Mattila & Lyman
13-14/11/2013	**French Caribbean****	2	10	Mattila & Sandilands
	Anguilla		1	
	Belize	1		
	Colombia		1	
	Dutch Caribbean		4	
	Trinidad and Tobago		1	
	Puerto Rico		1	
	St. Lucia		1	
	St. Kitts and Nevis		2	
	Venezuela		1	
18-19/01/2014	**Mexico (El Vizcaino Biosphere Reserve)**	14	20	Mattila & Lyman
3-4/4/2014	**Dominican Republic****	10	14	Mattila
	Puerto Rico		2	
29-30/7/2014	**Tonga**	2	7	Mattila
	Vanuatu	1	2	
22-23/09/2014	**Mexico (Oaxaca)**	0	35	Landry
9-10/10/2014	**Mexico (La Paz, advanced)**	0	33	Lyman
3-4/11/2014	**Mexico (Pt Vallarta, advanced)**	10	30	Mattila

*These numbers are estimates, as the seminars and classroom training were open to Government staff, Universities, Scientists, Veterinarians, Navy and other potential support or decision-making parties, but who were not candidates for the practical training on the water.

** Several "National" trainings which were arranged in conjunction with regional IGO's such as UNEP-CEP-SPAW, UNEP-SPREP and CPPS, brought some trainees from member countries to participate in the National trainings for Ecuador, the French Caribbean and Mexico.

Table 2

Summary of invited overview seminars

Date	**Venue**	Participants	Countries
8/11/2011	**ICMMPA2**	150	42
14/2/2012	**Korea (CRI)**	40	
25/3/2012	**Argentina (Univ.)**	30	
31/10/2012	**Norway (Science Council, Fisheries)**	20	
4-6/12/2012	**WSPA Debris Symposium**	60	20
11/4/2013	**Permanent Commission of the South Pacific (CPPS)**	30	5
13/5/2013	**WHOI (Scientists)**	40	8
6/9/2013	**SPREP**	30	26 (Pacific Islands)
17&20/10/2014	**American Samoa (DMWR, NPS, NOAA)**	25	
1/12/2014	**SOLOMAC and SOMMEMA**	90	15 (Latin American)
27-29/1/2015	**Arabian Sea**	30	12
22/3/2015	**European Cetacean Society**	30	

The Workshop **congratulated** the trainers and the trainees, recognising the importance of this work, not only in terms of training the entanglement teams but also in stimulating discussion surrounding the ultimate goal of prevention (see below). It noted the advantage of having more than one trainer where this was feasible (e.g. see Item 3.2.3) and **agreed** that efforts would be made to expand the international pool of trainers in the future.

Further discussion of the programme is considered under Item 3.3.

3.2 Overview of newly trained participating national networks

3.2.1 Argentina

On behalf of Dr. Uhart, Marcondes presented an update on Southern Right whale entanglements in Chubut, Argentina. The report was kindly provided by Bellazzi *et al.*, of the Chubut Cetacean Stranding and Disentanglement Network. Between 2012 and 2014, five entangled whales were reported at the breeding ground off Península Valdés. There was one case, an entangled female (that was accompanied by a calf), where the team was able to partially disentangle the animal (with ropes successfully cut in most life-threatening areas involving the mouth and head) but was then unable to make further attempts to cut the remaining ropes because of interference by the calf. Disentanglement of the other animals (one adult, two sub-adults and one calf, all of unknown sex) was not possible despite efforts to approach them (one case), or find them after initial reporting (three cases). Three entanglements were with rope, one was a net, and one was monofilament fishing line. The main limitation for disentanglement success thus far was the inability to re-locate animals after receiving initial reports (3 cases). In the other two cases, someone stayed by the whale until the response team arrived.

The Workshop **thanked** the Argentinian team for its report. It was noted that as part of the IWC's Conservation Management Plan for right whales in the southwest Atlantic, a refresher course and advanced training was being planned.

3.2.2 Brazil

Marcondes presented data on entanglements of whales along the east coast of Brazil. Two databases (strandings 1990-2014 and research cruises 2005-2014) were interrogated and information on those cases where the presence of fishing equipment was confirmed and the type could be identified was presented. A total of 11 entanglements were recorded between 1993 and 2014 (mainly humpback whales (9 cases) with one case each of a southern right whale and a sperm whale. Entanglements in floating gillnets were the most frequent (6 cases) followed by ropes (4 cases) and longline (one case). There were two attempts at disentanglement. One was successful (made by a non-trained captain of a whalewatching boat) and the other (by a trained vet) was aborted because of the behaviour of the whale. The southern right whale was entangled in Abrolhos Bank and moved south along the coast for at least 1,750 km where was observed no longer entangled. Three of the selected cases were long term entanglements that probably caused great suffering to the animals.

Groch also presented a summary of southern right whale entanglements cases recorded between1999 and 2014 in southern Brazil. During austral winter and spring, southern right whales concentrate off the coast of Santa Catarina State, for breeding and calving. Aerial and boat surveys have been regularly conducted for ecological studies and evidence of entanglement of right whales in fishing gear have been recorded. A total of 38 entangled right whales were reported, the majority adult females accompanied by a calf (74%, n=25). In most of the cases (97.4%), the fishing gear involved consisted of parts of monofilament gillnet, which became attached to the whales callosities when they swam through the fishing net. Photo-identification studies enabled the individual recognition of 20 right whales, a follow up of 16, from which nine (56%) were free of fishing gear when resighted. No signs of external physical injuries associated to the entanglements were observed or recorded. Because of the nature of the entanglements, and the documented cases of identified whales resighted free of gillnet, no interventions have been necessary. Entanglements were recorded from July to November, peaking in August (45%, n=17), corresponding to the beginning of the species´ wintering season. A mean of one entanglement/year was recorded in the first 10 years (1999-2008), and 4.7 entanglements/year were recorded in the later period, comprising six years (2009-2014). The number of records per year represents a mean of 3.4% of the total number of whales sighted/year during aerial surveys conducted in September, the peak month of whale occurrence. Most of the records (79%, n=30) occurred in the species' main aggregation area, the Right Whale Environmental Protection Area (APABF) region. A formal Entanglement Response Network was established in 2012 in APABF region, involving cetacean experts and marine authorities. The evaluation of interactions between fishery and whales requires regular monitoring of the whale population and fishing activities, and continuing efforts to document whale entanglements. The acquisition of a disentanglement tool-kit, as well as training of a disentanglement team is required, to enable appropriate response if necessary.

The Workshop **thanked** the Brazilian team for its report. In discussion, the importance of archiving gear and related items (e.g. bone and gear) was highlighted and this is considered further under Item 4.5.3.

It was also noted that when examining proportions of entanglements by gear type and/or age or reproductive class by region, account must be taken of information of temporal/geographical availability of various gear types and any temporal/geographical segregation by age or reproductive class.

3.2.3 Mexico

Frisch reported on 'RABEN', the Mexican network that comprises 15 teams with 180 members along the Mexican Pacific coast and Baja California peninsula. Most of the teams work mainly with humpback whales and one team works with gray whales. RABEN follows the IWC disentanglement protocol. RABEN teams are inter-institutional with members from NGO's, universities, whalewatching tour operators and government institutions (Navy, Wildlife Ministry and harbour masters).

In 2004, the first successful team disentanglement took place in Banderas Bay (Puerto Vallarta) and in 2006 David Mattila (NOAA) gave the first training workshop. Since then RABEN Banderas Bay worked on their own capacity, building their own tools and annual self-training; the team has now successfully released 16 whales. Since 2012, the NGO Ecology and Conservation of Whales (ECOBAC) has been receiving support from CONANP (Mexican National Park System) for training and gear in order to build a National Network. In 2012, two large whale disentanglement workshops and one stranding workshop were carried out with the collaboration of the IWC; David Mattila (IWC), Scott Landry (CCS), Ed Lyman (NOAA), Michael Moore (Woods Hole Oceanographic Institute) and Frances Gulland (Marine Mammal Center, San Francisco) conducted the workshops. In 2013, training conducted by ECOBAC took place and in 2014 again in collaboration with the IWC, three disentanglement workshops took place in three different locations (each workshop was conducted by a different instructor: David Mattila (IWC), Scott Landry (CCS) and Ed Lyman (NOAA)). The support of the IWC and the ability to have workshops conducted by instructors with great expertise has proved to be extremely valuable, since they have their own experiences to share. This has proved to be particularly helpful with the RABEN members that used to conduct snorkelling or even diving disentanglements. RABEN is coordinated by ECOBAC and fuel and boats have to be provided by team members or local individuals. Thus far, RABEN has followed up on 59 entanglement reports and following IWC protocols, successfully released 27 whales (2 gray whales, the rest humpback whales). Of the other 32 reports, responders were either not able to release the whale, to relocate it or to confirm the report. For 2015, RABEN will work to improve documentation, communication and the database.

The Workshop **thanked** the RABEN team for its report and **commended** them for their thoughtful and comprehensive dedication to further training and improvements following the IWC guidelines and principles, and for the careful manner in which a range of stakeholders have been involved. In discussion, the importance of documenting certain types of information (e.g. behaviour) was raised as well as the importance of public outreach in all languages. This is discussed further below.

3.3 Review of strategy, curriculum and prioritisation

3.3.1 Introduction

In discussing this item, the Workshop took into account the 2011 workshop report (especially Annexes E and F), the discussions under Items 3.1 and 3.2 and consideration of A15/ER/ALL9. This last document comprised a brief report from one of the IWC sponsored trainings, held in La Paz, Mexico in 2012. It was co-sponsored by the IWC, UNEP-CEP-SPAW and the Mexican Government. It was noted that the training included an extra day of training in the determination of human impacts to whales. It was noted that the training had been very well received by the trainees, based on their evaluations and comments (Tables 1 & 2, and Annex 5 of the report). It was also noted that, as at previous and subsequent trainings, all trainees on the second day of practical training on the water, were evaluated using criteria which became the basis for the trainee evaluation form that is currently used.

Mattila noted that since the first workshop in 2010 (Maui), which prioritised whale populations of highest management concern, the prioritisation of when and where to conduct capacity building had evolved to include criteria other than just the recovery status of the population concerned. Subsequently, the criteria for evaluating requests that come through the IWC for training have evolved into the following:

(a) Conservation: How endangered is the whale population and how significant is the entanglement impact?
(b) Human Safety: Are well-meaning but un-trained people currently responding with dangerous techniques?

(c) Animal Welfare: How many whales are likely to benefit from the range states developing a response network?
(d) Socio-economic impact: How much impact do entanglements have on the affected fishers?
(e) National support: Has the country requested and is supporting the training?
(f) Added impact: Does the training fit into and/or encourage other productive initiatives?
(g) Funding: Is there logistical and financial support?

3.3.2 Conclusions and recommendations

The Workshop **reiterated** its support for the existing strategy and curriculum, including emphasis on the long-term goal of prevention, recognising that local circumstances must be taken into account when finalising individual workshops. In particular, the Workshop **emphasised** the importance of involving members of the commercial sector in the process (e.g. fishing, whalewatching); it noted that in many cases the effort expended by the fishing community in prevention involves business decisions; as witnessed for example by the successful work undertaken in Newfoundland over several decades, it is important to work with fishermen in the context of how improved practices will assist them as well as whales.

The Workshop **agreed** that it was important to evaluate priorities in the light of experience and **endorsed** the above criteria. These should be made clearly available on the IWC website. It **agreed** that a degree of flexibility would be required in assigning the balance amongst the above criteria on a case-by-case basis. The importance of some commitment to a reasonable level of longer-term funding to ensure that training was not wasted was also stressed. With respect to funding, it was noted that the issue of entanglement response and bycatch prevention are attractive to outside funders and it is particularly important that evidence of the success of the Networks be visible.

The Workshop also **stressed** the importance of follow-up training. This can take a number of complementary forms including:

(1) apprenticeships of several weeks, such as those hosted by CCS which can provide broad-based training including attendance at actual entanglement response events should they occur as well as exposure to photo-identification, biopsy sampling and other relevant research activities;

(2) follow-up workshops held by expert trainers, primarily aimed at participants from initial workshops and which can be tailored in the light of local experience and events with on-water training focussing on more difficult scenarios than the initial training;

(3) internal follow-up work (such as that discussed under Item 3.2.3 undertaken by RABEN) involving a considerable degree of self-critique that may also involve remote interaction with other experts from the global network.

3.4 Consideration of adding additional subjects to the IWC training programme

3.4.1 Introduction

Mattila noted that the training described in A15/ER/ALL9 was the result of a joint proposal developed in discussions between some IWC member countries, UNEP-CEP-SPAW representatives and representatives of the Sister Sanctuary agreement between the Dominican Republic Whale Sanctuary, the AGOA Sanctuary (French Caribbean) and Stellwagen Bank Sanctuary (USA). It was submitted at IWC64 by the Dominican Republic, France, Mexico, Netherlands, Panama and the USA, and proposed three workshops and trainings addressing common goals to understand and mitigate human impacts, in particular entanglement and ship strikes. As such an extra day for instructing veterinarians in the most current techniques to determine human impacts to both free-swimming and stranded whales was added to the standard two day entanglement response training. This training was conducted on the first of three days, and was primarily attended by veterinarians from Mexico, Panama, Peru and the Dominican Republic, all of whom stayed the next day for the first (classroom) day of the entanglement response training. Additionally, some of them were able to participate in the practical training on the water, on the third and final day of the workshop. In this particular situation, this arrangement seemed to work, although extra trainers were needed. Both the standard entanglement response training, and the 'impact determination' training received high trainee evaluations.

3.4.2 Discussion and conclusions

Within the Workshop, there was considerable discussion of the advantages (e.g. cost, common personnel especially in 'developing' areas, related 'human impact' considerations) and disadvantages (diluting the focus, size, time, different management requirements) of adding an additional component to training workshops such as 'strandings'.

In conclusion, the Workshop **agreed** that in general it was more productive to hold focussed entanglement response workshops rather than combined workshops that may dilute the effectiveness of either topic. However, it **agreed** that requests to hold combined workshops should be considered on a case-by-case basis.

There was also a brief discussion of how to handle requests for entanglement response for other marine species (e.g. small cetaceans, pinnipeds, turtles etc.). The Workshop **stressed** that the appropriate authority, responses, expertise, equipment and logistics may be quite different to those for large whales, which is the primary focus of the present global network; where appropriate expertise is available, the network may direct requesters to relevant advice/advisors.

3.5 Discussion of co-operation between Government and private sector

The Workshop noted that in most if not all response networks, to some extent there is involvement of a combination of stakeholders including authorities, academic institutions, NGOs, fishing industry, other marine users etc. The relative proportions of these vary from country to country and sometimes by region within countries.

The Workshop **agreed** that the involvement of a wide range of stakeholders at a variety of levels ranging from direct participation to fundraising was important and valuable and probably inevitable. However, it also provides a number of organisational challenges that must be faced. In particular, careful organisation and an agreed 'chain-of-command' are crucial. It is essential that all know their duties and responsibilities, the limits of their involvement and the legal framework. Such an organisational framework is essential to prevent 'well-meaning disasters'. The Workshop noted the different situations from around the world and **agreed** that it was not possible to be prescriptive about particular frameworks but rather **recommended** that such frameworks be developed if they do not exist. To assist in the development process, the Workshop **recommended** that participants should submit relevant existing documents to the IWC Secretariat and that these be made available as examples on the IWC website.

3.6 Review of different approaches to legal authority

3.6.1 USA

Smith provided a brief presentation highlighting key points from two documents: 'criteria for response roles and training levels' (A15/ER/ALL/17) and 'policy for advancement between response roles' (A15/ER/ALL/18). The US entanglement response programme was described with a focus on programme accomplishments, authority and permitting, responder training, criteria for advancement to higher levels within the network and number of advanced responders within the US programme. Smith requested informal feedback from workshop participants on the development of a US national training plan with requirements on routine proficiency trainings, issuance of responder ID cards, and required first aid and CPR trainings.

3.6.2 Australia

As a brief overview for the Australian and particularly from the Western Australian perspective, Coughran noted that all cetacean species both resident and migratory are protected under Commonwealth and State legislative processes. The Commonwealth and the States administer certain statutes and management of those statutes are the responsibility of designated Government Agencies.

The Acts that protect cetacean species determine, or define legal authority to do certain things associated with responding to interact with protected species as in the case with whale entanglement response and mitigation. There are other legislative mechanisms associated with the legislative Acts such as Regulations, notices, legal authority (e.g. permits, licenses and approvals).

In addition there is legislation for humane treatment of animals, including cetaceans that not only binds the public and corporate bodies, but also binds Government. Response projects are assessed and either approved or rejected by Ethics committees. The issuing of such ethics approval carries with it reporting and audit processes.

It is important to note, updated legislative processes allow ongoing adjustment to changing protection processes and circumstances.

Annex D to this report provides a summary of the approach adopted in Australia related to training to manage risk at a high standard to ensure team safety.

3.6.3 Discussion

As for previous items (e.g. Item 3.5), the Workshop **noted** that it was not its responsibility to be prescriptive with respect to recommendations on appropriate legislative frameworks but rather to note that it is important that such

frameworks be developed. It **stressed** that the IWC and the global network, whilst providing training, were not formally 'authorising' responders. National networks must take care of themselves in terms of legislation, authorisation and responsibility

Discussion under this item focussed rather on the importance of regular training, the sharing of both successful and unsuccessful events amongst members and, for specific agreed events, with the public through *inter alia* the IWC website.

As part of this process, the Workshop **recommended** that networks provide regular updates to the global network of:

(1) training exercises;

(2) successful and unsuccessful case studies;

(3) proposed example case studies for the public section of the IWC website.

4. REVIEW OF PRINCIPLES AND GUIDELINES (SAFETY, PROCEDURES, DECISIONS, TOWARD PREVENTION) AND TRAINING CURRICULA

4.1 Considerations for 'less than ideal' situations

4.1.1 Advice to artisanal fishermen

Marcondes presented the results of interviews with 153 fishermen in the northern portion of Abrolhos Bank, Brazil, about the impact of the recovery population of humpback whales over the fishery. Nearly 40% of the fishermen reported cases of entanglement. Over 56% considered that whales hinder the fishery, the remainder were indifferent to the presence of the whales. The fishery gear types reported as most affected by whales were floating gillnets (26%), longlines (19%), hooks and lines (19%) and bottom gillnets (19%). Some 8% of fishermen reported collisions with whales. Many fishermen considered that it is almost impossible to fish with the whales in the area and so to avoid loss of equipment they preferred not to fish but receive some kind of compensation by the Government. Some fishermen reported that to reduce the losses they replaced the surface longlines by bottom lines or hooks and lines. They believed that this reduces the risk of losing equipment but also reduces likelihood of capture. The replacement of gillnets and driftnets by longlines and hooks and lines during the whale season were suggested as possible ways to reduce losses. There is no easy solution to the conflict between whales and fishermen in Abrolhos Bank and a consensus solution is unlikely to be reached. Nevertheless dialogue is necessary to develop ways to minimise the problem both to the fishermen and to the whales.

The Workshop **thanked** Marcondes for this presentation. It **reiterated** the importance of dialogue with the fishing community and the need to involve them in an active way in developing mitigation measures. The Workshop noted that there may be a workshop on artisanal gillnets at the SMM (Society for Marine Mammalogy) conference in December 2015.

Ledwell reported on the way the system in Newfoundland/Labrador has evolved in conjunction with the fishermen and the guidelines developed for whales trapped in anchored gear. An important component of the work is to save the gear or to try to lose as little of the fishermen's gear as possible. The first question is whether or not the whale is entrapped; then what species it is; whose gear it is (the gear cannot be touched until this is established); whether other fishing gear is nearby (a further entanglement threat that may need to be moved through contact with the owner). He highlighted the need to monitor the animal's behaviour (e.g. ability to swim, 'aggressivity'), discourage other boats from approaching and the need to slowly approach the animal. It is necessary to first look with mask and snorkel at the gear underwater. The last rope to be cut away from the animal is the one holding it in place. With humpback whales, if the animal is caught by the mouth this rope is often removed last as it is the most sensitive position on the animal. A rope is tied to a safety boat or anchor to pull personnel away from the whale, if needed. Successful disentanglement events can vary in time from very short (as little as half an hour) to long (up to a week) to get a whale out of gear.

Discussion of the provision of advice to non-trained personnel including fishermen is given under Item 4.1.3.

4.1.2 Using heavier boats when an inflatable is not available.

USA

In introducing this topic, Lyman pointed out that vessels are in effect tools, and like any tool their use depends on their appropriateness, and secondly, availability and familiarity. While one may not always have the best tool, using the tool that you have access to and are familiar with can be valuable and appropriate if adjustments (procedural or to the tool) are implemented as necessary. Concerns regarding vessel use in large whale disentanglement efforts lie with maintaining control of the immediate environment. Larger vessels generally, due to their greater mass, are not as responsive, provide less accessibility to the gear and animal, and are complicated by complex super structures that create dangerous snag points. All these may pose additional risks, especially on close approaches to the animal and the gear. Operational adjustments to large, heavier boats might allow their greater use (e.g. the use of lighter, longer poles, and remote tools such as flying knives and cutting grapples).

Lyman noted that there might be situations where a larger, heavier vessel might be more appropriate towards certain large whale entanglement response efforts (e.g. in cases involving mother/calf pairs, competitive groups or surface-active animals). The advantages of larger vessels might be platform height and stability to address sea state. There may also be cases where there are no advantages to using a smaller vessel and no disadvantages from a larger platform. Cases where small vessels may pose greater risk include: the drag created on small diameter line when a small boat is dragged by the whale, may pose more risk to animal; gear types such as gillnet and longline posing greater risk to responders; or where no kegging or line handling is warranted and/or possible. He provided several video examples of the cutting grapple and fixed knives being used from larger vessels.

It is important that responders to make every attempt to use the right tool; if a smaller vessel is warranted, then it should be used. However, in cases where only the larger platform is available, investment in remote tools (poles and flying tools) that decrease the platform's proximity to animal and gear, might allow their greater use. Familiarity with a tool is a consideration, but still not an excuse to not to use the right tool or to not adjust. Ultimately, be aware of the risks and if the risks cannot be managed, then stand-down.

NEWFOUNDLAND AND LABRADOR

Ledwell reported on the increasing incidence of large whales entangled in long strings of from 25 to 300 snow crab pots with typically 14 mm polysteel rope in deep water from 80 - 165 or more fathoms. This has required a diversion from the traditional methods of releasing whales using the inshore methods and protocols. The method of releasing whales from fishing gear in this area has always been 'do whatever needs to be done to get the animal **clean** of gear' as safely as possible and with as little gear loss as possible. Entangled whales in snow crab gear are so heavily weighted down with often multiple wraps of rope around the peduncle, pectorals and through the mouth that the release team cannot reach the gear to remove it. In those cases, longliners (15-20m long) are used in combination with the disentanglement inflatable. The longliners use a large grapple to attach to the gear holding the whale using a "creeping" technique. The longliner raises the gear, releasing tension on the whale allowing the animal to rise and giving the release team in the inflatable access to the gear on the animal. He noted that this is a potentially a risky technique as the animal is tethered to the winch on the longliner and could end up close to it; the risk is managed by the release team and it has proved to be a highly successful and valuable disentanglement technique.

LATIN AMERICA

Mattila raised the issue of using 'pangas', small rigid boats which are widely available in Latin America and may in some cases be the only option available. Currently, in areas where light inflatables are not available and pangas are used, the advice is to add more drag to slow the whale to a speed where the panga can be towed. But always be aware of trailing line, especially if the motor cannot be lifted.

DISCUSSION

The Workshop noted that there are advantages and disadvantages to using larger vessels as compared to the 'traditional' inflatable rescue boats as discussed above.

The Workshop **agreed** that there may be practical and logistical reasons such that in some cases larger vessels may be appropriate (or the only option). In such cases, the Workshop **recommended** that responders fully examine any potential dangers and manage the situations accordingly in the safest possible manner (which may include not proceeding with the release effort).

4.1.3 'Remote' advice to non-trained responders

INTRODUCTION

Mattila noted that as the convenor of the Global Whale Entanglement Response Network [editor's note: This name and acronym (GWERN) is temporary and may soon change through email vote of the network], the Secretariat

periodically receives requests for real-time advice on how to respond to an entangled whale, from untrained responders. This takes on extra urgency when the animal belongs to a critically endangered population, as has happened recently from Chile (a southern right whale), Oman (a humpback whale), Panama (a humpback whale) and Russia (a gray whale). These requests for advice are circulated to the current IWC entanglement expert advisory group. He has acted as a conduit to help consolidate the advice of the group into a few (email) communications, and he asked the workshop participants if this procedure was working and if it should be expanded to the broader global network coordinators. He noted that any advice provided is necessarily very conservative and may only consist of educating the untrained responders about the ultimate value of good documentation of the species, individual animal, health, entangling gear and configuration, as this can help lead to prevention in the future.

In addition, Mattila noted that these requests for advice were often accompanied by a request for one of the expert group to travel to the country and assist in the release of the animal. As these requests often come from individuals or governments who are not familiar with the practicalities of entanglement response, the technical advisor must often deal with the delicate matter of informing them that this is extremely unlikely to be productive, and instead, use the event as a teachable moment and suggest that a local response team should be trained. However, he noted that there may be instances (e.g. severely anchored whale from an endangered population) where the global group might consider sending an expert.

ADVICE TO FISHERMEN IN THE USA

Lyman reviewed two documents[4] that relate to US fishermen's involvement in large whale entanglement response efforts in the state of Alaska. Both documents are products of fishermen workshops performed in Alaska to engage and enlist the assistance of fishermen towards the goal of reducing large whale by-catch. The first document provided recommendations and review of legal obligations of fishermen towards large whale entanglement response efforts. It emphasized reporting, preventive measures, and assisting authorized response. In cases where the entangling gear was tended (i.e. their vessel was attached), recommendations were provided to the best course of action. Recommendations included *not* approaching closer than 30ft to the animal, and/or 'overhauling' an animal using the vessel's equipment which may put human safety (and possibly animal) at risk. Authorisation to otherwise engage in disentanglement efforts was not provided. The document was reviewed by NOAA legal counsel, and was based on the efforts of fishermen, Alaska Sea Grant, NOAA Fisheries, and NOAA's Hawaiian Islands Humpback Whale National Marine Sanctuary.

The second document was a wheelhouse card outlining preventive measures for fishermen and from fishermen in the state of Alaska. The 'tips' focused on preventing 'tended' gillnet entanglements to large whales like humpback whales.

CONCLUSIONS

There was considerable discussion on whether it was a good idea to provide advice directly to fishermen on disentanglement. The Workshop recalled previous recommendations and the principles and guidelines that **stressed** the importance of having trained personnel present. However, the Workshop recognised that circumstance may arise in which advice/messaging may need to be provided to reporters/ fishermen in cases where authorised, experienced, well-equipped network response is not possible. In such circumstances the following was **agreed**:

(1) Ask if they have reported to local/ regional authorities? If possible get contact information. Depending on circumstances may need to provide advice here as well.
(2) Obtain basic information to try to make a typical assessment of the entanglement if this is possible;
(3) Given (1), in most cases it should be possible to let them know that whale is probably not in immediate danger – it may also be appropriate to explain that some animals free themselves of entanglements over time;
(4) Emphasise human safety i.e. their life is the most important consideration. If they were to get hurt it may have a detrimental effect on whale response for years to come.
(5) Further assess their safety. If they are attached to the gear (i.e. in a tended fishery), primarily advise them to not approach closely (i.e. maintain at least one whale body length) and release the vessel from the animal, perhaps with a small buoy if there is a chance that a trained team may be in a position to find and release

[4] http://seafa.org/wp-content/uploads/2014/05/NOAA-Lare-Whale-Entanglement-Obligations-Response.pdf

and wheelhouse card No. 13. http://nsgd.gso.uri.edu/aku/akuh08002.pdf

the whale later. If not attached, re-emphasise the dangers involved and stress that they should not approach the animal and they should leave any gear on it. Stress that it is not appropriate to try to haul the animal to remove gear.

(6) Emphasise the importance of documentation and the value of gaining information towards potentially helping this animal later (even if unlikely) and addressing the threat in general;

4.2 Improvements in assessment and documentation of events (e.g. determining gear type and configuration, whale species, health and stress)

4.2.1 New information on impacts to individuals and populations

ENERGETIC CONSIDERATIONS

van der Hoop provided an overview of her and her colleagues' work measuring drag from sets of fishing gear removed from entangled North Atlantic right whales, as well as the satellite telemetry buoy used to relocate animals for disentanglement. Drag forces measured from entangling fishing gear vary considerably, increasing from a minimum of 8.5N by 36 fold, to 315N. The telemetry buoy adds on average 70N of drag across measured speeds (0.3 – 2.2 m/s). Removing 75% of a line's original length can reduce the line's drag by 90%, but interference drag and changes in swimming behaviour will still apply. Mean drag can be predicted from the dry weight or length of an entangling gear set.

Combining gear drag measurements with theoretical estimates of drag on whales' bodies suggests that entanglement increases drag and propulsive power by 1.35 fold at minimum, and 1.98 fold on average. Integrated over the course of each entanglement, individuals require on average 8.20×10^{9} ($\pm9.87\times10^{9}$) J to 8.05×10^{10} ($\pm1.34\times10^{11}$) J more energy than non-entangled whales (1.0457×10^{10} to 9.6550×10^{10} J) to complete the additional work required due to entanglement.

Large gaps in individuals' sightings histories can make it difficult to infer the date that entanglement occurred. For the 15 cases in van der Hoop's study, 80% were disentangled within 6 months of the initial entangled sighting (median = 57 days), and 75% of disentanglements were resolved within 17 days of telemetry buoy being added (median = 9.5 days).

In discussion, the Workshop **thanked** the authors for their innovative work, recognising that it was inevitable that certain assumptions had to be made, and encouraged its continuation. The Workshop **endorsed** the following recommendations made by the authors:

(1) the current disentanglement response practice of reducing trailing lines/rope to ~20m to accommodate a telemetry or marking buoy should be continued;

(2) estimates of drag based on length, and consequent energetic costs, should be incorporated into response assessments and serious injury determinations.

4.2.2 Rope strength

Knowlton presented a study on the parameters of ropes removed from entangled large whales from the western North Atlantic. For 30 right whales, 30 humpback whales, 8 common minke whales, the breaking strength of the strongest ropes at manufacture (based on polymer type and diameter) was significantly lower in minke whales than in right and humpback whales. Adult right whales were found in stronger ropes than juvenile right whales and all humpback whale age classes. For right whales, rope breaking strength was significantly stronger for those with severe injuries compared to those with minor injuries. For right whales, when all entanglement interactions were evaluated (both with attached gear and scars only; n = 1,032 events), moderate and severe injuries have been increasing and gear configurations have become of higher risk (constricting wraps or multiple anchoring points or trailing gear greater than one body length) over the past three decades, possibly due to changes in rope manufacturing in the mid 1990's that resulted in stronger ropes at the same diameter. Our results suggest that broad adoption of ropes with breaking strengths of 1,700 lbs or less could reduce the number of life-threatening entanglements for large whales and still be strong enough to withstand the routine forces involved in most fishing operations. Load cell testing will be conducted to understand the strains placed on ropes while fishing and to define water depths and gear configurations where reduced breaking strength ropes could be effectively used. Reduced breaking strength ropes should be developed and tested to determine the feasibility of its use in a variety of fisheries. Ropeless fishing techniques are being explored and may be useful in offshore waters where reduced breaking strength ropes would not be feasible. Collection, archiving, and assessment of entangling gear is recommended for all countries to help inform the nature of the entanglements within each country and how it relates to this global problem.

The Workshop **thanked** Knowlton for presenting this information and encouraged its continuation. As noted elsewhere (see Item 4.5.3) in its report, it **recommended** the archiving of entangled gear as a valuable resource in terms of revisiting and understanding past events. The Workshop **recommended** that other archives be tested for trends in rope breaking strength, as this could help validate the work presented and potentially produce broader recommendations for mitigation.

4.3. New tools for veterinary assessment and survival

4.3.1 Use of sedation

Barraclough *et al.* (2014) describes a method for a best estimate of body weight to calculate a safe sedative dose for an entangled North Atlantic right whale, to facilitate gear removal. It is based on acquisition of vertical, aerial, scaled images to estimate body length and widths. These data are then entered into a matrix generated from known weights, lengths and widths of other right whales. The discussion centred on the practical limitations of implementing sedation as a routine tool in disentanglement response. Narcotic regulatory, veterinary care and drug supply chain practicalities have limited the uptake of this tool in routine disentanglement.

The Workshop **recommended** to establish a similar analysis for other species, to enable more routine deployment of this tool in a commonly entangled species such as humpback whales, to increase experience and understanding of the approach. To do so could reduce disentanglement stress significantly, akin to the benefit to restraining a horse chemically as compared to the use of a hobble, a practice that is no longer widely used in veterinary medicine for reasons of safety and animal welfare.

4.3.2 Evaluation of serious injury/mortality

Robbins described a mark-recapture study of North Atlantic right whale survival after entanglement (Robbins *et al.*, in review). The study was possible thanks to the efforts of the Atlantic Large Whale Disentanglement Network and intensive population studies by the North Atlantic Right Whale Consortium. Fifty individuals were identified in entangling gear between 1995 and 2008 and their subsequent survival was compared to 459 individuals that were not observed with gear during the same period. The results indicate an approximately 20% lower survival of right whale adults and juveniles after entanglement. Of the three entanglement characteristics examined, apparent health was most predictive of subsequent survival, but the entanglement configuration and the resulting injuries also appeared to affect outcome. When the entanglement configuration was assessed as high risk, human intervention (disentanglement) improved the survival outcome. These results point to the importance of early entanglement detection, intervention and prevention.

The Workshop **thanked** Robbins and colleagues for this valuable study. It noted that such work makes an important contribution to trying to quantify the effects of entanglement when examining the status and future trends in populations. The Workshop **endorsed** the authors' conclusions that this study emphasises the importance of early entanglement detection, intervention and prevention.

Morin introduced the approach used to evaluate serious injuries and mortalities of whales in the USA. The Marine Mammal Protection Act (MMPA) requires the National Marine Fisheries Service (NMFS) to analyse any human-induced large whale incidents that could result in a serious injury or mortality (SI&M). The SI&M criteria was developed for all cetaceans with a primary focus on entanglements and ship strikes. If a positive confirmation of a SI&M is made, that count will go against the potential biological removal (PBR; the maximum number of animals, not including natural mortalities, that may be removed from a stock, while allowing it to reach or maintain an optimum sustainable population) for the stock and reported in the annual stock assessment reports. Large whale entanglement SI&M determinations fall in to 5 categories: positive or negative findings for gear involving hooks; positive or negative findings for gear with constricting wraps; a prorated value for cases with insufficient information to define in the first 4 categories. A positive value = 1 and negative value = 0 which is counted against PBR. Prorate value is based on a 5 year summary of entanglements (additional years will be added as they become available) and the percentage of large whale entanglements that showed deteriorating health or ending in a mortality. The current prorate value for large whale entanglements is 0.75.

The Workshop **thanked** Morin and Smith for introducing this document. It noted that this information is extremely important in an IWC context when using population modelling to assess status and the effects of a variety of human impacts on populations (data using this approach was valuable in the recent IWC North Pacific gray whale workshop, SC/66a/Rep08). With this in mind it **encourages** presentation of this paper at the forthcoming IWC Scientific Committee meeting in May 2015.

4.4 Determining gear/debris type and origin

4.4.1 Best methods to determine fishing gear

Smith provided a brief overview of two documents: NOAA Fisheries Gear Collection and Retention Policy for Gear Collected from Entangled Protected Marine Species (A15/ER/ALL/25) A15/ER/WP/20, WP to be elevated) and NOAA Fisheries Marine Forensics Chain of Custody Form (A15/ER/ALL/26) A15/ER/WP/21, WP to be elevated). The gear collection, retention and investigation procedures were developed based on fisheries regulated by NOAA Fisheries on the Atlantic coast while trying to learn as much as possible on the origin of gear, compliance with fisheries regulations, and effectiveness of required fishery gear and technique modifications. It was emphasized how important it is to have experts familiar with fisheries, e.g. previous fishermen, examining removed gear and interviewing owners of gear that was removed from entangled whales.

Lyman provided a recent example of the process, where the gear removed from a humpback whale off of Hawaii, was retrieved, processed and tracked to a specific fishery, location and fisher in the Aleutian Islands, and which, it was determined, had been on the whale for around four months and a minimum of 2,050 nm.

The Workshop participants **recommended** that countries consider developing similar protocols investigating entangling gear removed from animals, highlighting a proactive relationship with fisheries to document and learn as much as possible about the entangling gear and scenarios resulting in an entanglement and ultimately sharing of that information with other nations. However, it was also understood that, while working cooperatively with the fishing industry to identify entangling gear is the ideal goal, there can be numerous challenges to developing this type of framework, ranging from lack of reporting infrastructure to varying legal frameworks which might make a fisher more or less likely to participate.

4.4.2 Marine debris discussion

The Workshop noted the summary of the previous IWC workshops on marine debris that had included consideration of ALDFG and other debris. These workshops noted that determining whether materials removed from entangled whales were actively fished or ALDFG upon original contact, could be very difficult, but it was recognized that, in regions where entangling gear was tracked to its origin, the majority was actively fished when the whale encountered it. The workshop participants agreed that, in their experience, this was predominantly the case. They also recommended that all entangling materials be retrieved and archived, including detailed images, descriptions and samples of organisms removed from the gear, in order to better determine the relative risk of actively fished gear vs ALDFG and other debris..

THE GLOBAL GHOST GEAR INITIATIVE

Toole introduced the Global Ghost Gear Initiative (GGGI)[5]. Whale entanglements can occur due to both active gear and inactive, or derelict gear, also known as ghost gear. There are challenges to understanding how many large whale entanglements can be attributed to ghost fishing gear because the strength of large whales will often cause the entangled part of the gear to break away from the active part. Whilst information from this group suggests that the majority of large whale entanglements occur in active fishing gear, (Johnson et al, 2005),, ghost gear is a huge problem in our oceans. It is estimated that 640,000 tonnes of fishing gear ends up lost or discarded in our oceans each year. That is the equivelent of 2000 tonnes a day – this gear travels great distances via ocean currents and can persist in the ocean for up to 600 years, continuing to catch and entangle marine animals. A 2012 review of all available literature at the time estimated that between 57,000 and 136,000 seals, sea lions and large cetaceans are impacted by ghost year each year[6]. This estimate is heavily caveated because it is only based on published literature which is scarce for developing countires and doesn't account for animals that die unseen. So the true number of animals entangled each year in ghost gear is likely to be hundreds of thousands, if not millions.

World Animal Protection has founded the Global Ghost Gear Initiative (GGGI) a cross sectoral alliance of parters seeking to ensure safer, cleaner oceans by driving economically viable and sustainable solutions to the problem of ghost gear globally. It's three specific objectives, reflect the cross sectoral nature of the initiative and are to: 1) Improve the health of marine ecosystems 2) Protect marine animals from harm 3) to safeguard human health and economies

[5] [5] http://www.ghostgear.org/

[6] Estimated animals affected by entanglement per annum (entanglement rate X population estimate) World Animal Protection, Untangled, 2012

The GGGI structure includes three working groups; 1) Build evidence 2) Define best practice and inform policies and 3) Catalyse and replicate solutions

Standardisation of data collection on ghost gear and development of a ghost gear data portal will be a objective under the Build Evidence working group.

World Animal Protection recommends involvement of the IWC and the disentanglement network in the Global Ghost Gear Initiative, so that data collected by disentanglement teams can help inform the GGGI and for partnership opportunities for working on mitigation. Toole emphasised that that the GGGI can help strengthen the IWC's work on marine debris and disentanglement.

The Workshop **thanked** Toole for her presentation of a complex and major initiative. It noted that its objectives were far more ambitious than simply relating to large whale entanglements, which the available evidence suggested was due more to active fishing gear. However, it **encouraged** participants to cooperate with the initiative as appropriate and noted that the IWC would consider the GGGI in the context of marine debris.

4.4.3 Retrieved gear archiving

While Smith had previously (item 4.5.1) outlined the protocols for handling and investigating gear that is removed from entangled whales in the Atlantic coast of the USA, the workshop participants discussed the importance of retaining and archiving entangling materials for future study and forensics. Smith, Knowlton and Moore emphasized that in the USA, NOAA fisheries retains gear removed from entanglements in a specific facility in Rhode Island. The potential for research and information is tremendous and has been very helpful in showing fishermen the extent of the fishing gear and whale interactions given that these interactions are rarely observed at sea by fishermen. In some cases managers have worked with fishermen to "reverse engineer" entanglements, gaining insights into high risk attributes of the gear and even whale behaviour. The Workshop **agreed** that archiving entangling materials is valuable and encouraged all entanglement response networks to do so, in partnership with the relevant National authority.

5. DATABASE COMPONENTS AND STRUCTURE:

5.1 Overview of existing data collection, archival and databases

5.1.1 USA

ATLANTIC COAST

NOAA Fisheries Atlantic coast database developed out of a regional NMFS need to address commonly asked management questions (A15/ER/ALL/16). A number of primary data fields were used or adapted from work done in the Center for Coastal Studies (CCS) database. The database is Oracle based with a PHP front end design, with a primary goal of recording any large whale incidents including entanglements, ship strikes, mortalities/general injuries. The user workflow follows on the case type (ex. entanglement) -> animal (ex. humpback - ID is "Reflection" a known adult female) - > case (ex. NMFS specific identification numbers for this case) -> observations (the event specifics such as location, reporter, who responded, how the whale was entangled, outcome, etc.). This user workflow allows multiple cases for an animal and multiple observations within a case. Documentation such as photographs and forms are another key component and are linked with the case. Gear fields have also been added for an in depth analysis of any gear witnessed or recovered. Some gear field highlights include compliance to current regulations, gear modifications based on mandated requirements, gear type, measurements of recovered gear, and gear owner information. Serious Injury and Mortality determinations have also been incorporated within the database.

Smith added that NOAA is adapting the database so that it can easily produce annual reports, and share appropriate information with different groups (e.g. public, response network, etc.)

HAWAII AND PACIFIC

Lyman provided an overview of the database used in Hawaii to compile data on large whale entanglement reports. The FilemakerPro database was established in 2003 for the Hawaiian Islands Humpback Whale National Marine Sanctuary for entanglement case documentation and reporting to NOAA Fisheries' Marine Mammal Health and Stranding Program. Today it includes over 100 large whale entanglement. cases. The objectives of the database are to gather information on anthropogenic threats, their impacts, response efforts, and outcomes all towards risk reduction associated with both the threat of entanglement and the response to the threat. While the database is not yet integrated with the associated information-sharing website, plans are underway to do so, and also implement a mobile (iPad) data logger that can be used during research and response efforts to better gather information in real time. Lyman suggested that an app could be designed that would fulfil the same purpose of the data logger, but at a greater scale, and potentially provide much greater data gathering capability.

CCS

The Center for Coastal Studies database focuses on whale entanglement reports from the Bay of Fundy to Florida with records going back to 1979. The database tracks individual entanglement cases, entanglement responses and relevant associated data such as telemetry, gear samples and biological samples. The database has been used to answer questions about the veracity of entanglement reports, species specific details of entanglement and disentanglement, trends in entangling gear types, and fate of entangled whales, among other subjects.

DISCUSSION

It was noted that the two NOAA entanglement databases are very similar (and had their origins in the CCS database). They are both designed to handle all distressed large whales, including ship strike reports, unhealthy or "out of habitat" animals, as well as entanglements. In addition, they are organized around individually identified animals as "cases" with the possibility for many 'events' occurring under one case. For instance each new report of the animal, or each attempt to release it is recorded as a new event for that case. Subsequently, each database has many fields (more than 150 for NOAA's Atlantic database).

5.1.4 Canada

BRITISH COLUMBIA

The BCMMRN is coordinated by Fisheries and Oceans Canada (FOC). The network consists of government agencies, non-government organizations, whale watch industry, academia and hundreds of volunteers. An expert large whale disentanglement team was put together in 2008. The Pacific large whale entanglement and response data base is managed and maintained by Fisheries and Oceans Canada. All reported large whale entanglements are investigated and a detailed data base maintained. The information collected for the data base includes all details of the entanglement and response. All gear removed and recovered from a response is archived. The type, time and origin of where the gear became entangled is investigated and documented.

NEWFOUNDLAND/LABRADOR

Summary reports marine animal entanglements, strandings, ice entrapments, species at risk and those uncommon are written each year and have been in a consistent format for the past 36 years. These reports have been submitted yearly to the Department of Fisheries and Oceans. Entanglements are recorded by species, date, area, gear type, description, outcome, size and sex if known. This information is also entered into a running Excel file. Detailed accounts of entanglements are also kept in yearly diaries describing how the animal was entangled and disentangled, gear types, water depth, injuries, fishermen involved and the outcome.

5.1.5 Australia

Coughran reported that the Western Australian (WA) Cetacean Stranding Database provides a tool with which to assess some of the key issues relating to baleen whale entanglement by investigating patterns in reported entanglements.

Reports of stranded, entangled or otherwise cetaceans along the WA coast are routinely submitted to the Department of Parks and Wildlife (DPAW). These reports are investigated and records with sufficient detail and certainty of correct species identification are entered into the WA Cetacean Stranding Database. The database has had a single custodian (DKC) maintaining data quality control since it was created in 1982.

Prior to 1981 there was no formal process in place to maintain accurate records of stranding events in Western Australia and only a portion of events were captured through specimen records of the Western Australian Museum. In 1982 the Western Australian Cetacean Stranding Database was created. Reports of cetacean incidents (i.e. stranding, entanglement, ship/vessel strike etc) on the Western Australian coast are now routinely made to the Western Australian Department of Parks and Wildlife and recorded in the database. The department is responsible for administration of the Wildlife Conservation Act 1950 and managing issues relevant to fauna as defined under the Act, which includes whales and dolphins (cetaceans). In this capacity, DPAW staff attend strandings either to investigate the cause of death of animals or to assess the live animals to determine what action, if any, is required (e.g. rescue attempt, euthanasia) and consequently are the major source of information in the database. In a small number of cases information was obtained from other government officers (e.g. officers from the Department of Fisheries), or from members of the public.

In discussion it was noted that W. Australia's database only contains reports that are confirmed by trained responders. As such it is simpler than those that try to keep track of all reports, with the associated varying levels of certainty.

5.1.6 S. Africa

Meyer reported that prior to the formation of the South African Whale Disentanglement Network (SAWDN), the only standardised data (with sampling survey/effort) on whale entanglements were collected by the KwaZulu-Natal Sharks Board (KZNSB). These data were exclusively for shark net operations along the KwaZulu-Natal (KZN) coastline, commencing in 1981. The establishment of SAWDN in 2006 led to greater formalisation of incident reporting and data collecting outside of KZN, with incidents being reported to a central coordinator, residing within the Department of Environmental Affairs (DEA). Since 2006, data were collected by SAWDN in collaboration with KZNSB, and both sets of data were maintained in identically designed Excel spreadsheets. Reports on incidents of confirmed entanglement by both groups were sent to the DEA coordinator where the information was validated after interviewing persons involved in the disentanglement. Analyses are aimed at determining long-term trends in entanglement, inter-annual/seasonal trends, the breakdown of entangling materials, mortality and the outcomes of entanglement events including resightings of entangled, disentangled or partially disentangled animals. The database mainly consists of records of humpback and southern right whales, which are the species that are most prone to entanglement in South Africa.

5.1.7 Korea

An reported that virtually all of the reports in Korea are from fishermen with a whale anchored and dead in their gear, as the vast majority are smaller minke whales. Therefore the database contains a lot of very specific data about the gear and entanglement configuration, as well as the sex and length of the bycaught whales. Morrissey reinforced the value of these type of data and reported that in New Zealand they were finding that most entangling gear was set in 30-40 meters, and that most entanglements occurred during June and July. The group agreed that wherever possible, specific information about gear type, location and other set characteristics, along with entanglement configuration, and accurate measurements of the entangled whale, were very valuable toward understanding the issue.

5.1.8 Brazil

Marcondes presented the Brazilian Monitoring System of Marine Mammals – SIMMAM. Dr André Barreto from Vale do Itajai University (UNIVALI) created this system based in open source technology. SIMMAM integrates data from strandings, sightings and bycatch of marine mammals along the Brazilian coast and rivers. The Brazilian Government have bought the rights to use this system as a databank. All institutions that are members of Brazilian Stranding Network (REMAB) submit information to SIMMAM. Scientists are encouraged to input data into SIMMAM. Some 'basic' data are public e.g. species, location and date; information available in the scientific literature is also public. The Brazilian Government has access to all data and can use this information for management purposes e.g. the establishment of marine protect areas or for environmental impact evaluation. The institutions members of the SIMMAM can choose share their data with other institutions or with the public. They also can choose keep the data private for a maximum of five years to have time to analyse the information. After that, all data are for public access. SIMMAM was on-line[7] and have a public access area.

5.2 Review of current ongoing information gathered by IWC and other IGO or NGOs

5.2.1 IWC National progress reports

The Workshop reviewed the current relevant data fields for recording large whale entanglements in the annual National Progress Reports provided by member countries to the IWC Scientific Committee. While the information required is rather limited, it was noted that the National Progress Reports are intended to provide a summary of cetacean research and impacts with contact details for where detailed information can be obtained. It is not intended to be a source of data for a comprehensive analysis of the topic. A similar situation is that for ship strikes, where the Scientific Committee agreed to develop a global database on the topic rather than complicate the progress reports (see Item 5.3).

5.2.2 Other

Mattila noted that, as the IWC begins to engage more frequently with other Intergovernmental Organisations, it has begun dialog with COFI and a number of regional seas organizations. Some of these gather bycatch data, however this is usually from fishery observer data, and these programs are known to severely underestimate large whale entanglement, as whales very frequently drag all or part of the gear far away from where it was originally set. A number of these organizations have indicated that they look to the IWC to provide data on large whale entanglements.

[7] http://simmam.acad.univali.br/v03/app/web/bin/Simmam2.html

The Global Ghost Gear Initiative was discussed under Item 4.5.2.

5.3 Brief review of IWC ship strike database (e.g. structure, challenges, pros and cons)

Ship strikes are similar to entanglement cases in that the data can come from a range of sources including observations of dead animals on the beach, dead animals at sea, or live animals with obvious injuries. The same entangled whale may be reported in a number of different ways. The database needed to be structured to link potential duplicates but bearing in mind there may be a level of uncertainty in the link. The mechanisms in the ship strike database for linking separate records into 'cases' seem to work well for identifying duplicates but did require considerable development work.

A large amount of effort was put into a web based data entry system for the ship strike database. This was intended to be used by the public (e.g. mariners who had no specific knowledge of the issue who had observed a collision). This data entry system has had minimal use. It is proven cumbersome for anyone entering multiple records. There is still a need for better tools for scientists contributing small numbers of records (typically 5-20) which has been the most common source of data. The database fields were designed to match national databases (e.g. in the US and Australia) with a view to fully electronic data transfer, but this has not been put to the test yet.

So far, the greatest challenge for the ship strike database has been persuading people to submit data. The only real solution seems to have co-ordinators who are prepared to take data in any form from a contributor and do whatever work is needed to get it into a suitable form for the database. The reluctance to submit data appears to be more often related to the time and work involved than any unwillingness to share the data in principle. Maintaining even a small, simple database generates a substantial workload. Any global effort will require a dedicated co-ordinator who takes ultimate responsibility for all aspects of the maintenance and functioning of the database. There is also a need for a clear policy on dealing with requests for data. The great majority of correspondence regarding the ship strike database are requests for data.

The Workshop **agreed** that lessons learned from the development of the ship strikes database will be valuable in consideration of an entanglement database for large whales.

5.4 Recommendations to IWC with respect to a global database

5.4.1 Background

The IWC is the recognised international body responsible for managing whaling and addressing all other human-caused mortality to whales including welfare aspects. For many years it has recognised that entanglement in fishing gear and debris is a known source of injury and mortality, which may be of concern both as an animal welfare issue and potentially a population level problem. It is for this reason the IWC has held three workshops on this topic, including the present one. The IWC recognised that the capacity for reporting, documentation and mitigation varies across nations which *inter alia* affects the ability to determine numbers and possible population level effects.

The most recent workshops (Provincetown, 2011), had recognised the potential value of a global database dedicated to entanglement of large whales. It had recommended that a review of the value of different database models (e.g. single international, metadatabase, online etc.) with the aim of submitting a formal recommendation for a database system that will assist in the collection, recording and dissemination of data related to data on entanglements and entanglement response (including human issues) to allow a better quantitative understanding of the issues and in particular to assist in developing solutions to reduce entanglement risk. Taking this work forward is one of the important tasks of the present workshop.

5.4.2 Recommendations regarding a global database

The Workshop considered the need for a global database from a number of perspectives, taking into account (1) the review of existing databases under Item 5.1 and the need to avoid duplication of effort; (2) the importance of providing advice and resources to new entanglement networks with respect to data management and archiving; (3) possible confusion arising out of having separate databases recording impacts to animals, especially given difficulties in attempting to make determinations of mortality or serious injury from stranded animals; (4) lessons learned from the development of the IWC global ship strikes database (Item 5.3).

Initial discussion **stressed** the importance of agreeing to the potential objectives of any IWC-related database before discussing development details. The Workshop **agreed** that the primary long-term goal of the IWC initiative is to improve the understanding of the impacts of entanglements on whale populations and the factors associated with

entanglement risks in order to minimise and ultimately eradicate entanglement of large whales in fishing gear, recognising that complete eradication may prove impossible.

Although entanglement is a widespread problem, in many areas the sample sizes of reliable observations are small. Thus any centralised global database could facilitate informative analyses of factors that may affect entanglement risk by species and gear type at a broader level than may be achieved by looking at regional data alone.

Sub-objectives for a database could be to:

(1) determine the incidence of lethal entanglement and relevant sub-lethal effects (or at least put reasonable bounds on incidence that can be incorporated into population dynamics models);

(2) identify the fisheries/gear types and specific practices that lead to a high risk of entanglement (globally and regionally), differentiate COAFG from ALDFG and other debris, and identify particularly vulnerable species, reproductive/age classes, seasons etc;

(3) record and archive the information obtained from entanglement response networks (both successful and unsuccessful) in order to:

    (a) improve present practice;

    (b) obtain a better understanding of how entanglement occurs and survival of animals;

    (c) inform mitigation/prevention measures

(4) combine information from (1)-(3) to prioritise and develop mitigation and prevention measures.

The Workshop **agreed** that these sub-objectives are appropriate and valuable and are sufficient to justify its **recommendation** that a fully specified, costed proposal is developed for submission to the IWC at the 2016 Annual Meeting. It recognised that there was insufficient time to achieve this at the present workshop and that it would require a concerted effort of a small group to develop such a proposal. In this regard it **recommended** that a small sum (e.g. £3000) be allocated by the IWC, to allow one short meeting of the group in 2015/16 in order to develop the database proposal, and that the task be assigned to a small group (e.g. six) comprising: the IWC Secretariat, and others.

The Workshop **agreed** that the fully specified proposal should take into account *inter alia*:

(1) maximising synergies with existing databases, learning from their strengths and weaknesses;

(2) meeting the objectives and sub-objectives given above (and consideration of likely analytical methods associated with these where appropriate);

(3) the discussions on important fields arising out of this workshop (including the discussions on the data form at the present workshop and that in 2011) and emphasis on consistent and specified definitions;

(4) lessons learned from the development of the ship strikes database including those related to data entry (both new data and the inclusion of data from existing databases) and validation (including levels of uncertainty);

(5) data availability considerations (authorisation; confidentiality; data sharing amongst networks, the IWC Scientific Committee and others; what summaries might be made public etc.);

(6) links with other mortality-related databases and archives;

(7) mapping capabilities;

(8) links to other material (e.g. photographs, videos, original field reports);

(9) alternative software approaches (including web-based, stand alone, metadata etc.);

(10) the provision of a service to new entanglement response networks;

(11) consideration of curation and maintenance.

5.3.3 Entanglement response data form

The Workshop revisited the entanglement response data form that was developed during the last workshop (IWC/64/WKM&AWIrep1, Annex D). This form was intended to enhance and better standardise data collected by entanglement response teams (existing and new). It incorporated fields on health that had been identified in the first workshop, as well as data on wounds, entangling gear configuration and behaviour that are not always easily captured by other means. Most workshop members had not used the form *per se*, but have their own data collection schemes already in place, sometimes including much of the same types of detail. The CCS response team had added the form to its usual documentation since the last workshop in order to help to evaluate its format, content and potential value in research and management. They highlighted several recommended modifications, including fields that could be added and fields for which greater specificity and guidance would be useful. Several further discussions and modifications were then made during the workshop. Changes included a tiered approach that differentiated between the minimum essential data (for less experienced responders) and other detailed data that should be collected whenever possible. However, there was not adequate time to finalize the form during the workshop and so further work was recommended to take place intersessionally.

6. NEW TOOLS OR PROTOCOLS FOR EUTHANASIA (ESP. AT SEA)

6.1 Euthanasia workshop

Moore reported on the IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans held at the Institute of Zoology, London 11-13 September 2013 (Report). Participants came from Argentina, Australia, Brazil, Germany, Iceland, Ireland, Japan, Norway, South Africa, United Kingdom, and USA. The objectives of that workshop were to:

(1) improve the evidence base for future assessments of when and how to euthanize stranded cetaceans to optimise animal welfare, using the most effective technologies available and taking into account different circumstances (e.g. economic, logistical and available expertise);
(2) identify how to improve the efficiency and quality of information/data generated by large whale stranding events, including lessons that can be learned from them;
(3) focus on biological considerations and technological measurements taking into account the decisions that need to be considered such as health and safety, logistics, physical - both location and species, triage at Mass Stranding Events (MSEs), and existing protocols/guidelines;
(4) generate a list of techniques (established protocols) for each method of euthanasia (chemical, ballistics, explosives, etc.);
(5) provide advice on how to manage different situations in the context of the media and the general public.

Recommendations of that workshop included:

(1) IWC member nations refine existing or develop new incident response protocols based on the principles and guidelines found in this report
(2) Collection of appropriate data, full documentation of the event and the sharing of experiences/data to refine decisions and situation handling in the future.
(3) Addition of a number of 'outcome' fields to the existing IWC National Progress report database for live strandings: released/rescued; euthanized (method categories as in Table 3); no intervention
(4) Establishment of a voluntary group of experts that can be consulted by the IWC and others to: (1) provide advice on euthanasia protocols and methods to relevant authorities; (2) provide objective information to the media if requested and (3) assist the IWC Secretariat in populating the IWC website.
(5) Establishment of a live stranding response component of the IWC website with a layered capacity
(6) More work is needed on the environmental persistence and potential effects of some chemical methods and encourages this research and provision of information.
(7) Encouraged the development of a darting-gun type delivery system that it is suitable for beached animals and may also be appropriate for entangled whales at sea (see Item 6.2, below).
(8) The need to develop methods for euthanasia of cetaceans at sea (entangled or otherwise requiring human intervention).
(9) IWC consider holding or facilitating the holding of a future Workshop on mass stranding events, including management, social, welfare and euthanasia considerations.

In the context of next steps, it was noted in discussion that cetacean mass strandings will be the topic of one or more workshops planned for the 21st Biennial Conference of the Marine Mammal Society (December 2015) and euthanasia will probably form part of the discussions.

6.2 Euthanasia at sea

Øen presented an overview of the need to develop methods for euthanasia at sea which had been recognised by the IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans in 2013 recognised *inter alia* the need to develop methods for euthanasia at sea. It stated that the humaneness should be the first criteria for any euthanasia method rather than concerns over aesthetics or public acceptance and that a humane death will often involve the very shortest time to death. It also recommended that criteria for the chosen method of euthanasia should include availability of equipment, knowledge, expertise and relevant legal/regulatory framework like cultural, political, aboriginal, socio-economic differences between countries. The workshop stressed that human safety should always be considered paramount.

For practical and safety reasons euthanasia of whales in open sea has to be carried out by means that can be remotely delivered. Remote delivery requires specific tools to safely deploy the euthanizing/killing devices at/into the site/organ where it is can be expected to take effect. Remote delivery therefore limits the potential methods that can be expected to give a successful outcome grossly to the following three principles:

(1) explosives (whaling grenades)
(2) high-velocity/high energy projectiles
(3) fast acting and potent drugs.

6.2.1 Explosives

The explosive Penthrite (Pentaerythritol tetranitrate, PETN)) has been successfully used in modern whale (harpoon) grenades. Penthrite creates pulsating, supersonic 'shock' and pressure waves that fatally injure and damage organs and tissue vital for life like nerves and central nervous system and heart, lungs and blood vessels.

Penthrite grenades are remotely delivered from deck-mounted harpoon guns used in the costal whaling operations from fishing boats in Greenland, Iceland, Japan and Norway or from hand thrown Darting guns used in Alaska for the hunt of bowhead whales. The grenade used for deck-mounted harpoon guns is triggered to detonate at a predetermined depth in less than 1/10 sec after penetration. The darting gun grenade is triggered to detonate after 4.5 sec.

Modern penthrite grenades are currently probably the most secure and most effective means for instant or very rapid killing/euthanasia of large whales at sea. Deck-mounted harpoon guns using penthrite grenades are available in Greenland, Iceland, Norway and Japan and can be used to kill/euthanise entangled large whales of all species at sea in the countries were such tools are available. Darting guns and darting gun penthrite grenades designed for the hunt of bowhead whales are probably the most rapid tool for killing/euthanasia of right whales at sea. To be used for other large whale species parts of the delivery system need probably to be slightly modified or adjusted for the different species. The current darting guns used are manufactured in USA while the darting gun grenades are produced in Norway.

Penthrite grenades should only be handled and used by trained personnel.

6.2.2 High-velocity/high energy projectiles

Several papers and reports have been published and/or submitted to the IWC Working group on Whale Killing Methods and Associated Welfare Issues that describes and document how firearms have been successfully used for euthanasia of small and larger cetaceans. The effect of ballistics to euthanise/kill stranded large whales was also thoroughly discussed during the 2013 IWC Workshop.

The brain is extremely vulnerable for high-velocity/high energy projectiles because its inelasticity and also because it is enclosed by rigid bones where there is no room for expansion. The sudden energy transformation from a high-velocity/high energy bullet when it passes the brain will dramatically increase the pressure inside the cranial cavity resulting grossly destructive brain damages that may be almost 'explosive' in character ('Krönlein' shots). Øen reminded of the need for preparation of figures and maps showing the position of brain and upper neck in relation to external features like flippers, eyes, blowhole and other external characteristics for large whales like it has been done in Norway for minke whale, to help directing the shot correctly. He also reminded that if firearms are to be used for euthanizing at sea it has to be taken into account that water has a tremendous braking effect on bullets. By passing

only through a short distance of water the speed and impact energy of the bullet will be significantly reduced and will negatively affect the bullet's penetration ability and efficiency.

6.2.3 Drugs

With regard to drugs, it was pointed at that the drugs had to be injected directly into well vascularised tissues like muscles or directly into the thorax or abdominal cavity to be absorbed rapidly. Injection into the blubber will result in a slow and delayed absorption of the drug. To avoid spilling of drugs in the blubber, the syringe has to be equipped with needles that delay injection until the needle has penetrated past the blubber. Currently, the only drug known, which have a potential to euthanise whales with remote delivery, is etorphine. However the use of etorphine carries a great risk of intoxication for uses and bystanders and should only be permitted used by well-trained personnel. The drug also carries a risk for intoxication of scavengers.

6.2.4 Discussion

The Worksop **thanked** Øen for his presentation that had been based on previous recommendations from IWC Workshops (IWC/62/15; Report).When considering the applicability of this tool for euthanasia of species other than right whales, it was clarified that the penthrite grenade is already used in the hunt of a variety of large cetacean species in several countries. On the question of possible deployment by air rifle, Øen clarified that the force would be inadequate to penetrate the body to the appropriate depth and to trigger the firing pin. The explosion could occur at or near the surface of the whale and thereby fail to euthanize and also create a hazardous situation for humans. He further clarified that the grenade produces a radiant charge but that there have been no injuries to humans yet in deployment. When asked about failed killing attempts, he noted that this had occurred in the past, due to improper targeting (i.e., outside of the required neck or chest areas) by individuals who had not had adequate training.

As noted in Item 6.1, further development of a gun-type delivery system had been recommended at the IWC euthanasia workshop, but Øen clarified that this had not advanced further because funding is required. The Workshop **endorsed** the earlier recommendation and encourages individual nations where this approach may be appropriate to support development of system further.

6.3 Western Australian procedures for euthanasia and firearms

Coughran presented A15/ER/ALL/5, which is a standard operating procedure (SOP) for the use of firearms for euthanasia. Live cetacean strandings are relatively common along the West Australian coastline (Groom and Coughran 2012), and the frequency of stranding events is expected to increase over coming decades (Schumann et al. 2013). While some stranded animals can be successfully returned to the ocean if viable, many stranded cetaceans require euthanasia. While operating procedures are in place to use explosive charges to humanely euthanise large (>7m cetaceans; Coughran et al. 2012), the use of firearms has been demonstrated to be the most humane method for euthanising small (<7m) animals (Blackmore et al. 1995). A15/ER/ALL/5 provides instruction on how to undertake this with appropriate firearms and ammunition. The Department of Parks and Wildlife (DPaW) is the designated lead agency for all cetacean stranding events in Western Australia, and the SOP applies to moribund small cetaceans undertaken by them across the state. When the DPaW is unable to respond to stranding events, this SOP may also be used to guide euthanasia of stranded small cetaceans undertaken by other authorised individuals or organisations. All DPaW personnel involved in attending to cetacean stranding events should be familiar with the content of this document. The SOP only applies to the use of firearms for euthanasia of stranded cetaceans up to about 7m in length. Euthanasia methods for larger cetaceans, such as use of explosive charges (Coughran et al. 2012), or chemical injection (Barco et al. 2012; Harms et al. 2014), are not covered. Other euthanasia methods may be more appropriate in some cases and their use is not precluded by the SOP. Euthanasia of cetaceans through chemical injection is an established method but requires specialised equipment (Barco et al. 2012; Harms et al. 2014). Personnel should be appropriately licensed, trained or where necessary, supervised when using any method.

6.4 Other

In discusson, Øen described the possible use of a lethal dose of etorphine to euthanize large whales at sea. But he clarified that etorphine is highly toxic and so its use at sea could result in unintended impacts in the environment (such as for scavengers). Thus, consideration would have to be given for appropriate containment and disposal of the carcass. In addition, it was noted that it is dangerous to humans, expensive and a controlled substance in many countries.

7. INTERFACING WITH THE PUBLIC

7.1 Working with media

As the IWC Secretariat is serving as the convener of the global whale entanglement response network, Mattila began discussion on this topic by providing some background on recent proposals to help the group increase its visibility, in order to counter incorrect, and even dangerous, information that get can sometimes become "viral" on the internet and social media. Firstly, as had been so effectively demonstrated by Mexico at this meeting, it is recognized that "branding" can be an effective tool to increase visibility and impact. In response to a query, the group confirmed that the working name, Global Whale Entanglement Network, and its acronym, GWERN, are temporarily acceptable for the networks working together under the auspices of the IWC, but that a new name and acronym may be chosen by email vote shortly after the workshop ended.

Participants **confirmed** their earlier agreement to send stories of successful rescues to the IWC Secretariat for potential posting on the IWC web site, and for distribution to organisations supporting the global network. These stories would be tailored for the public, and of course will not contradict the consensus principles and guidelines developed in 2011, and reviewed and re-endorsed here. The Workshop also **agreed** that an accessible, public-friendly regular summary of achievements of the global network be included on the IWC website and sent to contributors to the initiative.

The Workshop discussed the particular challenge of countering incorrect and inappropriate messages on line, particularly given that many of these are "feel good" stories. It can be difficult to provide an appropriate counterpoint in such cases without appearing negative or having the proper message lost or diluted. One strategy when commenting on websites or blogs is to first applaud the good intentions of the actions before clarifying what the appropriate action should have been taken. Mattila noted a recent instance where a group of respected climate scientists used online software, currently still in development by a non-profit called "Hypothes.is", to insert a layer of factual corrections and references in a prominent news story on climate change. He noted that if this software becomes usable, it may be worth considering using it to correct erroneous information, especially in highly visible sources. Another strategy is to contact parties offline (or outside the web) and share the appropriate message with them privately. Some have been happy to revise stories to incorporate a more appropriate message. This approach takes advantage of the visibility of the original post while avoiding a negative interaction. Some members have also tried with some success to provide response awareness training to key members of the news media and filmmakers.

An important, parallel strategy is maximizing positive, appropriate stories and information online. It was noted in discussion that Google searches can help to determine the visibility of the GWERN, as well as individual groups and websites with legitimate information on disentanglement. Searches in English and Spanish conducted during the workshop suggest that these currently hold the highest rank. Several members were reassured that although there have been some very persistent and damaging stories that circulate online, by and large most of these events tended to fall into relative obscurity over time online. Wikipedia was identified as a potentially valuable tool for putting reliable information online in a place where it was very likely to be accessed by the public. Mattila **agreed** to look at initiating topics there and populating with reliable information.

7.2 Working with the fishing community

Several approaches were suggested to improve communication with and engagement by the fishing community. Whale response at Newfoundland/Labrador is the first example of strong engagement, as it began as a fisherman assistance program and continues to operate with that understanding. They do not touch fishing gear without first obtaining permission from the fisher, and often have the gear owner on site where information can be relayed directly to the team. The success of this approach is evident, as it continues to be well-known and well-advertised within the fishing community. In many entanglement situations where the whale is free-swimming, this particular outreach approach is not possible and other outreach efforts are equally valuable. The workshop also discussed the benefits of outreach through participation in fishermen workshops/fora, actively involving fishermen in gear studies (also studies of pingers and depredation), and including them directly in response efforts whenever possible (including in a support capacity). Lyman relayed that the State of Massachusetts Division of Marine Fisheries made it a high priority to interact with fishers and to meet with them on their own vessels. He considered that practice to have been quite valuable for developing his relationships and dialogs with the fishers. Finally, it was suggested that in areas where

fishermen fear ramifications for reporting entanglements, limiting the amount of personal information (i.e., allowing anonymous reporting) may put them at greater ease.

8 GATHERING AND ANALYSING INFORMATION TOWARD PREVENTION

8.1 Review of work in various regions

8.1.1 USA

The Workshop discussed recent and on-going work on the issue of entanglement prevention. The co-occurrence of whale distribution and fisheries has been modelled for both the East Coast and areas of West Coast (A15/ER/ALL/21) of the United States. The East Coast co-occurrence model was instrumental in a federal strategy and recent law to reduce lethal large whale entanglements by strategically reducing the number of vertical lines in the water column. The Atlantic Large Whale Take Reduction Team also maintains an on-line matrix of research that has been identified to potentially facilitate entanglement understanding and prevention[8].

Successful prevention depends on the quality of the underlying data on entanglements and their impacts. Lyman described efforts to reach out to the fishing community and the public on line to assist with aspects of entanglement case follow up. He also highlighted the value of scar studies and new analytical approaches, such as studies of skin-associated bacteria on whales to better understand health (Apprill *et al.,* 2011; Apprill *et al.,* 2014). A study is underway in Alaska by Kate Wynne and colleagues to evaluate the potential effectiveness of pingers for reducing net entanglements of large whales (see further discussion of pingers under 11.2). Finally, Lyman reported a preliminary insight from a comparative analysis of gear removed from humpback whales in their feeding and breeding ranges. A lower frequency of gillnet entanglements in Hawaii versus Alaska may indicate that individuals that become entangled in net are less likely to survive. , or that some gillnet entanglements are minor and their cryptic nature makes them difficult to detect. Knowlton called attention to the Consortium for Wildlife Bycatch, which is coordinated by the New England Aquarium. They maintain a searchable database at bycatch.org that attempts to keep track of entanglement research and mitigation efforts world-wide.

8.1.2 Australia

Coughran presented a case study of research and mitigation efforts surrounding whale entanglements in the western rock lobster fishery off Western Australia. The northern migration of humpback whales along the Western Australian coast coincides with the 'traditional' end of the Western Rock Lobster Fishery (WRLF) (June 30). Half of all reported whale entanglements are associated with rock lobster pots, however there are also entanglements associated with aquaculture and other pot based fisheries (crab and octopus) (Groom and Coughran, 2012). Analysis of entanglement rates with WRLF gear has shown an increase since recording began back in the early 1990's (Groom and Coughran 2012). Entanglement rates did drop between 2006 and 2010, which was likely result of the introduction of industry codes of conduct for a range of fisheries to reduce the likelihood of interactions (Groom and Coughran 2012), as well as significant pot reductions in the WRLF during this time (de Lestang *et al.,* 2012). However, over the last few seasons (2010/11 and 2011/13) there have been significant changes to the management arrangements for the western rock lobster fishery. A move to quota-based management has also included an increase in pot usage and a change to season length with the season extending until the end of August in 2011 and September in 2012. The 2013/14 season was the first season with no temporal closure, allowing fishing to occur year round.

Coughran explained that an extension of the season has led to a movement of fishing effort into more months when the humpback migration occurs, resulting in a significant increase in the number of whale entanglements in fishing gear, and predominantly lobster fishing gear. While there are more pots being fished in the winter months, they are also being left for longer (greater soak times), resulting in significantly more pot-lines in the water. In 2012, there were 22 entanglements of humpbacks in fishing gear, with 13 of these being confirmed as WRLF gear. Previously entanglements have occurred predominantly in June. It should be noted that these are the dates at which the entangled whale was spotted, and represent some period of time after the entanglement actually occurred. In the last two years, with the increase of pots in the water in later months, the number of recorded entanglements has moved to more entanglements in these later months. There were 16 entanglements in the last 2 years where the identification of the fishing gear could be determined. Thirteen of these were lobster gear, with 3 entanglements from octopus fishing.

Based on this work, it was concluded that changing fishing behaviour or gear would be necessary to prevent increasing interaction rates. Most interactions appeared to occur with the float gear and ropes of set pots. They appeared to

[8] http://www.greateratlantic.fisheries.noaa.gov/whaletrp/plan/gear/Gear%20Research%20Matrix_Oct%202010_final.pdf

occur throughout the fishery and in all depths (but perhaps more 30+ fathoms). Interactions began in June and overlapped the fishing season duration. New mothers travel coast-wise later in the season (Oct-Nov) and because there had not been fishing their previously, there was a risk of further interactions. This has led to a collaborative approach among government and industry to reduce entanglements. Two projects have been funded to study mitigation strategies. Spatial information has been gathered and gear modifications were employed in 2014. Entanglements appear to have diminished by approximately 50% since 2013, but the assessment is on-going.

In discussion, it was clarified that some key elements of mitigation involved eliminating unnecessary slack in the surface system and profile, and also minimizing the amount of time that gear was in the water. The Workshop noted with interest that humpback whales on their northbound migration appeared to turn south and head coastward after entanglement. It had been possible to establish this because the fishermen provided information on exact location of where gear was set and when it went missing and this was compared to where the entangled whale was later encountered. The behaviour was interpreted by Coughran as possible predator avoidance.

The Workshop discussed pingers as an entanglement prevention tool for large whales. There is conflicting anecdotal evidence on this to date, and systematic studies have been lacking. Meyers reported that there was the possibility of increased humpback whale entanglements in one circumstances after pingers were added, even with four pingers on a single net panel. Some of the issues with pingers include that their batteries can die without the fisher being aware, and led lights are now being added to make this more apparent. Additionally, the effectiveness of pingers depends on whether they are spaced appropriately. There has been considerable research on the effectiveness of pingers in preventing entanglement in small cetaceans and this has been discussed for many years by the IWC Scientific Committee. Aspects of how those studies were designed and implemented could be a valuable resource when considering the design of a systematic study of large whale pingers. The Workshop **stressed** that even if the use of pingers (or any other mitigation methods) is found to be effective in an experimental situation, monitoring should be undertaken to ensure that the desired effect persists.

8.1.3 South Africa

Meyer reported that towards the close of 2013, the Department of Agriculture, Forestry and Fisheries (DAFF) in South Africa issued several experimental octopus longline permits along the South African coastline. Within four months of the start of the 2014 whale season, three whales had been entangled of which two had died and one was successfully released by SAWDN. Together, DAFF and the Department of Environmental Affairs (DEA) summoned all permit holders and cetacean biologists to review the permit conditions for the Octopus longline. Permit holders were given a presentation on whale disentanglement to understand the issues involved and the meeting discussed possible mitigation measures. The permit conditions were reviewed to include gear modifications to reduce the amount of rope in the water column both horizontally and vertically. These included sinking rope or lead weights spliced into the bottom rope to reduce floating line in the water column. To reduce entanglement vertically an initial 10m of chain from the buoy was spliced into the floating rope to the anchor. Diving surveys indicated that the design presented by a permit holder restricted floating rope at traps to 1 m above the ocean floor. These modifications despite 500 traps being presently deployed appear to have prevented further entanglements by the industry.

Workshop members welcomed this information, noting the magnitude and immediacy of the effect after this experimental fishery was initiated. This gear is also in use in Australia and so the timely sharing of information has provided valuable information to managers there. A question was asked as to whether the fishery could be prevented from moving forward. Meyer explained that it could be done with some effort and it might be considered if the issue continues.

In discussion of the profile of the floating line, it is valuable to look at these patterns at different stages in the tide (where tide is a factor) because this can affect the profile. In New England, sensors have been placed on the gear to track the profile over time versus a snapshot.

8.1.4 Canada

Cottrell relayed information from Canada in which floating lines were replaced with neutrally buoyant lines in 50 trap strings in a certain area. The entanglement rate appears to have diminished from 2-3 humpback whales per year to none observed since the modification was implemented

9. OTHER BUSINESS

The workshop participants thanked the Center for Coastal Studies for hosting the workshop, David Mattila for convening, and Arne Bjorge for Chairing the meeting.

The IWC Secretariat thanked the supporters of the capacity building initiative as follows:

Initial support was provided by the USA through the secondment of a technical adviser (Mattila) and an initial Voluntary Contribution to the IWC, which created an "entanglement fund" to use in order carry out trainings, purchase tools and support apprenticeships. Further significant contributions (>$20,000 USD), to support these activities have been provided by the USA, World Animal Protection and UNEP Specially Protected Areas and Wildlife, Regional Action Committee (SPAW-RAC). Other contributions to the fund or trainings identified by the IWC, using criteria developed by its entanglement expert advisory group, include: Permanent Commission of the South Pacific (CPPS), Secretariat of the Pacific Regional Environment Programs (SPREP), NOAA, Center for Coastal Studies, National Resource Defense Council, Animal Welfare Institute, International Fund for Animal Welfare, Humane Society International and OceanCare. In addition, considerable financial and in kind support have been contributed by the Governments hosting the trainings, through numerous National Agencies and NGOs.

10. REVIEW AND ACCEPT REPORT

Part of the report was able to be reviewed at the end of the Workshop. The remainder was adopted by email on 24 May 2015.

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Johnson A, Salvador G, Kenney J, Robbins J, Kraus SD, Landry S, Clapham P (2005) *Fishing gear involved in entanglements of right and humpback Whales*. Marine Mammal Science 21:634-645

Annex A

List of Participants

Yong Rock	An	Korea
Arne	Bjorge	Norway
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List of Observers

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Katie	Moore	USA
David	Morin	USA
Doug	Sandilands	USA
Lisa	Sette	USA
Jenn	Tackeberry	USA
Julie	van der Hoop	USA

Annex B

AGENDA FOR THIRD WORKSHOP ON LARGE WHALE ENTANGLEMENT ISSUES

Provincetown, MA (USA), April 21-23, 2015:

Day one

1. Introductions
2. Nominate Chair and Rapporteur(s)
3. Review and adopt Agenda and documents
4. New information since 2011 workshop
   - *4.1.* Aspects of reports from relevant workshops in 2011-2014
   - 4.2. New or unusual relevant cases since 2011 (Guadalupe, Korea)
   - 4.3. New tools or techniques (net cutters, cutting grapple…etc.)
   - 4.4. New safety or risk assessment tools or protocols.
5. Review of IWC Capacity Building
   - 5.1. Summary of work since last meeting (challenges, successes).
   - 5.2. Overview of **newly trained** participating national networks (e.g. Argentina, Brazil, Mexico, Panama)
   - 5.3. Review of strategy, curriculum and prioritization
   - 5.4. Should stranding and/or other complementary capacity building be added? In what instances?
   - 5.5. Discussion of cooperation between Government and private sector (NGO, fishers, ecotour…..etc): advice for success?
   - *5.6.* Review of different approaches to legal authority (e.g. in different countries) ,
6. Review of principles and guidelines (safety, procedures, decisions, toward prevention) and training curricula
   - 6.1. Considerations for less than ideal situations
     - *6.1.1.* Advice to artisanal fishers (Latin America, Arabian Sea…etc)
     - 6.1.2. Using heavier boats when inflatable is not available.
     - 6.1.3. "Remote" advice to non-trained responders (e.g. Chile right whale, Russian gray whale, Panama humpback….etc.)
7. Improvements in assessment and documentation of events (e.g. determining gear type and configuration, whale species, health and stress)
   - *7.1.* New information on impacts to individuals and populations

Day two

   - 7.2. New tools for veterinary assessment?
   - 7.3. Determining gear/debris type and origin
     - 7.3.1. Best methods to determine fishing gear.
     - 7.3.2. Marine debris discussion
     - 7.3.3. Retrieved gear archiving
   - 7.4. quad copters
8. Database components and structure:
   - 8.1. Overview of existing data collection, archival and databases
     - 8.1.1. US National
     - 8.1.2. Hawaii and Pacific
     - 8.1.3. CCS
     - 8.1.4. Canada (BC, Newfoundland and Labrador).
     - 8.1.5. Australia
     - 8.1.6. S. Africa
     - 8.1.7. Other:
   - 8.2. Review of current ongoing information gathered by IWC and other IGO or NGOs.
     - 8.2.1. IWC National progress reports
     - 8.2.2. Other: UN Regional Seas, WAP
   - 8.3. Brief review of IWC ship strike database (e.g. structure, challenges, pros and cons) \
   - 8.4. Recommendations to IWC

8.4.1. Improved Nat. Prog. Rep. only, or full web-based, public entry
8.4.2. Important data fields

9. New tools or protocols for euthanasia (esp. at sea)
   9.1. See review of euthanasia workshop
   9.2. Penthrite grenade gun (pros and cons, costs, appropriateness for different species…etc.)
10. Interfacing with the public
   10.1. Working with media
   10.2. Working with fishers

Day Three

11. Gathering and analysing information toward prevention
   11.1. What is currently happening in various regions?
12. Other business
13. Review and accept report.

Annex C
List of Documents

Document Number	Title	Authors
A15/ER/ALL/1	Draft Agenda	D. Mattila
A15/ER/ALL/2	Entanglements of baleen whales off the coast of Western Australia between 1982 and 2010: patterns of occurrence, outcomes and management responses	C. J. Groom and D. K. Coughran
A15/ER/ALL/3	status changed to working paper	
A15/ER/ALL/4	How much does a swimming, underweight, entangled right whale Eubalaena glacialis) weigh? Calculating the weight at sea, to facilitate accurate dosing of sedatives to enable disentanglement	Asjley Barratclough, Paul D. Jepson, Philip K. Hamilton, Carolyn A. Miller, Kenady Wilson, Michael J. Moore
A15/ER/ALL/5	Euthanasia of small stranded cetaceans using firearms	Jordon Hampton, Peter Mawson and Douglas Coughran
A15/ER/ALL/6	Carcass Disposal in Australia	Department of Parks and Wildlife
A15/ER/ALL/7	Report of First IWC Marine Debris workshop (2013)	M. Simmonds et al
A15/ER/ALL/8	Report of Second IWC workshop on Marine Debris	M. Simmonds et al
A15/ER/ALL/9	Report of IWC-SPAW training workshop (2012)	D. Mattila
A15/ER/ALL/10	Annex E Principles and Guidelines	IWC report
A15/ER/ALL/11	IWC-64-WKMAWI-Rep1 Annex D data form	IWC report
A15/ER/ALL/12	A deadly mother-calf bond in Caribbean sperm whales?	Rinaldi and Rinaldi
A15/ER/ALL/13	Wheelhouse card for Alaskan Fishermen	State of Alaska, NOAA, Fishermen
A15/ER/ALL/14	Decision tree for tagging	NMFS
A15/ER/ALL/15	New equipment testing protocol	NMFS
A15/ER/ALL/16	Online entanglement report form	NMFS
A15/ER/ALL/17	Criteria for response roles and training levels	NMFS
A15/ER/ALL/18	Policy for advancement between response roles	NMFS
A15/ER/ALL/19	USA serious injury determination	NMFS
A15/ER/ALL/20	Update on Southern Right Whale entanglements at Peninsula Valdes, Argentina (2012-2014)	G. Bellazzi, R. Orri, S. Montanelli
A15/ER/ALL/21	NOAA-TM-NMFS-SWR-044: Understanding the co-occurrence of large whales and commercial fixed gear fisheries off the west coast of the United States.	Lauren Saez, Dan Lawson, Monica DeAngelis, Elizabeth Petras, Sarah Wilkin, Christina Fahy

A15/ER/ALL/22	U.S. west coast large whale entanglement information sharing workshop report	NMFS
A15/ER/ALL/23	Annex F Strategy and Curriculum for Capacity building	2011 IWC entanglement workshop
A15/ER/ALL/24	Fixed Gear Guide: California, Oregon and Washington Commercial Fisheries, trap/pot, gillnet, longline/set line	NMFS
A15/ER/ALL/25	NOAA Fisheries Gear Collection and Retention Policy For Gear Collected From Entangled Protected Marine Species	NMFS
A15/ER/ALL/26	Marine Forensics, Chain of Custody	NMFS

Annex D

D. Coughran

TRAINING TO MANAGE RISK AT A HIGH STANDARD TO ENSURE TEAM SAFETY

The Department of Parks and Wildlife, Western Australia is a Registered Training Organisation. The department as a training provider is registered by the Australian Skills Quality Authority (ASQA) to deliver Vocational Education and Training (VET) services. RTOs are recognised as providers of quality-assured and nationally recognised training and qualifications. This type of training has been delivered to all other nationwide Australian State Environmental Agencies that have the Legislative responsibility to risk manage incidents related to large whale entanglement response.

As an RTO the department is approved to train and assess qualifications, units of competency and accredited courses in the areas of:

(1) Conservation and Land Management
(2) Frontline Management
(3) Government
(4) Public Safety

Each of these areas has a Custodian who works with the departments Learning and Development's RTO Coordinating team to ensure currency and compliance with training and assessment material and processes. At the competent completion of learning, the RTO is responsible for issuing the learner with the appropriate qualification or statement of attainment.

Trainers and Assessors are employees of Department of Parks and Wildlife who have the appropriate qualifications and vocational experience to deliver accredited training and assessment, relevant to the training subject, in this case the risk management of large whale entanglement response.

The Department of Parks and Wildlife's RTO support the departments' formal training program (accredited training) through competency based training and assessment. This means the focus is on what can be done in practice or in the workplace so that learners can demonstrate competency against a particular set of standards. Leaners are either competent or not yet competent. There is no pass or fail.

The level of knowledge and skills accredited training and assessment will cover will depend on the certificate level the learner is studying.

Certificate II: At the end of the studies the learner will be able to do a wide range of activities where the choice of actions required is clear and there is a limited difficulty in the tasks they will be completing.

Certificate III: The learner will be able to choose the best action to take in new environments and be able to give advice and some leadership to solve problems.

Certificate IV: The learner will be able to show leadership in a variety of situations and give in-depth advice to solve difficult problems.

Training is the process of learning and the department offers its employees the opportunity to learn by:

Accredited Training is training and assessment that results in the participant/s undertaking a Nationally Recognised qualification, accredited course or unit of competency.

Nationally Recognised Training has been developed based on the National Training Package for the given industry and is conducted in accordance with the requirements of the *National Vocational Education and Training Regulator Act 2011* and Standards for NVR Registered Training Organisations 2012.

Non-accredited Training is training that doesn't result in the participant/s attaining competence in a Nationally Recognised qualification, accredited course or unit of competency.

Non-accredited training may include licences, product-specific certifications, 'internal' certifications or other training which are not aligned to a Nationally Recognised qualification.

Assessment is the process of collecting evidence and making judgments on whether competency has been achieved, to confirm that an individual can perform to the standard expected in the workplace, as expressed by the relevant endorsed industry/enterprise competency standards of a Training Package or by the learning outcomes of a VET accredited course.

(SNR3 Standards for NVR Registered Training Organisations 2012)

The Department of Parks and Wildlife relies on its RTO's qualified assessors to determine the competency of learners, based on the evidence collected during the assessment process.

Learners are considered competent when they are able to show sufficient evidence of consistent application of their knowledge and skills in a range of new situations and environments, in accordance with the standards of performance expected in the workplace.

Evidence is collected through the assessment processes of:

(1) Assessment Activity
(2) Credit Transfer
(3) Recognised Prior Learning