Annex J

Report of the Working Group on Bycatch and Other Human Induced Mortality

Participants: Leaper (Convener), An, Baker, Baulch, Best, Bjørge, Campbell, Di Guardo, Feindt-Herr, Fortuna, Funahashi, Gallego, Galletti, Iñíguez, Kock, Leslie, Marcondes, Mattila, Nuñez, Palka, Panigada, Podestá, Ridoux, Ritter, Rosa, Simmonds, Sironi, Stachowitsch, Víkingsson, Williams.

1. CONVENOR'S OPENING REMARKS AND TERMS OF REFERENCE

Leaper welcomed the participants. The Terms of Reference for the Working Group continue to relate to issues of estimating human-induced mortality of great whales other than directed takes.

2. ELECTION OF CHAIR

Leaper was elected as Chair.

3. ADOPTION OF AGENDA

The adopted Agenda is given as Appendix 1.

4. APPOINTMENT OF RAPPORTEURS

Mattila agreed to act as rapporteur.

5. AVAILABLE DOCUMENTS

The following documents were relevant to the Working Group: SC/64/BC1; IWC/64/WKM&AWI1; North Atlantic Right Whale Consortium (2011); Meyer *et al.* (2012); Gende *et al.* (2011); Harris *et al.* (2012); Benjamins *et al.* (2012); Wiley *et al.* (2011); Bull and Smith (2012) and Peltier *et al.* (2012).

Due to some delays with changing to electronic submission of National Progress Reports these reports were not reviewed this year.

6. PROGRESS ON JOINING THE FISHERIES RESOURCE MONITORING SYSTEM (FIRMS)

The IWC is currently an observer to the FIRMS partnership (Fisheries Resources Management System), a collaborative partnership organised by the FAO, which enables fishery management bodies to share information. It had been hoped that FIRMS may hold data on fishing effort that could be useful in estimating bycatch. Full partnership has previously been considered but it had been agreed to wait for a database of IWC bycatch data to be developed. Simon Northridge reported by email that all the bycatch records reported to the IWC between 1967 and 2011 have now been entered by SMRU, St. Andrews, UK, but FIRMS appears to have changed its focus somewhat since initial discussions with the IWC and is now more focused on producing fact sheets about fishery issues.

The Working Group **recommended** that the Secretariat contact FIRMS to establish whether the partnership was still attempting to collate data on fishing effort in such a way that could be of use to the Committee in estimating bycatch.

7. ESTIMATION OF RISKS AND RATES OF ENTANGLEMENT

Whale disentanglement data for the South African coastline up to and including 2009 are described in Meyer *et al* (2012). There were two centres of recorded entanglements, one off the coast of KwaZulu-Natal (KZN) involving nets set parallel to the shore to protect bathers from sharks, and the second off the coast of the Western Cape involving traps and attached lines set for rock lobster: the first primarily involved entanglement of humpback whales and the second southern right whales. Off KZN the data were of two types, actual whales found entangled (maximum of six per year) and holes torn in nets (maximum 40-50 a year) that represented presumed whale entanglements: the latter were only recorded systematically since 2000. After allowing for the combined length of the net installations (as an offset variable in a GLM analysis), the trend in humpback whale entanglement since 1990 was estimated at 15.1% pa (95% CI 9.5, 21.6%), and the rate of suspected whale encounters from 2000 as 10.3% pa (95% CI 4.1, 16.4%). Both were compatible with the rate of population increase of humpback whales recorded further north on the KZN coast between 1988 and 2002 (9-11%). Recorded whale entanglements off the Western Cape apparently increased from 1990, with a peak at 14 individuals including eight right whales in 2008. Using annual estimates of the number of calving right whale females as an offset variable in a GLM analysis, the rate of increase of southern right whale entanglement (3.5% pa) was not significantly different from zero. Interventions were successful in removing gear from 81% of whales entangled in shark nets off KZN (38 humpback, 17 right whales), while 11 humpback and two right whales were found dead. Off the Western Cape, whales were successfully disentangled in 23% of cases (n=90) and partially disentangled in another 12%. While 5% managed to free themselves unaided, another six were dead on discovery. Differences in success rate could be attributed at least partially to the different natures of entanglement, with whales normally being immobilised in shark nets but often free-swimming after having broken out of or being cut free from rock lobster gear.

Recognising that observed entanglement reports represent a minimum, other methods for estimating entanglement rates for this area were discussed. However the aerial methodology of the annual right whale surveys off the Western Cape, and the corresponding height of photographs obtained, make identification of characteristic entanglement scars difficult. In addition, mature females with calves are the primary focus of the surveys, making it a potentially biased subset of the population for this type of analysis. It was noted however, that most of the mature females that have been confirmed with entanglement scars appear to have acquired them prior to their addition to the photo-id catalogue, suggesting that many entanglements occur as juveniles (i.e. before they are entered into the catalogue). It was suggested that juveniles may be more likely to engage in 'play' behaviour which often involves the local kelp, but has also been observed to occur with rope, which may be one mechanism for entanglement in this population.

In response to a specific question about ship strikes and entanglement, Best noted that, to his knowledge, there had not been incidences of a whale being both entangled and struck in this region.

Entanglement data collected by the Whale Release and Strandings Program off the coasts of Newfoundland and Labrador, Canada from 1979 to 2008 are described in Benjamins *et al.* (2012). These include information on the species, location, gear type and entanglement outcome for 1,209 large whale entanglements, consisting of primarily humpback whales (80%) and minke whales (15%). With intervention, average mortalities for all years were reported to be 16% for humpback whales and 60% for minkes. However, the authors noted that this represents a minimum, as the fate of many 'released' animals was not known, and that a certain percentage of those would subsequently die, especially those for which not all gear was removed. The highest mortality rates for both species were found in cod traps and gillnets. However, entanglements also occurred, and could be lethal, in virtually all passive fishing gear, whether anchored or drifting.

Some of these data were reported previously (IWC, 2012), however this paper presents a more complete analysis of gear types and trends over time. In particular, given dramatic changes in fishing effort with the collapse of the cod fishery the authors divided the analyses of the data into two time periods, 1979-92 and 1993-2008. During the period 1979-92, the network received an average of 64.3 entangled whale reports per year dropping to an average of 19.2 reports per year for the period 1993-2008, following the moratorium on cod fisheries in 1992. While detailed fishing effort data is lacking, this region of Canada saw a major reduction of inshore cod traps and gillnets which had been used in the cod fishery and which had represented the primary source of entanglement for both humpback and minke whales. With the phase out of this type of gear in 1992, crab pots began to represent a higher percentage of the gear type implicated in entanglements. The authors note that much of the fishing effort changed from cod and salmon, to crabs and monkfish. This change in target species not only corresponded with a change in fishing gear type but also the fishing effort became more widely distributed, especially moving further offshore. Despite the dramatic decrease in (reported) entanglements after 1992, the authors recognise that most of the reports they receive are biased toward inshore waters, as that is the practical limit of their response capabilities, and that the number of actual entanglements offshore are likely to be much higher than reported.

The Working Group noted the value of the extensive data sets described in Meyer *et al*. (2012) and Benjamins *et al.* (2012) and that these contributed to an understanding of the impacts, rates and trends over time in entanglement mortality. Both studies had been able to identify trends over time and relate these to other factors. In particular, Benjamins *et al.* (2012) had demonstrated the substantial reduction in entanglements related to the reduction of high risk fishing gear in a particular region (i.e. inshore). It was also noted that the authors classified some of the fishing gear removed from whales as 'discarded'. There is a need to better understand what proportion of large whale entanglement can be attributed to actively fished compared to lost or discarded gear, but differentiating between these is difficult. It was noted that threats from marine debris, including fishing gear no longer being actively fished, were being discussed within the SWG on Environmental Issues (see Annex K).

Iñiguez presented SC/64/BC1 on behalf of the authors, noting that this report was stimulated by recent capacity building on entanglement which had been conducted by the IWC working in conjunction with both national and regional authorities in Argentina. The paper reported nine cases of entangled southern right whales in the province of Chubut, Patagonia, Argentina from 2002 to 2011. Of the nine confirmed cases of entanglement, six whales (67%) were successfully released and three (33%) were not re-sighted in spite of the search efforts by the Argentine Coast Guards, whalewatching boat operators and Cetacean Stranding and Disentanglement Program members. Of the documented entanglements, 56% corresponded to moorings and the remaining 44% to marine debris (rope) and fishing gear.

There is little or no passive fishing gear in the Gulfs of Península Valdés, and boat moorings represent the primary entanglement risk. Although many of these mooring systems contain heavy chain and relatively thick diameter rope, they were still found to entangle whales. It was noted that these right whales were often seen 'playing' with mooring and anchor lines, as has also been observed with southern right whales off South Africa. This behaviour is believed to be a primary mechanism for entanglement in this region.

The second IWC Workshop on Welfare Issues Associated with the Entanglement of Large Whales, was held in Provincetown, MA, USA, October 2011 (IWC/64/WKM&AWI Rep1). The primary focus of this Workshop was on entanglement response and capacity building. However some aspects of the report are relevant to estimating mortality. In particular, new information was introduced concerning large whale entanglements in New Zealand (22 in the period 2000-11) and in British Columbia, Canada, where 26 entanglements were reported from 2008-11. The majority of these were humpback whales (22), and a variety of fishing gear was involved, including gillnets (11), crab traps (8), unidentified ropes and floats (6), prawn traps (2), seine gear (1) and longline gear (1).

The Provincetown Workshop received summaries of three other entanglement related workshops that were held in 2010-11 in the USA, all of which recognised and reiterated the value of collecting a suite of data while responding to an entangled whale. One workshop in particular (Werner, 2011), involved bringing entanglement responders, fishermen and biologists together to examine the data (i.e. images, gear, briefing reports, etc.) collected from 40 well-documented right whale and humpback whale entanglement cases. The aim was to gain insight into the causes and mechanisms by which large whales become entangled by reverse-engineering the entanglement. The Provincetown Workshop also received information from a particularly well-documented, single response to an entangled right whale. Deployment of a D-tag during disentanglement allowed post-event calculations of the drag forces and energetic costs associated with the effort. The increased power demand required by the whale to overcome additional drag forces imposed by various gear configurations ranged from 10-132% at speeds of 0.75-2.9m s^{-1}. Ultimately this whale was found dead 11 days after the rescue efforts, but a detailed necropsy was performed which allowed the impacts of both the entanglement and the disentanglement effort to be documented. The Workshop also received information on new studies underway that would help improve the data collected during entanglement responses, including field testing of breath collection, and a study assessing the health impacts of various implanted telemetry tags. In addition, a new study of entanglement scarring has been initiated in South Africa.

The Working Group noted the value of data collected during entanglement responses and welcomed the efforts at the Workshop to develop a data form to standardise the data now being collected around the world. The Workshop participants had also proposed to form a 'global network of entanglement response teams' and seek the endorsement of the IWC as an expert panel to advise member nations on issues related to large whale entanglement including setting up response networks, methodologies for understanding scope and impact on local populations, and response capacity building. It was noted that both the proposed group and a potential database could assist the work of the Committee and further collaboration was **recommended**. The Committee could also assist both the group and database by providing its expertise with regard to data collected and potential analyses. In many cases there are additional data available from entanglement incidents that could supplement the summary data currently requested in National Progress Reports. The IWC could become a repository for such data through a similar effort to the Ship Strike Database.

8. ESTIMATION OF SHIP STRIKES

Baldwin presented a preliminary summary of strandings, lethal entanglements and ship strikes of large whales in the Arabian Sea region, which revealed seven documented ship strikes and four lethal entanglements between 2000 and 2012, involving three Arabian Sea humpback whales, five Bryde's whales, one sperm whale and two unidentified baleen whales. It was noted that these data represent an underestimate of actual strandings and mortalities, and were compiled largely from incidental reports, personal communications and public media. Data are strongly linked to survey effort, which is sporadic and localised. Reporting of strandings is notably higher in areas proximal to urban centres. Mortality of Arabian Sea humpback whales is of particular concern due to the conservation status of this subpopulation which has an estimated population of 82 (95% CI 60-111) individuals. A total of nine strandings of Arabian Sea humpback whales are documented between 2000 and 2012. The gender of two is known; one female and one (juvenile) male.

Given the precarious status of the Arabian Sea humpback whale population and the increasing shipping traffic in this busy region the Working Group encouraged the authors to report in more detail to next year's meeting and to submit relevant records to the IWC ship strike database.

Best reported that between 1999 and 2010 there were 71 recorded mortalities of right whales on the South African coast, including 34 calves, eight juveniles and 21 adults: the non-calves tended to be found floating dead or came ashore partly decomposed, whereas calves were more often stranded live or found freshly dead (Best *et al.*, 2011). Five of the non-calves bore injuries consistent with a ship strike, and there were seven reported instances of non-lethal contacts between right whales and vessels during the period. Adult females with dorsal propeller scarring first appeared in the photo-identification catalogue (started in 1979) in 1993 and have formed between 0.3 and 0.8% of the adult females photographed annually thereafter: all four individuals have been seen with multiple calves.

Brownell reported that two pygmy blue whales were struck and killed in Sri Lankan waters within a 12-day period in early 2012. The first was found draped on the bow of a container ship in Colombo Harbour on 20 March 2012 and following its disposal 25km offshore, washed up on a beach 10km south two days later. The second whale was found floating dead at sea on 2 April 2012. As this individual did not strand, no details apart from species and sex are available. The southern coast of Sri Lanka is one of the busiest shipping routes in the world and it overlaps with an area of high whale sightings. In the absence of any abundance estimate for the local population of blue whales, the population impacts of ship strikes are not known, highlighting the urgent need for long-term monitoring of the blue whale population in Sri Lankan waters and elsewhere in the northern Indian Ocean.

One of these carcasses had been quickly towed approximately 25km offshore but came ashore two days later, further to the south. It had significantly deteriorated in the hot weather in that short time. There is a need to better understand the variables that affect carcass drift, detection and decomposition, including the phenomenon by which a large whale carcass may 'swim' after death, because of ocean swells acting on its tail flukes, and the observation that a carcass can sink and refloat after many days.

The model MOTHY, initially developed by MétéoFrance in the context of maritime safety, is a fully deterministic model that uses wind archives and outputs of tidal models to predict the drift of floating object (Peltier *et al.*, 2012). The model can make forward calculations to predict a stranding location or backward calculations to estimate the likely origin of an object. The thickness and immersion rate (buoyancy-1) determine the extent to which the object would be driven by the wind and by tidal currents. The specific objectives of the study were to investigate the immersion rates of carcasses, how this rate changed with time after death, and to determine time from death for carcasses based on visual criteria that could be assessed from photographs of stranded animals. These data were then used to estimate stranding rates and the likely origin of the strandings that were observed.

The immersion rate of small cetaceans was experimentally found to vary from 100% at death to *c.*75% a month later, with an average of 92%. One hundred small cetaceans bycaught in fisheries were tagged with a plastic plate fitted to the tail and dropped off at known locations and dates in the Bay of Biscay and western Channel. MOTHY predictions showed that 62 of these were expected to reach the coast. Eight tagged individuals were reported by the stranding network suggesting an observed stranding rate of 8% with the unreported animals either sinking or not being reported. Pictures of stranded common dolphins were used to establish a frequency distribution of time after death for common dolphins in winter. These were used to generate back trajectories for the 869 common dolphins found stranded in winter from 2004-09 indicating likely origins mostly in the central and south continental shelf of the Bay of Biscay.

It was noted that some carcasses may 'sail' across the wind to variable degrees, depending on the orientation of their dorsal, flippers and flukes which may act like a keel. Possible predation on carcasses was not explicitly taken into consideration in this study, but is included in the percentage of carcasses that disappear. The Working Group **recommended** further study of the variables affecting carcass drift, detection and deterioration for large whales that could be used to establish the location of death from a ship strike or other sources.

Improving understanding of role of ship speed in both risk of a collision and the risk that such a collision will be lethal was one of the motivations for developing a global database of collision incidents. Wiley *et al.* (2011) used data

on shipping density and speed from Automatic Identification System (AIS) together with published relationships between risk and speed to examine the relative risk reduction that might be achieved by speed restrictions in the Stellwagen Bank National Marine Sanctuary, USA. They suggested that risk reduction would change from around 30% to 57% for speed restrictions of 12 and 10 knots respectively. The much greater value for a 10 knot restriction was partly driven by the difference between this speed and the overall distribution of ship speeds.

Gende *et al.* (2011) and Harris *et al.* (2012) both describe observations of humpback whales from cruise ships in Alaska, USA and relate the sighting location of the whales relative to the ship to the speed of the ship. Harris *et al.* (2012) inferred a greater risk from ships travelling at >13 knots due to whales more frequently surfacing closer to the midline of the ship and the ship's bow than at slower speeds. Gende *et al.* (2011) examined changes in the observed radial distances with ship speed. Using a Bayesian change point analysis they found that the relationship between whale distance and ship speed changed at 11.8 knots with whales encountering ships, on average, 114m closer when ship speeds were above 11.8 knots. The Working Group did not discuss these in detail but noted the potential for such studies to contribute to a better understanding of the relationship between risk and speed.

A workshop focusing on ship strikes in the Bay of Biscay was held in London, 18-19 April 2012. Participants included scientists, NGO representatives and representatives from the shipping industry including ship's captains. A series of recommendations were formulated at the workshop, mainly dealing with mitigation measures but aspects of the quantitative assessment of the effectiveness of mitigation measures are relevant to assessing risk. The workshop considered ways in which a large dataset of observations from vessels may be of value in these assessments of risk. The IWC Ship Strikes Database and how to further disseminate the need to provide data was also discussed. The workshop identified the need for a clearer definition of 'near miss' events and what could be inferred from these. Two specific recommendations regarded the IWC:

(i) work with the IWC to identify what data could be collected for the reporting of near misses and ship strikes; and
(ii) disseminate the findings of the workshop to ASCOBANS and the IWC Ship Strike Working Group.

The Working Group welcomed the approach taken by the workshop to engage a wide variety of stakeholders, and noted that the report could also be relevant to work in other regions. The difficulties in defining a 'near miss' have been discussed before by the Committee and further analyses leading to papers for next year's meeting were encouraged. It was noted that active acoustic alarms were one of the mitigation tools considered by the workshop but the potential for these to reduce risk had still to be evaluated. The Committee has previously expressed concerns over noise from shipping and the introduction of any further noise sources is also of concern.

A proposal for a workshop of cetacean and shipping experts to agree on appropriate analytical and modelling techniques to assess ship strike risks arose out of the IWC-ACCOBAMS Ship Strike Workshop in 2010 (IWC, 2011). At the time there was some uncertainty about the availability and content of data on shipping density and it seemed likely that analysts would need to make requests for data from centralised databases that had some level of processing. However there are now commercial sources of raw data which would allow the optimum analytical methods for the particular study.

It was noted that approaches to analysing AIS data are still likely to be most effective on a case by case basis, taking into account the previous discussions within the Committee regarding a consistent approach as to what is meant by shipping density and the most appropriate metrics for ship strike risk. AIS data may also be used to assess other threats to cetaceans including underwater noise and pollution. In particular there are several noise mapping initiatives that are likely to require shipping data.

The Working Group **agreed** that a dedicated workshop is not needed at this stage but that papers looking at ship strike risks based on overlap of shipping and whale density should continue to be encouraged. The need for a workshop could then be reviewed to address any issues that arose from those studies. In addition it will be useful to make contact with other projects that may be requesting shipping data in order to combine data requests to reduce costs. The need for shipping data to assess ship strike risks could also usefully be brought to the attention of other workshops that are considering ship strikes or noise mapping.

The IWC has been developing a global database of incidents involving collisions between vessels and whales since 2007. The specification and developments have been reported annually to the Scientific Committee. A web based data entry system has now been in place for two years but there have been few reports.

Most of the interessional database related efforts were to promote awareness. Mattila has been seconded to the Secretariat to assist with work on mitigating conflicts between whales and marine resource users. While most of his initial effort has been in relation to large whale entanglement, he was able to describe and promote awareness of the Ship Strike Database in several international venues, including ICMMPA2 (42 countries represented), an International Symposium in Korea, and a UNEP workshop on marine mammals and human impacts in the wider Caribbean and Latin America. The existence and purpose of the database was also brought to the attention of the Marine Mammal Officer of SPREP (Secretariat of the Pacific Regional Environmental Programs) of UNEP in Apia, Samoa.

The Working Group **agreed** that a more pro-active approach was needed to encourage data to be entered. It was also noted that it is important that a proactive approach by the IWC complements and does not conflict with national data gathering efforts. This will require good communication between the IWC and national contacts that could best be achieved at the IWC end by a single point person.

The Working Group **recommended** the appointment of a dedicated IWC ship strike data coordinator with the tasks described in Appendix 2. It was noted that these tasks included development of a database handbook. This would include a description of the process and criteria used by the data review group.

A specialist workshop was held in January 2012 in Woods Hole, MA, USA, with the objective of developing internationally agreed upon criteria for determining human impacts on live and dead marine mammals, including evidence for and results of ship strikes on large whales. The report of this workshop was not available in time for IWC/64, but will be available for IWC/65 and will be very useful in developing these criteria for the IWC handbook.

The *Journal of Cetacean Research and Management* has also published papers on ship strikes. The Working Group

recommended that the Guide for Authors should encourage authors of papers containing data on ship strike incidents to report these to the database.

9. OTHER

A number of papers concerning impacts of marine debris were considered by the SWG on Environmental Issues (see Annex K). The Working Group encouraged further activities that could help to quantify mortality related to marine debris, noting the difficulty in determining debris from actively fished gear.

10. WORK PLAN

The focus of the group will remain in estimating mortality due to bycatch and ship strikes. The work plan will include:

(1) reviewing progress in including information in National Progress Reports;
(2) estimating risk and rates of bycatch and entanglement;
(3) development of methods to estimate mortality from ship strikes;
(4) continuing development and use of the international database of ship strikes; and
(5) review of information on other sources of mortality.

11. ADOPTION OF REPORT

The report was adopted at 16:00 on 18 June 2012.

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Appendix 1

AGENDA

1. Convenor's opening remarks and Terms of Reference
2. Election of Chair
3. Adoption of Agenda
4. Appointment of rapporteurs
5. Available documents
6. Collaboration with FAO on collation of relevant fisheries data
7. Progress on joining the Fisheries Resource Monitoring System (FIRMS)
8. Progress on including information in National Progress Reports
9. Estimation of risks and rates of entanglements
10. Estimation of ship strikes
11. Other issues, including assessing mortality from acoustic sources and debris
12. Work plan and budget requests
13. Adoption of the Report

Appendix 2

SHIP STRIKE DATABASE

The ongoing development of the IWC Ship Strike Database requires data gathering, communication with potential data providers and data management. The Working Group **recommended** a part-time post initially for three months a year to undertake the following tasks.

Data gathering:

- Identify national contact points, organisations or groups that hold data on ship strikes that have not been contributed to the database.
- Approach these organisations to facilitate and encourage contributing data to IWC database, including discussing preferred mode of delivery of ship strike reports in a way that complements national data gathering efforts.
- Regularly contact national co-ordinators or stranding networks (from IWC list) providing them with any new updates relevant to ship strikes and helping to facilitate data entry of any new records to the IWC database. Review the *Journal of Cetacean Research and Management* for ship strike information and contact authors to collate data for entry into the database.
- Follow up on reports of new incidents in order to gather information as soon as possible after the incident took place. Ensure national coordinators are informed quickly of any reported incidents within their area.

Outreach and communication:

- Monitor and respond to any communications, including reports of new incidents, giving feedback to data providers and dealing with requests for summary information from the database.
- Keep IWC ship strike website pages up to date including updating publicly available summaries from the database.
- Develop and document a communication strategy. For example, ensure the current leaflet on ship strikes prepared by Belgium is as widely distributed as possible within the shipping industry (direct to vessels), shipping management companies, and maritime academies. Explore ways of raising the profile of the database by contacting other organisations including academic (e.g. ECS, ACS), NGOs, recreational boating associations, maritime organisations.
- Assist Secretariat with maintaining links with IMO.
- Explore funding options for future IWC ship strike work.
- Provide an annual update to the Scientific Committee.

Database management:

- Data entry of new records including data presented in meeting papers and National Progress Reports at Annual Meetings of Scientific Committee.
- Work with data review group to ensure that all new records are appropriately reviewed including identification of potential duplicate reports.
- Further development of database handbook including criteria for determining whether ship strike was a cause of death. Ensure database documentation remains up to date.
- Maintain database and data entry system, making adjustments as appropriate in response to user problems and suggestions.
- Communicate any changes in database schema to all potential collaborators.