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Report of the Second IWC Workshop on Welfare Issues Associated with the Entanglement of Large Whales With a Focus on Entanglement Response

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Report of the Second Workshop on Welfare Issues Associated with the Entanglement of Large Whales, With a Focus on Entanglement Response

Contents

The Workshop was held from 24-26 October 2011, at the kind invitation of the Provincetown Center for Coastal Studies in Provincetown, Massachusetts, USA. The list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Welcoming remarks

Mattila (convenor) welcomed the participants. He was particularly pleased that there were representatives from the world's primary entanglement response networks attending (Table 1).

Table 1
Entanglement response networks present at the meeting

NATIONAL ENTANGLEMENT RESPONSE NETWORKS
Australian Large Whale Disentanglement Networks (Australia)
Department of Conservation (New Zealand)
National Marine Mammal Health and Stranding Response Program (NOAA, USA)
South African Whale Disentanglement Network (South Africa)
REGIONAL NETWORKS (in National Networks)
British Columbia Marine Mammal Response Network (Canada)
California Large Whale Disentanglement Network (USA)
Hawaiian Large Whale Entanglement Response Network (USA)
Atlantic Large Whale Disentanglement Network (USA)
OTHER
Marine Animal Entanglement Response (PCCS, New England, USA,): Developed the first procedure for disentangling free-swimming whales (1984)
Marine Mammal Center (Northern California, USA)
Whale Release and Stranding (Newfoundland, Canada): Established the first organised disentanglement program (1979)
Woods Hole Oceanographic Institute (New England, USA)

1.2 Objectives of the workshop

In July 2011, the Commission endorsed a number of initiatives to help advance the recommendations of the first large whale entanglement workshop that had been held in Maui in 2010 (IWC/62/15). One of main initiatives was for a second workshop to be held in order to advance certain aspects and recommendations of the first. The three following priorities were identified:

(1) advance the progress made at the 2010 workshop;

(2) develop 'recommended practices' for entanglement response; and

(3) develop a capacity building curricula and strategy.

From the outset, the present Workshop **reiterated** that prevention, not disentanglement is the ultimate solution to the entanglement problem (see Item 7).

1.3. Election of Chair and rapporteur(s)

Bjørge (Norway) was elected Chair. Taylor and Wilkin were appointed rapporteurs. Final editing and organisation of material was undertaken by Donovan after the conclusion of the Workshop.

1.4 Adoption of agenda

The working Agenda was adopted at the start of the meeting to aid discussions. The final agenda developed from the workshop report is given as Annex B.

1.5 Material available

The documents available are listed in Annex C.

2. NEW INFORMATION SINCE 2010 WORKSHOP

2.1 Overview of new participating national networks

2.1.1 New Zealand

Morrissey reported that New Zealand's large whale entanglements have averaged around two animals per year since 2000. Initially, whales were partially disentangled by removing or cutting away crayfish pots in the belief that the remaining rope entanglement would not jeopardise the animal's survival. The tragic death of Tom Smith while attempting to release an entangled whale in 2003 and subsequent disentanglement training by Doug Coughran (Australia) in 2005 elevated New Zealand's response to what is deemed to be an international standard. Since the first training of one staff member in 2005, New Zealand has progressed to 10 certified members (9 active). Training and management of this team is now formally accepted as vital to ensure the safety of staff, volunteers and animals. The ongoing support from worldwide entanglement teams has played a vital role in maintaining and upgrading knowledge in a relatively isolated part of the world. Without such support New Zealand would not be in this current positive position. During discussion, Morrissey noted that most entanglement cases in New Zealand involve free swimming whales and only one known entanglement case involved line though the mouth (and see discussion under Item 2.2.1).

2.1.1 Canada (British Columbia)

Canada has a nationally funded marine mammal response programme. There are six Canadian regions that cover the three coasts (i.e. Pacific, Arctic and Atlantic). Since 2008, all regions have been looking at large whale entanglement issues to varying degrees[1].

The British Columbia marine mammal response network was initiated in 2008 and was developed to identify potential anthropogenic threats affecting the recovery of marine mammals at risk, including entanglements. It has several hundred volunteers including several government agencies who report injured, distressed and entangled marine mammals in British Columbia waters. A specialised, well-trained rapid response disentanglement team was

[1] A disentanglement programme has been in effect in the Newfoundland-Labrador region for over 30 years (see Table 1).

formed to respond to entanglements. In British Columbia, from 2008- 2011 there have been 26 confirmed baleen whale entanglements of which 16 (62%) have been partially or fully disentangled. The 26 whale entanglements included 22 humpback whales, one gray whale, one common minke whale and two unidentified baleen whales. The entangling gear (i.e. identified once removed from the animal or from pictures of the gear on the animal) incidences include gill nets (11), crab traps (8), unidentified ropes and floats (6), prawn traps (2), seine gear (1) and long line gear (1).

2.1.3 Argentina

Uhart provided an overview of southern right whale disentanglements in Argentina. Numbers of right whale entanglements seem to have been increasing over the last few years at Peninsula Valdes. Since 2009, there have been nine reported entanglements; four in 2009, three in 2010 and two cases up to October 2011 (the whale season ends in late December). There is as yet no official entanglement response team (see below) but since 2002 there have been three known interventions.

The first case was a 10m juvenile male (September 2002), which was entangled in the mooring line of a large whalewatching boat. The whale was towed to shore at low tide, stranded and disentangled. It returned to sea on its own with the high tide and was resighted in September 2006. The disentanglement effort was conducted by the Puerto Piramides Rescue group, including WEF (Wild Earth Foundation), professional divers, whale watch operators and park rangers.

The second case was a 12m juvenile female in August 2009. Disentanglement was coordinated with government agencies (wildlife and protected areas) and the operation was again conducted by the Puerto Piramides Rescue group. Initial attempts were made by divers from the water. This was followed by a two-boat operation. The whale was herded towards shallow waters to keep it from diving. All ropes were cut and the gear was recovered. The female was resighted one month later in a mating group, her wounds visibly healed.

The third case was an adult whale of unknown sex, caught in a fishing net with buoys. It was released by divers.

The additional seven cases of entangled whales have been reported. These were either animals that were not seen again, where the entanglement was not considered life-threatening (two cases, decision to not intervene) or permission to disentangle was not granted by government agencies. Those animals were entangled in rope and fishing gear around the caudal fin. The most recent case was an animal reported entangled in fishing gear in 2011 but to date it has not been re-sighted.

Mitigation measures implemented include the prohibition of mooring whalewatching vessels (all boats must be removed from the water every day) in Puerto Piramides, and the setting of 'breakable' moors at the Puerto Madryn Nautical Club during races (boats are not moored permanently in the water at this site either). Following the death of three people attributed to a breaching whale in 2009, all further disentanglement efforts have been cancelled by the government for human safety reasons. Consequently, following the 2010 Maui workshop, Argentina's IWC Commissioner has formally requested training in large whale disentanglements by appropriate international experts.

2.2 Reports from relevant workshops in 2010-2011

2.2.1 The role of large whale behaviour, sensory abilities and morphology in entanglements

2.2.1.1 SUMMARY

A scientific workshop organised by New England Aquarium and the Provincetown Center for Coastal Studies, with support from the National Marine Fisheries Service was held from 3-4 May 2011 to review the role of large whale behaviour, sensory abilities and morphology in entanglements. The final report was not available[2] but Robbins presented the following summary.

Invited presentations and discussions focussed on aspects of documented entanglements, the behaviour of whales and their prey, morphological considerations and new sensory research. The workshop discussed how data accumulated through entanglement responses, population studies and new technologies have improved insight into some aspects of entanglement interactions. Examples included new estimates of the frequency and severity of mouth entanglements in humpback whales in the Gulf of Maine and North Atlantic right whales (more often reported in the latter) and the corresponding implications for how those populations become entangled. Nevertheless, much of the information available pointed to the likely complexity of those dynamics and there are still major limitations in our basic understanding of large whale biology. The workshop made a number of recommendations to address data gaps, from fundamental biological studies to entanglement-specific experimental research. With regard to the latter, new vision research may be the closest to providing specific data with which to further guide gear modifications. However, it remains unclear whether incremental gear modifications based on limited biological data can adequately reduce the impacts of entanglement on endangered populations. This highlighted the importance of

[2] The reference to the final report will be added when known.

continued development of ropeless fishing gear, technologies and techniques to most expediently and systematically solve the entanglement problem. Robbins particularly highlighted a recommendation to increase the amount of data collected during disentanglements and to standardise those data across areas where disentanglement teams operate.

2.2.1.2 DISCUSSION AND CONCLUSIONS

In discussion, Ledwell reported that in fact most humpback whale entanglements seen in the Newfoundland region do originate from the mouth. The Workshop **agreed** that this probably reflects that in that region, entanglements are discovered closer to the time of entanglement i.e. before the configuration has shifted over time. Underreporting of mouth entanglements may occur in some areas since they are less likely to be observed from small boats on free-swimming whales, particularly in dark water. It might also be expected that mouth entanglements will be more common in feeding areas (when compared to breeding or migratory areas) and that rates will vary by foraging and feeding strategies.

The Workshop **concurred** with the importance of working towards prevention (see further discussion under Item 7) and the need to increase and standardise data collection (see further discussion under Item 3).

2.2.2 Cetacean Entanglement Mitigation Innovation Workshop

2.2.2.1 SUMMARY

The Cetacean Entanglement Mitigation Innovation Workshop was held in New Bedford, Massachusetts, at the New Bedford Whaling Museum from 1-2 November 2010 and its report (IWC/O11/ER9) was summarised by Smith. There were 26 participants, including the facilitator, ranging from academia, non-profit, and state and federal governments in the United States and Canada. The workshop focussed on sharing information and experiences regarding existing entanglement response tools and techniques; its main objective was to work towards increasing the knowledge base for gear identification and recovery from entanglement cases to further management and research questions. The workshop identified numerous research areas to focus on for future improvements in entanglement response and forensic gear analysis including: marking of cuts on lines, marking of the exact location of lost entangling gear in order to potentially come back and recover the gear, thorough assessment and documentation of entanglement cases, and the overall configuration of lines and gear on an animal. The workshop also discussed the importance of similar techniques and conservation measures across country boundaries since the animals are trans-boundary including: gear analysis, disentanglement techniques and guidelines, sharing of information regarding entanglement cases and gear removed from animals.

2.2.2.1 DISCUSSION AND CONCLUSIONS

Smith brought forward the recommendations below for consideration by the present Workshop.

ACTION ITEMS

(1) Host a discussion on sedation protocol, including day-of deployment and develop a sedation operational protocol.

(2) Develop an annual two-day workshop for speciality training for advanced disentanglers.

(3) Establish training for the users of the crossbows in order to maintain proficiency, especially for biopsy sampling and remote cutting.

(4) Emphasise the need for high-resolution photographs of the gear on the whale.

(5) Develop a protocol throughout the disentanglement network for retrieval of lost gear, including whom to call for help with gear retrieval.

(6) Develop a standard gear-marking tool for disentanglers.

(7) Streamline the documentation processes.

(8) Create a Facebook page for disentanglement to increase public awareness.

(9) Develop a secure website for internal discussion within the disentanglement community.

(10) Develop post entanglement monitoring telemetry; and

(11) Focus on better identifying recovered gear.

RESEARCH PRIORITIES

(1) Devices for addressing flipper wraps.

(2) Devices for addressing head wraps.

(3) A combined cutting and grappling device to retain cut gear.

(4) Variations of the flying cutter including a flying cutter launched from a spring-loaded pole system and a flying cutter with longer blades.

The Workshop **endorsed** these recommendations, recognising that in some cases they overlapped with recommendations made elsewhere in this report and the Maui report.

2.2.3 Dynamics of Large Whale Entanglements in Fishing Gear

2.2.3.1 SUMMARY

IWC/O11/ER10 is the preliminary report of a workshop on the Dynamics of Large Whale Entanglements in Fishing Gear held from 9-11 February 2011 organised by the Consortium for Wildlife Bycatch Reduction at the New England Aquarium. It was attended by United States and Canadian east coast fishermen, biologists, policymakers and entanglement responders. Landry reported that the workshop tried to understand how individual entanglement cases occurred by reverse-engineering well-documented whale entanglement cases (cases for which a gear sample was collected, rope breaking strength was measured, entanglement configuration was well-understood and severity of injuries were well assessed). The exercise highlighted the continued need for a high level of documentation from entanglement responders (and necropsy teams), especially in regards to the exact configuration of gear on the bodies of entangled whales. The participants recognised that the exercise was mutually beneficial for biologists and fishermen.

2.2.3.2 DISCUSSION AND CONCLUSIONS

The Workshop **endorsed** two recommendations brought forward by Landry for consideration calling for:

(1) improvement by response networks in collection of gear samples, especially from free-swimming entangled whales; and

(2) collaborative gear inspections post-retrieval by biologists, managers and fishers.

2.2.4 Euthanasia methods for stranded cetaceans

2.2.4.1 SUMMARY

A workshop was held in Virginia Beach, Virginia USA from 12-14 October 2011 to develop recommendations for stranded cetacean euthanasia methods. The final report was not available[3] but Moore presented the following summary.

The workshop considered euthanasia constraints in terms of drug choice, non-chemical methods, safety and disposal. Where barbiturates could be used without risk to scavengers or the environment, their use with or without prior sedation was condoned. Under circumstances when barbiturates could not be used, heavy sedation followed by potassium chloride was considered a viable option. The workshop also discussed the use of heavy sedation followed by thoracic trauma but this was seen as a method of last resort. Cranial implosion was seen as a viable option if adequate safety, training, expertise and deployment location could be assured. The use of ballistics for animals < 6m, and letting nature take its course where active euthanasia methods were impractical were also discussed. There were no obvious methods suitable for euthanizing (as opposed to killing) free-swimming animals.

Moore brought forward three recommendations for consideration by the present Workshop.

(1) Further analysis of scavenger and environmental issues of euthanasia drugs should be undertaken.

(2) Cranial implosion techniques should be considered for adoption in regions where whales strand alive, given the relatively benign environmental impact of these techniques. Necessary resources, training and public education would be required.

(3) Methods for at sea euthanasia should continue to be investigated.

2.2.4.2 DISCUSSION AND CONCLUSIONS

During discussion, the Workshop recognised the environmental concerns associated with the use of chemical euthanasia. It **endorsed** recommendation (1) above for further analyses of scavenger and environmental issues surrounding the use of euthanasia drugs and **suggested** that barbiturates should only be used when there is an adequate carcass disposal plan.

It also **endorsed** recommendation (2) above regarding cranial implosion techniques. The Workshop **agreed** that the use of cranial implosion (Coughran *et al*., in press, JCRM) as a euthanasia method yielded the quickest time to death for whales > 6 m. It was noted that countries other than South Africa and Australia currently have not made use of the available technical expertise to use explosives as a euthanasia method and the Workshop **agreed** that other countries should investigate this approach, noting the need for the provision of necessary resources, training and public education.

Finally, the Workshop **endorsed** recommendation (3) on euthanasia at sea. The Workshop **agreed** that without the proper tools there are no appropriate methods, noting that the explosive harpoon is a well-established tool for whale killing. In certain cases, there may be an option of towing severely moribund animals to shore to euthanize them.

2.3 New or unusual relevant cases since Maui

2.3.1 North Atlantic right whale

Moore and van der Hoop provided the overview of the entanglement response to a North Atlantic right whale (New England Aquarium catalogue number Eg 3911) and the information gained through analysis of the response efforts.

On 15 January 2011, Eg 3911, chronically entangled and displaying consequent emaciation,

[3] The reference to the final report will be added when available.

was sedated, partially disentangled to the extent possible, administered antibiotics, and satellite tag tracked for six subsequent days. In addition, a Dtag (a digital acoustic recording tag with a suction cup attachment that measures received sound, time, temperature, depth, and allows for calculation of pitch, roll and heading) was attached during the operation. Drag forces experienced by the whale based on its body proportions, and the additional drag and energetic demand experienced as a consequence of the entangling gear were calculated. Dive behaviour was observed to be significantly restricted in depth and duration while the animal was towing the entangling gear and buoys. Respiration rates did not differ significantly before and after disentanglement or sedation. Gear drag was modelled in a simple boat based tow test. Increasing speed-specific drag at higher velocities for gear and buoy configurations suggest buoys have a disproportionate effect on drag across velocities. The increased power demand (watts) required by Eg 3911 to overcome additional drag forces imposed by various gear configurations ranged from 10 – 132% at speeds of 0.75 – 2.9 m s^{-1}.

Eleven days following the disentanglement effort, the animal was found dead. A complete necropsy was conducted to the extent permitted by the carcass decomposition. A broadhead cutter and a spring-loaded knife used for disentanglement were found to induce secondary moderate wounds to the skin and blubber. The LIMPET telemetry tag, with two barbed shafts partially penetrating the blubber, induced histological change that could have led to premature shedding and subsequent healing. One of four darts administered failed to shed and was found post-mortem with an 80° needle bend at the blubber-muscle interface. This bend most likely occurred due to epaxial muscle movement relative to the overlying blubber. This resulted in necrosis and cavitation of underlying muscle, suggesting that rigid, implanted devices that span the cetacean blubber muscle interface, where the deep muscles move relative to the blubber, could have secondary health concerns.

2.3.1.1 DISCUSSION AND CONCLUSIONS

The Workshop discussed the necropsy findings in the context of the injuries resulting from the disentanglement tools used. The spring-loaded knife should be customised to reduce the depth of blubber penetration. It should be noted that in a previous case, the knife had resulted in lesions that healed and had caused no noticeable behavioural response from the (non-sedated) animal. The retained dart resulted in a cavity that appeared immediately below where the needle penetrated; this cavity was determined to be pre-mortem trauma resulting from the needle bending acutely following penetration. This animal was observed to be minimally reactive to the response operations following sedation, but it was noted that animals' reactions may vary in different scenarios and may depend upon the amount of necrosis around the entanglement wound. Highly necrotic wounds typically result in a reduced or absent sensation of pain and are less likely to elicit a response from the animal.

The Workshop also discussed embedded line (such as was left in the lip of Eg 3911) and the potential long-term impacts on animals. In some cases, animals may be able to heal completely around embedded line; one example was given of a pinniped with a monofilament line passing through the brain that was behaviourally normal until removal of the line. However, with different kinds of line, the possibility remains for the wound to act as a route of infection.

The Workshop **endorsed** the five recommendations below proposed by Moore based on this case study.

(1) Sedation has enabled gear removal for two refractory right whales with serious health impacts. The first case (Eg 3111) has not been observed since and the second (Eg 3911) died later despite apparent partial disentanglement success. Enhancement of whale approachability by sedation should be considered much earlier in the management of aversive animals, before their decline becomes irreversible. Necessary equipment and logistics need to be entrained.

(2) The sedation dart tether and float system should be upgraded to enhance in-water drag, while sustaining in-air flight capacity.

(3) Post sedation and disentanglement monitoring with tags that do not penetrate the sub dermal sheath should be deployed.

(4) To better understand the pathophysiology of entanglement, Dtag or other simpler TDR suction cup tags should be deployed during disentanglement operations, especially if deployment does not impact operations and tag release control can be achieved to enable timely tag recovery.

(5) Broadhead and spring cutter tools should be maintained as part of the disentanglement toolbox, for their proven efficacy with minimal secondary harm by controlling depth penetration.

The Workshop also discussed the energetic calculations presented. It **recommends** analysis of the case history of Kingfisher (Eg 3346), a North Atlantic right whale with a history of entanglement since 2004 that still has a good health index and a

known migratory history. This case suggests that at least some animals may be able to adapt to the additional energetic requirements of increased drag from towing gear. Methods for restraining animals during entanglement responses are continually adapting and it was also **recommended** that additional information on the amount of drag that is added to whales during response events should be collected.

2.3.2 Eastern gray whale

Wilkin presented the case of a chronically entangled gray whale (EID 201008002) that was encountered and mostly disentangled off of Mendocino County, California, USA on 17 August 2010. The animal had a complex entanglement of nylon line spiralling around the body with wraps around both pectoral flippers and some line in the mouth; one end of the entanglement still had a crab pot attached. The wrap around the right pectoral flipper was very constricting. Line was embedded deeply into the flipper insertion, with necrotic tissue surrounding the wrap and a large population of cyamid whale lice in the wound. The entanglement response team grappled into the approximately 7m of trailing line to establish a control line and attach a telemetry buoy. When applying pressure to the line to attempt to attach the buoy, the line went momentarily slack and then taut again. Upon examining the whale, the additional drag upon the trailing line had caused the wraps around the flipper insertion to completely cinch through and amputate the flipper. Little blood was observed from the wound. The entanglement response team continued working with the animal and removed all gear but a small amount that was left in the mouth. The team was concerned over the unexpected outcome of the pectoral flipper amputation, having never considered this potential outcome from the standard entanglement response technique of applying additional drag to the entanglement.

2.3.2.1 DISCUSSION AND CONCLUSIONS

In discussion, the Workshop noted that there have been observations of fluke amputation as a result of chronic entanglement, but not pectoral flippers. However, the Workshop recalled other chronically entangled animals where the entanglement configuration might have resulted in future pectoral flipper amputation, even in the absence of additional drag on the line (from entanglement response or additional entanglements). Based upon the photograph provided with this case, the Workshop **agreed** that this flipper was probably severely compromised with a long-standing wound (perhaps even resulting from a previous entanglement) that may have eventually resulted in amputation on its own. Pectoral flippers that have been removed from carcasses under high pressure have presented very differently from this case.

2.4 New tools or techniques

Workshop participants presented tools and techniques that have been developed or more widely used since the Maui Workshop.

2.4.1 Tools

Smith and Moore provided a video and an overview of the design and use of the drug delivery device from its first use and each subsequent use and described how the system has been modified with each use. The first use of the device was to deliver antibiotics for a mother and calf humpback whale in the Sacramento River in California utilizing darts without a tethering system. Based on feedback from that case, where the darts were retained for more than 24 hours, a tethering system was integrated into the system, utilising a small Styrofoam float commonly used in the U.S. shark fishery. The second case was that of the severely entangled North Atlantic right whale (Eg 3111) also discussed under Item 2.3.1. Sedatives were administered to alter the evasive behaviour of the animal in order to safely and effectively remove entangling gear from the animal. Again, feedback from the use of the system on this case resulted in a modification of the float and tethering system with a more aerodynamic float so a missed shot would not break the tether. The final case was also of a severely entangled North Atlantic right whale off Florida to which sedatives and antibiotics were administered. Feedback from the use of the system in this case necessitates additional revisions to the float and tethering system due to a decreased drag in the new float design so as to facilitate the current slow removal of the deployed dart.

The Workshop recognised the importance of the ability for remote deployment of chemical sedatives and **recommended** further development.

Landry presented an update on the crossbow deployment of a rope-cutting broadhead arrow since the 2010 Maui Large Whale Entanglement Workshop. The relatively inexpensive and commercially available broadhead, Gobbler Guillotine, was deployed by crossbow on three entanglement responses in 2010 and 2011 off the US coast (two right whales and one humpback). In two cases the broadhead cutter successfully aided the removal of entangling gear. Follow-up on the individuals indicated minimal/acceptable superficial injury (no deeper than the skin) to the whale by the broadhead and active healing (e.g. see Item 2.3.1). In the third deployment the arrows did not hit their target; the whale was subject to a number of other disentanglement techniques but was later found dead.

The Workshop **recommended** use of the broadhead by other entanglement response networks with the following caveats:

(1) teams experienced with crossbow use, especially in conjunction with biopsy of large whales, should be targeted for training; and

(2) use of the tool should be highly selective and avoid shooting at entanglements near the eyes and nares.

2.4.2 Techniques

In terms of techniques, the Workshop watched a video provided by Coughran showing an aerial perspective of an entanglement response to gear wrapped around the peduncle. In the video, the response vessel, which had grappled into the entanglement, manoeuvred a wide circle to the side of the whale, which resulted in releasing the entanglement from the peduncle and the complete removal of the gear. In this case, the gear configuration was well understood, which allowed the responders to formulate this approach and resulted in the successful effort. Buoys on the trailing line located approximately midway between the whale's flukes and the response vessel also provided additional drag and gave a secondary 'pull' on the gear.

The Workshop also discussed the technique of the use of buoys to slow animals to aid disentanglement efforts and the risks of them adding to the entanglement (for instance, overnight) if the whale is lost and not relocated. Coughran reported that he has used a 'weak link' of natural rope to ensure that the buoys will be shed from the entanglement in a short timeframe. In the United States, the only case where a buoy (aside from a telemetry buoy) was intentionally left on overnight was when the animal was accompanied by the team. Meyer relayed an account of recreational fishers who were far from entanglement response groups who decided to puncture a buoy that was part of a trailing gear set in the belief that it was better for the whale. The Workshop was not in favour of this as a general approach and **agreed** that if there is any chance of re-sighting the animal, the buoy should be left intact both to provide a visual marker and to avoid having a sunken line as part of the entanglement.

With respect to the question of leaving small marker buoy (not telemetry) on animals overnight for assistance with relocation of the animal the following day, the Workshop **agreed** that while this technique has some risks, it may be appropriate in some situations. Making case-specific decisions, taking into consideration factors such as the species and habitat, is part of the decision tree developed at the Maui Workshop (IWC/62/15).

2.5 Safety protocols and risk assessment guidelines

The Workshop **stressed** that human safety is the primary concern of any disentanglement effort and is a major focus of one of the main objectives of the Workshop, the development of principles and guidelines for entanglement response (see Item 5).

In addition to the tragic death in New Zealand reported under Item 2.1.1, Ledwell presented an account from Newfoundland of a missing fisherman presumed to have been lost after becoming snagged in a trailing entanglement; this is of necessity speculative as neither the vessel or fisherman were found. As noted under Item 2.1.3, disentanglement efforts in Argentina are currently suspended following the deaths of three people (a wildlife photographer, a government officer and the boat captain) during a whale photography trip, potentially caused by a breaching whale landing on and sinking the boat. The Government of Argentina is in the process of investigating their responsibility and liability for actions conducted with their approval or authorisation.

The Workshop **welcomed** the provision of several documents that have been developed for the West Australian government to establish the conditions under which operations may occur (IWC/O11/ER14-18) as an important contribution to the development of the Workshop's principles and guidelines (see Item 5). The Australian documents are based upon the principles developed by the Provincetown Center for Coastal Studies. Participation in the authorised entanglement programme in Australia is strictly controlled. The Workshop **agreed** that safety and risk assessments must be conducted as part of all entanglement response efforts.

2.6. Examples of current training components and curricula for international capacity building

Before addressing another of the main objectives of the workshop, i.e. to develop a capacity building curricula and strategy (see Item 6), the Workshop was pleased to consider some example training curricula and manuals. Coughran noted that the Australian training exercises are developed around the competencies and completion of the training course results in having addressed all areas of competency.

Mattila reviewed the outline of a two-day training programme (IWC/O11/ER12) that was developed for capacity building trainings in countries with no pre-existing, formal entanglement response (e.g. Mexico and Argentina). He noted the importance of ensuring that the local organizers of the capacity building were either representatives from the responsible Government agencies, or had their approval, and that relevant authorities (*e.g.* Fisheries, Parks, Navy, etc.) were invited to attend. Day 1 was held in a classroom, covering all aspects of the entanglement issue, while Day 2 was conducted on the water using the specialised equipment in simulated disentanglements.

Throughout all trainings, human safety was stressed above all else, and it was noted that the two day training alone should not be considered sufficient to allow all trainees to conduct these potentially dangerous activities. Further discussion within the country and continued communications with experienced experts from other countries was encouraged.

A number of important general factors were made with respect to training, including:

(1) attending a 2-day programme alone is insufficient to allow a team to engage in a full response effort, because the actual training and assessment of a person can only happen during an entanglement response;

(2) obtaining hands-on experience with entangled whales in areas where entanglements are rare is difficult and thus means must be found (e.g. via internships, exchange programmes) to ensure that sufficient experience is gained;

(3) training should include at least some basic training on responding to stranded marine mammal carcasses and identifying entanglement scars

Coughran also gave a short demonstration of a prototype virtual simulation program that could potentially be used as a component of training as part of a multi-layered training course. The interactive program (developed for both Mac and PC) is intended to mimic many of the conditions and variables of real entanglement scenarios. Prior to entering this program, the responder is given the situational report from an aerial survey with the initial information received about the entangled animal. The user has to make many decisions including the approach to the animal and the tools used to assess the entanglement. Future programming will result in consequences following decisions made by the responder, including changing the behaviour of the animal (the unpredictability of whales being an important component of both safety and disentanglement success) and/or resulting [virtual] harm to the user.

The Workshop was enthusiastic about the potential uses of simulation programmes such as that being developed in Australia for aspects of training, as well as for exchanging information among experienced teams about particular events. Of course, simulation programmes cannot replace at sea training but they can be a valuable supplement. The Workshop **strongly encourages** further development of the Australian simulation programme as an evaluation and training tool. Workshop participants were willing to provide input into the types of parameters and scenarios to be incorporated. However, the Workshop also offered some words of caution with respect to the possibility of such programmes giving trainees a false sense of experience. Without appropriate caution, the programme may potentially encourage them to disentangle animals without appropriate levels of hands-on expertise; therefore trainers must emphasise that this is not the case. Even more importantly, there was concern that turning the programme into a publically available game to raise funds may encourage non-trained individuals to attempt disentanglement.

3. IMPROVEMENTS IN DOCUMENTATION OF ENTANGLEMENT RESPONSE EVENTS

The Maui workshop and other workshops, while recognising recent improvements, have stressed the value of improved documentation with the objectives of:

(1) learning lessons from entanglement response cases and thus, *inter alia* improve training, increase the safety and success rate of future efforts;

(2) understanding the scale and nature of specific entanglements, while at the same time gathering information that informs the scope and impact of the overall problem; and

(3) aiding in the development of mitigation and prevention measures (see Item 7).

The Workshop **agreed** that collecting additional data in the field can be a great burden upon entanglement response teams whose primary focus is on safely disentangling animals, often under stressful and pressured circumstances. This is particularly true for networks where human resources are limited. For these reasons, it is essential that any recommended data requirements are practical and focussed on specified objectives with the data and information being properly archived and analysed in a timely manner (see Item 8). It was also recognized that the greatest management and conservation benefit will be obtained if efforts are standardised across networks to the extent possible and that data are shared freely amongst networks while protecting the publication and other rights of data collectors (see Item 8).

3.1 Documentation of procedure/event

Moore provided an overview of case reports that are written for marine mammal stranding events that occur on the east coast of the United States. The case reports contain a variety of information relative to the stranding event including: stranding history, gross necropsy report, histology report, microbiology report and gear analysis. These case reports have been a valuable learning tool for wrapping up the stranding event and for completing a biological assessment. Participants discussed similar case reports that are compiled for entanglement response events. Landry reported

that his response programme has instituted a short narrative paragraph for each response event, composed during the first 24 hours following the response, to record observations that are not captured in photographs. Lyman noted that both the Hawaiian and Alaskan entanglement response networks have instituted a practice of developing operational de-briefing reports with the intent to improve safety and effectiveness. He provided a sample de-briefing document (IWC/011/ER22). In addition, Wilkin reported that a gear characterization report for the U.S. West coast has been developed in order to provide a better understanding of the fixed gear fisheries gear types that may pose the greatest entanglement risk.

The Workshop noted that reviews of historic entanglement documentation have shown that initial field assessments of the gear configuration is often inaccurate. The Workshop **emphasised** the need to thoroughly assess and document the animal during the response and also to revisit the initial field documentation after completion of later analyses.

The Workshop **agreed** entanglement case reports are important tools in understanding the medium and long-term consequences of removing all, some or none of the entangling gear. The Workshop **recommended** that full case reports be written for all whale entanglement response events. These case reports should be living documents that include the following components: overview of entanglement response, action plan(s) developed, operational debriefings, gear investigation report, and animal assessment (including case history information prior to and following the entanglement response, as available).

The Workshop **recognised** the importance of thorough photo-documentation and, to this end, the value of using several cameras, attached to various tools (e.g. poles) as well as to helmets and boats. The video (including sound) and stills generated by cameras help ensure that documentation is acquired even when the primary focus of the effort is releasing the whale in spite of time constraints or other logistical factors. In addition, Lyman presented a case where video review during the entanglement of a sei whale (*Balaenoptera borealis*) significantly changed the determination of the gear configuration, showing two lines from the flukes when only one line was observed by responders in the field. Finally, the Workshop **agreed** that such videos can prove valuable both in training and in sharing knowledge amongst experts and the general public.

3.2 Other information

There was some discussion of recent advancements in techniques for documentation of whale health, including photogrammetry, collection of breath vapour, biopsy sampling (for various tests and micro assays), blood sampling of free-swimming whales, and visual assessment of health indicators such as cyamid spread and skin colour. Uses (actual and potential) of such information ranged from hands-on use in decision-making with individual animal cases (e.g. estimation of drug dosages from photogrammetry measurements) to estimating what is happening at a population level over time (e.g. hormone measurement from biopsy samples).

The Workshop discussed the potential of using tags for long term monitoring to assess the risk to the whale and the likelihood of survival post-entanglement. The Workshop **agreed** that post-entanglement tagging should provide valuable data on survival that could be used to evaluate the impact of entanglement/disentanglement and aid in decision making for future entanglement responses. However, it is important to balance the various potential risks when deciding to tag a compromised animal. Several research projects are underway to assess the effects of tags on whale health. The Workshop **agreed** that brand new tag technology should ideally be used first on healthy individuals, and that, when tags are used on the entangled whales a priority should be given to those that are more likely to be re-sighted, so that potential effects on compromised animals can be better assessed. However, any decisions to use either towed or implanted tags, either for tracking an entangled whale or following a released one, will weigh the benefits of tracking versus the potential added impact to the whale. The value of examining scarring and scarring patterns was also stressed. Meyer noted that he has begun making an effort to photograph whale caudal peduncles and tail stocks at every opportunity, independent of reported entanglements. It is intended that the resulting photographic database will act as a baseline, allowing for assessment of inter-annual scar acquisitions and in the longer term, trends in entanglement rates (Robbins and Mattila 2004) to assess unobserved entanglements in his region.

Biopsy samples from entangled whales are being routinely collected in some regions (parts of the U.S., parts of Canada, South Africa and New Zealand). The primary reason for the sample collection was for identification (species, population and/or individual) and sex determination. Programmes that do not currently collect samples primarily do not do so due to lack of funding (for collection, sample storage, and/or sample analysis). Biopsy samples should be archived for future analyses, particularly health assessment, especially given new techniques that are being developed using small quantities of skin (epidermis) or blubber. The Workshop

recommended that samples be collected and archived to the extent possible for both current and possible future analyses, noting that a freezer is not always necessary for some analyses, but stressed that the appropriate storage technique depends on the nature of the analyses to be undertaken.

3.3 Conclusions

The Workshop noted that some aspects of entanglements are difficult to characterise comprehensively even if done retrospectively (as from images, video or samples). It was **agreed** that at-sea collection of basic data on whale health and apparent entanglement severity was important for evaluating the impact of entanglements and success of mitigation efforts, as well as predicting or evaluating survivorship. The Workshop **recommended** that a small group be convened by Robbins to develop a proposal for standardised data collection for entanglement response teams, taking into account the available resources of various operations and the need to prioritise accordingly; this sub group will also consider the question of databases (see Item 8). A preliminary, example data form was developed during the workshop to document key aspects of the entangling gear, wounds and behaviour of entangled whales (Annex D). It included basic health assessment fields that were identified at the 2010 Large Whale Entanglement Workshop (IWC/62/15, Appendix 4). The Workshop **agreed** that aspects of this form might be useful for other types of entanglement response evaluation such as assessments based solely on photographs.

4. COMMUNICATIONS AND OUTREACH

The Workshop participants were **extremely concerned** at the apparent growing number of very dangerous, amateur, attempted releases of entangled whales occurring around the world. These events are being broadcast widely on the internet and through social media, and this, in turn, appears to encourage more dangerous actions by uniformed, untrained individuals that may result in severe human injury or death. This serious concern underlies much of the following discussion under this item and Item 5.

4.1 Developing and maintaining the awareness of ocean users (professional mariners, non-cetacean researchers and the recreational community) on what to do when encountering an entangled whale

Workshop participants discussed and shared successful outreach products that displayed the entanglement response team contact phone numbers to solicit reports of sightings of entangled whales. These products included brochures (IWC/O11/ER4, IWC/O11/ER5 and IWC/O11/ER6), stickers, radio interviews and inclusion in industry documents such as codes of practice. Several products had uses in addition to the disentanglement number (field guide to whales, tide table) that encouraged retention by ocean users. A spirit of cooperation with the commercial fishing community is present in many areas with cross-agency responses, but participants also discussed increasing outreach to user groups outside of commercial fishers, including all ocean users.

Several participants noted the value of websites and a recommendation on this is made under Item 8. Lyman noted that he uses a website as an information and engagement tool for the public as well as for trained members of the response network, including updates from different geographic areas. In areas where entangled whales are infrequently encountered, Uhart recommended including information from marine mammal strandings to provide a more regular information flow to a website.

The Workshop **commended** a new video developed by the USA for outreach to the ocean user community, and requested that it be made available to the public on the web, as soon as possible. Its goals are to stress safe response practices, provide correct reporting guidelines, and to provide a documentation role for the ocean user to play. The Workshop suggested appropriate fora to share the video with the target audiences, including at trade shows, on dive boats, at museums, through newsletters aimed at different target audiences (print and electronic), social media (with appropriate tags so that the video is a result in web searches), whale watch naturalist trainings, and conferences/meetings of scientific researchers. Coughran noted that a DVD produced by Australia for the commercial fishery primarily to provide a code of practice (including safety requirements) at sea when encountering whales entangled in gear, is also used by the industry to fulfil workplace safety requirements.

4.2 Working with media

Workshop participants **agreed** that the best approach for working with the media was to be proactive. Many participants noted that ill-informed media coverage can have a negative effect on successful entanglement responses. To the extent possible, it is better to prepare materials before or during a response to be able to provide them to the media as quickly as possible during or immediately after the entanglement response efforts. In more remote areas, this may be facilitated by transferring text, images and video using the internet. This provides the best available information to the media directly from knowledgeable persons involved in the effort (assigning a contact person can be valuable), and also, to the extent possible, to focus the story in an

informed and accurate way. This approach also allows response networks to try to ensure that stories that could be perceived negatively actually portray a positive message regarding proper entanglement response. It is also an aid to fostering a good relationship with other stakeholders by giving them credit for their part of the response (e.g. prompt reporting of entangled animals by fishermen and others), thereby encouraging further co-operation. The value of being able to point to internationally agreed principles and guidelines was stressed (and see Item 8).

4.3 General public

It is important to provide good information to the general public, particularly in response to the question 'What can we do about entangled animals?' Messages to convey include: awareness that there is a response organisation; the importance of spreading awareness to others; the value of well-directed donations; a general awareness of the consequences of actions on the ocean environment. The best time for spreading a positive message is immediately following a successful response case, given the interest generated by the event. The role of social media in communication was also discussed, with an emphasis being given to making sure that the products (videos, press releases, etc.) developed by the response networks with correct messages have the correct key words so that they are found on searches. Again, the value of being able to point to internationally agreed principles and guidelines was stressed (and see Item 8).

5. RECOMMENDED PRINCIPLES AND GUIDELINES FOR ENTANGLEMENT RESPONSE

Following on from discussions under Item 2.5, the Workshop recognised the importance and value of developing an internationally accepted and publicly available (and see Item 8) set of principles and guidelines for entanglement response, such that human safety is paramount. These should encapsulate, based on the best information available, minimum standards that are universally applicable even for remote areas and limited resources, as well as those where resources are more plentiful. Each country can then use these principles and guidelines to develop more detailed protocols that take into account legal requirements and resources available. They are also an important component for the development of capacity building and training (see Item 6).

The principles and guidelines represent a living document, intended to be dynamic and evolving as new information and experience is gained and shared. The document is **not** an instruction manual but rather provides principles and guidelines to be used by trained, qualified disentanglement teams to increase operational safety, maximise the chances of disentanglement success and ensure that sufficient information is collected to allow lessons to be learned for future disentanglement efforts and to assist in the ultimate goal of prevention. The Workshop recognised that there are many entanglement scenarios and situations that warrant different response options and it was not feasible to capture all possible scenarios in one document. The Workshop **stresses** that however well-intentioned, attempts by untrained individuals to disentangle whales can pose a severe threat to human safety (including death) as well as to the whales themselves.

The principles and guidelines **adopted** by the Workshop (after reviewing an initial document developed by a sub-group) can be found in Annex E. The Workshop **strongly commended** these to the Commission (and see Item 8).

6. RECOMMENDED APPROACH TO CAPACITY BUILDING AND TRAINING

Following on from discussions under Item 2.6, the Workshop recognised the importance and value of developing an internationally accepted capacity building and training programmes that are in accord with the principles and guidelines for entanglement response (Annex E). Training should only occur with the approval of the relevant government authorities,

The details of training will vary from country to country and depend on a number of factors including the level of knowledge of the entanglement issue, whether the government involved has requested assistance, whether there are existing networks to build upon such as stranding networks, the extent of the coastline, the level of resources available etc. It is also important to recognise the primary objective(s) motivating any requests for training may include one or more of the following; public safety, animal welfare, population level conservation, public concern, retrieval of fishing gear, conflict with fisheries, conformity with national legislation or matters related to international trade (e.g. export of fish). That being said, the fundamentals of the training will remain the same and the Workshop has developed an outline for training programmes, within which the details will need to be tailored to the specific cases.

For countries in which there is no existing entanglement response network, there will need to be three levels of 'training' in the broadest sense. At each stage it is essential that appropriate local stakeholders are involved.

(A) Assembly of the available information on the entanglement issue *inter alia* to provide a rational to officials and managers for the need for an entanglement response network and to provide a context and idea of the scope of the problem. [This will be considerably easier for those cases where a government or governments have requested assistance].

(B) Development of the response structure with relevant local authorities and stakeholders in which disentanglement activities will occur, including improved documentation to assist with improving *inter alia* future prevention efforts (prevention is the best solution) as well as to enhance disentanglement efforts.

(C) Training by approved trainers of proposed members of disentanglement team or teams, taking fully into account the local situation.

The outline capacity building and training programme **adopted** by the Workshop (after reviewing an initial document developed by a sub-group) can be found in Annex F. The Workshop **strongly commended** this to the Commission (and see Item 8).

The outline covers a number of issues including: criteria for proposed trainees; the need for assessment of competence and accreditation; the need for leader apprenticeships; the need for refresher courses; equipment and resources.

7. PREVENTION

The Workshop **agreed** that the ultimate solution to the issue of large whale entanglements is prevention. However, the issue of prevention of entanglements (or at a minimum reducing the injury and mortality resulting from entanglements) was not the major topic of this Workshop and was only briefly reviewed. The need for a future Workshop devoted to this subject is discussed under Item 8.

7.1 Overview of present approaches

The Workshop briefly reviewed the various

methods used to promote entanglement prevention

including:

- working with fishermen to ensure fishing guidelines and regulations are followed;
- take reduction planning with stakeholders to decrease the marine mammal injury or mortality from commercial fishing practices;
- methods for diverting or deterring whales away from gear;
- gear modifications to reduce the number or severity of entanglements;
- seasonal fishing changes and/or closures (effort reduction); and
- gear characterisation and identification guides to better understand local fishing practices.

There was a short discussion among Workshop participants regarding which prevention techniques could be promoted, due to the lack of quantified information on the effectiveness of gear modifications promoted to date. The essential requirement for adequate monitoring was stressed (both compliance monitoring to see that proposed methods are being used and effectiveness monitoring to determine the success or otherwise of prevention/reduction methods and to determine if there are non-anticipated negative side effects for the ecosystem).

7.2 Information requirements

Numerous workshops have recommended that developing methods of gear identification is vital to determining when, where and how entanglements occur. As noted under Item 3, information obtained from entanglement response teams is a major input to understanding the source of entanglements, their effects and as such is also vital to developing preventative measures.

7.3 Research priorities

The United States Large Whale Take Reduction Team has developed research matrices in collaboration with fishers that identifies research priorities for reducing large whale mortalities[4]. Several of these priority projects have been funded. The Workshop **recommended** identifying, should they exist, areas where populations of whales overlap with fishing gear, but where there are minimal to no entanglements reported despite reasonable effort, and attempt to determine why the interactions are not occurring. The Workshop recognised the importance of analysing all available data sources at both the local, national and international level to further work on entanglement prevention.

8. AN INTERNATIONAL LARGE WHALE ENTANGLEMENT RESPONSE ASSOC-IATION AND THE ROLE OF THE IWC

The Workshop recognised the great benefits to entanglement response efforts of continued international collaboration and the establishment of a global network of recognised entanglement response operations. Given the global nature of the IWC, its work on many fields related to conservation and management, and in particular its developmental and supporting role for the recent

[4] http://www.nero.noaa.gov/whaletrp/plan/gear/index.html#gear

two workshops, there is great potential value in these international efforts being undertaken under the general auspices of the IWC. It noted that this will not preclude and can strengthen the great contribution that is being and can continue to be made outside as well as within IWC member nations (e.g. the major contributions from Canada at this workshop). It **requested** that the Commission endorses the global network of entanglement response operations (listed in Annex G), the Guidelines and Principles for Disentanglement Response (given in Annex E) and the Recommended Approach to Capacity Building and Training (given in Annex F) and consider the following approach.

(1) The establishment of a dynamic entanglement response component of the IWC website with a layered capacity.

- A general public section which *inter alia* includes an introduction to the bycatch issue (including the need for prevention), general information on what to do (and not to do) if an entangled whale is seen (including a link to the USA video discussed under Item 4), highlights the agreed principles and guidelines for entanglement response (Annex E) along with information (links, contact details) to accredited entanglement response networks around the world. This will also provide an opportunity for entanglement response team members and networks to refer the media and the public to internationally-recognised and agreed guidelines and principles when explaining their work and the difficulties it entails.
- A public but more scientific area that provides quantitative information on the large whale bycatch issue (particularly with respect to numbers, species, geographical and temporal distribution) obtained from *inter alia* the national progress reports and papers (published and working papers submitted to the IWC Scientific Committee – the IWC is already working on an online database for such information (see below).
- A secure section for accredited members of the global network of entanglement response teams that *inter alia* allows exchange of ideas and data, including provision of information and requests for and inclusion of comments on particular entanglement situations, potential new gear and approaches, safety considerations, training techniques etc, with the facility to share videos and photographs as well as reports, and allow comments to be made.

With respect to the website, the Workshop **nominated** a small group (Coughran, Landry, Lyman, Rowles, Smith and Wilkin) to work with the IWC Secretariat on the development of both the public and private segments of the website.

(2) **Review 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 entanglement prevention. The Workshop **nominated** a small group (Gales, Moore, Lyman, Robbins and Smith) to work with the IWC Secretariat to: (1) review existing methods of collecting and storing data; and (2) consider options for a possible standard relational database (objectives, fields, methods of populating etc), a metadatabase linked to existing databases or some combination of the two, in the light of the data collection discussions that have taken place at this workshop and within the Scientific Committee of the IWC.

(3) **Facilitate the exchange of information** using the model of the IWC Scientific Committee's Data Availability Agreement as well as the possibility of periodic workshops of the global network.

(4) **Promote the development of entanglement response networks** in regions where none currently exist, in the light of conservation priorities developed in conjunction with *inter alia* the IWC Scientific Committee, following the approach agreed for capacity building and training outlined in Annex F.

(5) **Provide advice** to Governments and others on entanglement response issues through the global network.

(6) Recognising that the only long-term solution to entanglement is prevention, develop a full proposal for a **future international workshop on prevention of large whale entanglements** after reviewing recent developments and experiences around the world. This will include objectives, documents and data requirements, potential participants, timeframe, costs and venue. Mattila agreed to take the lead with this effort.

(7) Continue to promote an **IWC managed fund** for issues related to entanglement response and bycatch mitigation and prevention. Applications for monies from the fund will follow expert review and recommendations in the usual IWC manner.

9. ADOPTION OF REPORT

Bjørge thanked the rapporteurs for their hard work. Mattila thanked Bjørge for chairing, PCCS for hosting the meeting, and NOAA and IWC for providing funding. The IWC thanked all of the participants for their hard work, particularly in achieving the primary objectives of developing international principles and guidelines for entanglement response and a capacity building and training strategy.

The outline report was adopted at 2:35 PM on 26 October 2011.The final report was agreed by correspondence on 31 December 2011. The edited version was circulated on 25 January 2012.

Annex A

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Annex B

Agenda

1. Introductory items
    1.1 Welcoming remarks
    1.2 Objectives of the workshop
    1.3. Election of Chair and rapporteur(s)
    1.4 Adoption of agenda
    1.5 Material available
2. New information since 2010 workshop
    2.1 Overview of new participating national networks
        2.1.1 New Zealand
        2.1.1 Canada (British Columbia)
        2.1.3 Argentina
    2.2 Reports from relevant workshops in 2010-2011
        2.2.1 The role of large whale behaviour, sensory abilities and morphology in entanglements
        2.2.2 Cetacean Entanglement Mitigation Innovation Workshop
        2.2.3 Dynamics of Large Whale Entanglements in Fishing Gear
        2.2.4 Euthanasia methods for stranded cetaceans
    2.3 New or unusual relevant cases since Maui
        2.3.1 North Atlantic right whale
        2.3.2 Eastern gray whale
    2.4 New tools or techniques
    2.4.1 Tools
    2.4.2 Techniques
    2.5 Safety protocols and risk assessment guidelines
    2.6. Examples of current training components and curricula for international capacity building
3. Improvements in documentation of entanglement response events
    3.1 Documentation of procedure/event
    3.2 Other information
    3.3 Conclusions
4. Communications and outreach
    4.1 Developing and maintaining the awareness of ocean users (professional mariners, non-cetacean researchers and the recreational community) on what to do when encountering an entangled whale
    4.2 Working with media
    4.3 General public
5. Recommended principles and guidelines for entanglement response
6. Recommended approach to capacity building and training
7. Prevention
    7.1 Overview of present approaches
    7.2 Information requirements
    7.3 Research priorities
8. Consideration of an international disentanglement association and the role of the IWC
9. Adoption of report

Annex C
List of Documents

IWC/O11/ER1	Benjamins, S., Ledwell, W., Huntington, J. and A. R. Davidson. 2011. Assessing changes in numbers and distribution of large whale entanglements in Newfoundland and Labrador, Canada. *Mar. Mam. Sci.*, 00(00): 1–23
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IWC/O11/ER7	Lyman, E. G. Hawaii Network Safety outline. 2011. Available from author.
IWC/O11/ER8	Down Home Life. 2011. "Whale rescue needs rescuing". www.downhomelife.com
IWC/O11/ ER 9	Report of the Cetacean Entanglement Mitigation Innovations Workshop. 2010. Edited by Vaslow, P.
IWC/O11/ER10	Report of the workshop on the Dynamics of Large Whale Entanglements in Fishing Gear. 2011. Edited by Werner, T.
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IWC/O11/ ER 14	Gov. of W. Australia, CALM 2011. Competency Matrix.
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IWC/O11/ ER 16	Gov. of W. Australia, CALM. 2011. Job Safety Analysis. v1.0
IWC/O11/ ER 17	Gov. of W. Australia, CALM. 2004. Delivery and assessment strategy. v1.0
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1WC/O11/ER19	Australia, Norway and United States. 2010. Entanglement response decision tree, from: the Report of the Workshop on Welfare Issues Associated with the Entanglement of Large Whales.
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IWC/O11/ ER21	Me er M.A., P.B. Best, M.D. Anderson-Reade, G. Cliff, S.F.J. Dudley and S.P. Kirkman. 2011. Trends and interventions in large whale entanglement along the South African coast. *African Journal of Marine Science* 33(3).

Annex D

Example entanglement response data form

ENTANGLEMENT RESPONSE DATA FORM

Date: __________ **Event#:** ________ **Species:** _________________ **Individual ID:** _____________ **Arrival at scene:** ____ **Departure from scene:** ____
DD/MM/YY

Team details	**Role**					
	Initials					

Event timeline	**Event**	**Time**	**Latitude**	**Longitude**
	Whale located			
	Whale engaged			
	Whale released/lost			

Gear and wound details	**Mouth**	**Head**	**Body**	**Left Flipper**	**Right Flipper**	**Peduncle**	**Tail**
Gear wrapping (Yes, No, Unk)							
Rope color/size							
Gear constricting (Yes, No, Unk)							
Tissue penetration (Epidermis-only, Blubber, Muscle, Bone, Other, Unknown. For flippers and tail, also indicate percentage penetration)				____%	____%		___%
Wound profile (Flat, Depressed, Raised, Unknown)							
Wound color (1=white/yellow, (2=pink/red, 3=green/blue/black, 4=unk)							

INSERT WHALE BODY DIAGRAM

Draw entanglement configuration, wound sites and disentanglement cuts

Gear trailing: _____ ft or m **Trailing profile**: floating / sinking **Visible components:** _______________

Gear type/parts (if known):_______________________________ **Anchored?** yes / no / unk

Gear type in area: _____________ **Whale movement**: stationary / circling / travel **Whale posture**: normal / hunched / head raised / tail raised / other

Estimated whale length: ______ ft or m **Class:** calf / juvenile / mature **Role (if applicable):** none / mother / other _________________

Body condition: normal / thin / emaciated **Odor detected?** breath / wound / gear Description: ____

Skin condition (for species)**:** normal / pale / sloughing / pitted **Cyamid proliferation**: normal / at wounds / at blowholes / widespread

Other condition details (note species-specific indicators): ____

Whale activity time line	**None**	**Low**	**Average**	**High**	**Evasive**	**Aggressive**
Pre-approach						
At first approach						
During disentanglement						
At release						
Post release						

Bio samples obtained: none / biopsy / sloughed skin / skin from gear / scat / other

Other data collected: photos / video / ventilation rates / detailed ethology / veterinary procedures /

Annex E

Principles and guidelines for large whale entanglement response efforts

DEDICATION
This document is dedicated to the memory of Tom Smith from Kaikoura, New Zealand. A kind and generous man, Tom was a fisherman and conservationist who tragically died during an attempt to disentangle a humpback whale while he was in the water. Particularly as a result of this and other human injuries recorded worldwide, an important motivation for these guidelines and principles is to try to prevent similar tragedies and to honour his family.

DISCLAIMER
While these principles and guidelines have been developed to try to maximise safe and successful operations, disentanglement operations are complex and can be unpredictable; following these guidelines does not necessarily guarantee personal safety, an animal's successful release, or operation in accordance with national rules and regulations (permits and/or letters of authorisation). All responsibility is upon the operator to undertake safe activities under their best judgment. The IWC and the authors of this document are not liable for any actions taken as a result of these guidelines and principles.

This is a living document, intended to be dynamic and evolving as new information and experience is gained. It is **not** an instruction manual.

OBJECTIVE
Based on the most recent information, the objective of this document is to provide principles and guidelines for trained persons to safely and effectively respond to reports of entangled live whales at sea. The objective of an entanglement response is to remove all detrimental entangling gear safely from the whale and learn as much from the entanglement as possible to ultimately prevent entanglements from occurring. Actions by well-meaning untrained persons can worsen an entanglement, through a lack of subject knowledge and experience. For example, removing easily accessible trailing gear from entangled whales may leave the most critical components on a whale, making future, organised disentanglements more difficult or even impossible, potentially resulting in severe harm or death to the animal.

Regional entanglement response scenarios and complexities may require different techniques and strategies (see Annex F on capacity building and training).

GOALS OF ENTANGLEMENT RESPONSE
(a) Human safety

(b) Animal welfare

(c) Contribution to the conservation of large whale populations, recognising that prevention is the ultimate goal

(d) Data collection to assist with identifying key fisheries and whale populations and thus better specification of actual entanglement problems within a region to assist with mitigation and prevention.

(e) Awareness of issues at all levels to improve reporting and appropriate measures to address issues (a)-(d)

(1) GENERAL SAFETY

(a) **At no time should an individual enter the water**. It is not necessary given the proper disentanglement training, tools and techniques. Over a thousand successful disentanglements have occurred with a boat-based technique without significant human injury, whereas human life has been lost during dive-based disentanglement attempts.

(b) Do not put the whale's rescue above human safety at any time

(c) Only trained and authorised operators should participate in disentanglement activities.

(d) Actions must be thoroughly thought through and planned, with full briefing to all **participants** and **team members**. All **participants** need to be clear on aims, objectives, operational procedure and roles.

(e) Do not secure a line from the whale to the vessel.

(f) In addition to focussing on the disentanglement itself, pay careful attention to the overall environment.

(g) Actions must not be pressured by weather, time of day, onlookers, media, or the perceived need to act.

(h) When in doubt about safety or the success of the operation, stand down, if possible attach a satellite telemetry device for tracking and/or try again on another day with better support, conditions, and/or resources.

2. PERSONNEL

(a) Human safety is the number one priority.

(b) Appropriately, trained, experienced and authorised personnel should be used for the roles required and actions/efforts must be based on the qualifications of personnel on hand.

(c) Roles must be assigned to team members based on their experience, training, and overall qualifications.

(d) Personnel should be monitored (e.g. for fatigue, dehydration, emotional state) at all times to maintain safety.

(e) Team members must be encouraged to speak up if they are not comfortable with a particular action or the general situation. Leaders must respect any concerns raised and not instruct personnel to take a role or action that they are not comfortable with.

3. PERSONNEL EQUIPMENT

(a) Personnel working near or with entangling gear must carry emergency safety knives on their persons at all times.

(b) Gloves must be used when handling lines or netting under load (i.e. attached to whale).

(c) Helmets must be worn by personnel operating near the whale and/or using poles.

(d) Appropriate attire and personal floatation/protection must be worn at all times. Examples include PFDs, wetsuits, drysuits, worksuits that are snag-free (without straps, D-rings, and clips that can act as snag points for lines/ gear).

(e) Proper communication tools must be available (e.g. waterproof VHF handheld, cellular phones).

(f) Carry sufficient water and food.

4. PLATFORMS

Response efforts are generally conducted from two vessels, a primary response vessel and a support/safety vessel.

Primary response vessel (PRV)

(a) This vessel is the main operational platform to assess, perform the entanglement removal and monitor the situation. It is essential that only disentanglement staff and essential equipment be carried.

(b) It should be maintained by a helmsman, a specialist crew member at the bow and a third specialist crew person to ensure trailing lines are clear of the engine leg and to assist the crew at the bow.

(c) Its deck must be kept clear and free of loose objects and any other materials or equipment which may potentially interfere with the safe deployment of running lines during the operation.

Support/Safety Vessel:

A support vessel is needed to carry necessary personnel, equipment and to maintain adequate redundancy in communication systems (i.e. 'two is one, and one is none'). This includes human first aid and resuscitation equipment and qualified staff to deal with possible emergencies.

5. ASSESSMENT

The following factors are used to determine whether an animal is a response candidate through methodology outlined in IWC/62/15.

Animal and Entanglement Conditions

(a) Size

(b) Species

(c) Temperament

(d) Behaviour

(e) Health condition (Appendix IV, IWC/62/15): body profile, cyamid coverage, general skin condition and colouration.

(f) Nature of injuries

(g) Company of other cohorts (pod members, calves) and the presence of sharks or other predators

(h) Mobility (anchored, small circles, big circles, free-swimming)

(i) Type and nature of gear (rope, line, pot, netting, chain, etc).

(j) Body part(s) affected and not affected

(k) Configuration and condition of gear

Environmental conditions

(a) Weather conditions and forecast

(b) Sea state

(c) Navigational constraints (e.g. rocks, ice, depth)

(d) Time of day (e.g. remaining daylight)

(e) Remoteness of location

(f) Availability of resources

Other conditions

(a) Visibility of event

(b) Media or public presence

(c) Surrounding vessel traffic

(d) Military operations

(e) High recreational use areas

6. SAFETY CONCERNS ON APPROACHING AN ENTANGLED WHALE

(a) Time spent in the danger zone (area immediately in front of and beside animal that is in range of tail flukes and/or flippers) must be avoided or at least minimised.

(b) A swimming entangled whale must never be approached in its wake, as unseen trailing gear may foul the approaching vessel's engines.

(c) Only the minimum required equipment and personnel should be present on the PRV (store non-immediate gear on support vessel). The approach boat must be kept 'clean' in order to minimise the risk of lines getting caught on the boat or gear stowed on boat.

(d) Sudden boat manoeuvres (e.g. gear shifting or sudden velocity changes) must be avoided as these have a higher probability of startling the whale.

(e) Approaches should be methodical and consistent. Animals may avoid and respond unpredictably to any perceived threat. It should be assumed that an animal does not know the responders are there to help.

7. ENTANGLEMENT RESPONSE PROCEDURES

Disentanglement procedures generally involve some control of the animal, cutting away gear using specialised tools, and documentation and follow-up of the event. The details of disentangling a whale involve a specialised discipline that is dangerous for both the responder and the entangled whale; as noted in the introduction this is **not** an instruction manual; specific disentanglement procedures should be addressed through a thorough and strict training programme (see Annex F).

8. DOCUMENTATION AND DE-BRIEFING

Documentation gathered during disentanglements offers one of the best and only opportunities to understand the scope and extent of regional entanglement issues.

Documentation may include:

(a) Photographs of operations and of the animal before, during, and after a response

(b) Video from point-of-view cameras mounted to safety helmets

(c) Collection and documentation of gear removed

(d) Biological sampling (biopsy, skin in gear)

(e) Field observations (operational log, behavioural log, etc)

This information should be assembled into a full disentanglement case study and shared with regional and international entanglement response networks.

Every attempt should be made to build documentation/data gathering into operational procedures. Data should identify species, individual, level of injuries, disentanglement activities and state of the animal and its entanglement at the end of an operation.

Effort should be made to monitor post-disentanglement behaviour and survival through the use of telemetry, genetics and or photo identification of individual animals.

Follow-up of an entanglement response is an opportunity to discuss the level of preparedness, the equipment, the process, and identify any changes to procedure or equipment that could be made to improve future disentanglement attempts.

NB: As discussed under Items 3 and 8 of this report, there is work underway on consideration of standardising to the extent practical data that are collected, methods of storing these and facilitation of sharing data.

Annex F

Recommended approach to capacity building and training

INTRODUCTION

The details of training will vary from country to country and depend on a number of factors including the level of knowledge of the entanglement issue, the level of government involvement, whether there are existing networks to build upon such as stranding networks, the extent of the coastline, the level of resources available etc. It is also important to recognise the primary objective(s) motivating the instigators that may include one or more of public safety, animal welfare, population level conservation, public concern, retrieval of fishing gear, conflict with fisheries, and conformity with national legislation or matters related to international trade (e.g. export of fish). That being said, the fundamentals of the training will remain the same and this document presents an outline of for training programmes, within which the details will need to be tailored to the specific cases.

For countries for which there is no existing entanglement response network, there will need to be three levels of 'training' in the broadest sense. At each stage it is essential that appropriate local stakeholders are involved.

(A) Assembly of the available information on the entanglement issue *inter alia* to provide a rational for the need for an entanglement response network and to provide a context and idea of the scope of the problem. [This will be considerable easier for those cases where a government or governments have requested assistance].

(B) Development of the structure with in which disentanglement activities will occur, including improved documentation to assist with improving *inter alia* future prevention efforts (prevention is the best solution) as well as well as to enhance disentanglement efforts.

(C) Training of a disentanglement team or teams.

(A) RATIONALE FOR NEED FOR ENTANGLEMENT RESPONSE

This primarily involves working with governments and managers. As noted above where this is driven by a request from a government or governments, this may be a relatively straightforward step; if it is driven by a conservation-related need (perhaps suggested by the IWC Scientific Committee) then it is essential that the evidence and potential solutions are provided to the relevant government in a concise and balanced manner; it is essential that governments are part of the process. One approach would be to hold a short seminar with the appropriate government officials. Where IWC member nations are involved, this could be organised in conjunction with the relevant Commissioner.

Information provided should include what is known about the local situation with regard to entanglement and examples of how such issues have been dealt with elsewhere in the world.

(B) DEVELOPMENT OF THE STRUCTURE WITHIN WHICH DISENTANGLEMENT ACTIVITIES OCCUR

Disentanglement activities cannot exist in isolation. Entanglement response requires a structure that covers all aspects from outreach and reporting to responding, verification of reports and decisions on the appropriate response including disentanglement, follow-up and documentation. Developing this requires involvement of managers, biologists (and stranding networks where these exist), fishermen and other marine users, including the coast guard and the navy, with assistance from international experts. It is important to stress the pre-eminence of human safety issues, the need to focus on achievable objectives and the need to work towards prevention. This phase will almost certainly entail at least one meeting.

This stage requires knowledge of the local entanglement situation (including species, likelihood of events, gear that might be involved, potential 'hot spots', resources that may be made available, the existing legal framework) and an overview of how experiences and structures elsewhere (including the Incident Control System approach) can assist in designing a workable and efficient local structure and all aspects of communication including dealing with the media. It is important to recognise that the entanglement issues may involve more than one country given the migratory behaviour of large whales.

(C) TRAINING DISENTANGLEMENT TEAMS

Trainers should be chosen from the accredited global network of entanglement response operations, by its members, using criteria they develop including, but not limited to: thorough knowledge of all aspects of the curricula, experience training in existing networks, experience disentangling the species involved, communication skills, availability.....etc.

Trainees should be identified within the local structures developed under (B) above. There are a number of roles to be fulfilled within a disentanglement team ranging from boat handling in the presence of whales, data

recording and direct disentanglement efforts. Criteria to be considered include previous experience with whales, with small boats, with fishing gear, gear under tension, availability and likelihood of remaining with the programme for a number of years, level headedness and communication skills.

There are a number of examples of existing training programmes (e.g. from the USA and Australia) and these were reviewed and the main components are listed below. Details will of course need to be tailored to particular situations, with relevant examples provided from elsewhere and will follow the agreed Principles and Guidelines for Entanglement Response Efforts (Annex E).

Much of the background information (e.g. legal context, what is known about local entanglement issues, basic biology of local populations) is best presented by local experts. Parts 1 and 2 (of the example outline for a training course given below) could usefully be attended by others than the trainees (e.g. managers, fishermen and other stakeholders). In addition to the training itself, the trainer, in collaboration with the trainees and managers, should aim at identifying potential leaders to undertake apprenticeships with established disentangling teams (see below).

Example outline of a training course

Part 1 – Background information with emphasis on local situation and relevant examples from elsewhere

1. International (IWC) perspective

2. Safety issues – stressing that this is the over-riding concern

3. Legal issues

4. Background and biology

    4.1. Local knowledge on entanglement events (and trends) in country - occurrence, geographical and temporal distribution, gear type/species

    4.2. Brief summary of biology of the large whales of the region that have been or may be involved in entanglements (particularly temporal and geographical distribution, status and behaviour related to entanglement and entanglement response

    4.3 Where, when and how do whales become entangled?

    4.4 The importance of prevention

Part 2 – Overview of the emergency response (this should be based on agreements and approaches that will already have been developed under component (B) above. i.e. the structure within which disentanglement activities occur

5. Components of response (general overview of what it takes to respond and the components of response). The agreed decision tree (IWC/62/15, Figure one) will be used to go through the next items.

    5.1. Outreach and reporting

    5.2. First response

        5.2.1. Verification and assessment

        5.2.2. Tracking the animal

    5.3. Action

        5.3.1. Tag

        5.3.2. Disentangle or monitor

    5.4. Document and follow up

        5.4.1. Fate of the animal

        5.4.2. Tracing the gear

    5.5. The Incident Control System (ICS) approach

6. The Network [This will be tailored to the agreed local network, thus some items may be redundant]

    6.1. Hot spots

6.1.1. How far apart?

6.1.2. Resources available (e.g. stranding teams, biologists, fishermen, whalewatching operators, military)

6.2. Rapid response team or local personnel approach

6.3. Training and experience

6.3.1. Criteria for selecting candidates

6.3.2. Simulated training vs. actual experience

6.3.2.1. Apprenticeships

6.4. Communications

6.5. Role of the Navy or Coast Guard

Part 3- The disentanglement training itself

7. Disentanglement Procedures

7.1. Common misconceptions

7.2. Assessing the situation (decision tree, including euthanasia)

7.2.1. Condition of the animal

7.2.2. Assessment of gear and entanglement

7.2.3. What action is warranted given conditions (e.g. weather, time of day, resources at hand)?

7.3. Telemetry buoys (brief informational summary)

7.4. Freeing an anchored whale

7.5. Controlling a free-swimming whale

7.5.1. Attaching to the whale and assessing strength of gear and whale

7.5.2. Attaching buoys and sea anchors

7.6. Cutting the whale free

7.7. Some examples (case histories), examine mistakes made

7.8. Unsuccessful operation (discussion of euthanasia)

7.9. New and experimental techniques (i.e. sedation)

8. Documentation and follow-up

8.1 Debrief including mistakes

8.2 Close-up reports (provide examples)

8.3. Status of the whale (health and survival, limpet tags, etc.)

8.4. Origin of the gear

9. Safety

9.1. Safety gear (e.g. helmets, life vests, knives….etc.)

9.2. Support vessel and communications

9.3. Safe procedures

10. Dealing with the media

11. Examination and familiarisation with special gear (on land)

Items 1-11 will normally complete one day's training.

The second day (at least one day but ideally more) will comprise on water familiarisation with equipment and techniques training including such activities as one boat acting as whale towing rope and gear while the second

boat acts as a rescue boat, identified individuals practice attaching, controlling and cutting using specialised tools.

'Leader' apprenticeships, accreditation and levels of competence (including refresher courses and evaluations)

Clearly a 2-3 day course will not be sufficient to allow a new team to begin unsupervised disentanglement work. It is essential that part of the overall process is the identification of one or more individuals who have a medium-long-term expectation to be involved in the local effort as leaders. These should then visit established teams to gain experience of real disentanglement efforts. Both in the US and in Australia there are good examples of ways to evaluate the levels of experience (if appropriate, links to these can be included) and these will need to be developed within the local legal and administrative system and with advice from the global network of entanglement response operations via the IWC. It is important that provision is also made for refresher courses and evaluations.

Use of simulation programmes

The group was enthusiastic about the potential of the use of simulation programmes such as that being developed in Australia for aspects of training, as well as for exchanging information among teams about particular events. Of course, simulation programmes cannot replace at sea training but they can be a valuable supplement. It strongly encourages further development of the Australian programme and is happy to provide input into the types of parameters and scenarios to be incorporated.

Equipment

It is essential that trained teams are provided with the necessary equipment. Some of the equipment is standard and 'merely' requires appropriate funding. Other equipment is effectively custom-made and ways to ensure that this is made available or made locally must be developed.