Annex J

Report of the Sub-Committee on Estimation of Bycatch and Other Human-Induced Mortality

Members: Aguilar, Almeida e Silva, An, Baba, Baker, Borodin, Brownell, Butterworth, Canadas, Carlson, Chilvers, Cipriano, Cooke, Cozzi, de Stephanis, Deimer-Schuette, Di Guardo, Dinter, Donovan, Double, Fernholm, Fortuna, Funahashi, Gallego, Galletti, Gedamke, Gonchorosky, Goto, Hayashi, Hester, Hughes, Hyugaji, Ilyashenko, Iñíguez, Ipatova, Kasuya, Kell, Kock, Kuningas, Larsen, Lauriano, Leaper, Lens, Litovka, Lovell, Lucetti, Lyrholm, Marcondes, Mattila, Mazzariol, Miasnikov, Miller, Nakamura, Newell, Northridge, Okada, Palka, Panigada, Park, Parsons, Perrin, Podesta, Porter, Porter, Read, Reijnders, Ridoux, Ritter, Ritter, Robbins, Rogan, Rojas-Bracho, Rose, Rowles, Senn, Simmonds, Simmonds, Stachowitsch, Straley, Strbenac, Tajima, Tichotsky, Urban, Van Waerebeek, Visser, Weinrich, Wiese, Williams, Yamada, Yamakage, Yasokawa, Yatabe, Young, Zelensky.

1. CONVENOR'S OPENING REMARKS AND TERMS OF REFERENCE

Perrin welcomed the members and noted that the terms of reference given to the Committee by the Commission (IWC 2007, p. 224) relate strictly to the issue of estimating human-induced mortality of the great whales other than directed take so that such mortality can be subtracted from any quotas set for directed take under the RMP. Therefore the sub-committee would consider only documents and questions relating to that issue, not considering other issues relating primarily to small cetaceans or to mitigation. The Commission also directed that primary attention be given to regions where the RMP is most likely to be implemented in near future, i.e. the northeast Atlantic and the western North Pacific.

2. ELECTION OF CHAIR AND APPOINTMENT OF RAPPORTEURS

Perrin was elected Chair. Leaper, Van Waerebeek and Northridge agreed to act as rapporteurs.

3. ADOPTION OF AGENDA

The adopted agenda is given as Appendix 1. Its headings reflect primarily the work plan developed by the sub-committee at its 2006 meeting (IWC 2007 p. 223).

4. REVIEW OF DOCUMENTS

Information relevant to the workings of the sub-committee was contained in SC/59/BC1, 3-7 ,9, 11-17; SC/59/E3, SC/59WW13; SC/59/ProgReps; and Baker *et al*. (2007). SC/59/BC documents relating primarily to small cetaceans were referred to the sub-committee on small cetaceans.

5. INFORMATION AND METHODS TO ESTIMATE BYCATCH BASED ON FISHERIES DATA AND OBSERVER PROGRAMMES

5.1 Collation of bycatch and FAO fishery data

Northridge reported on work on collating IWC bycatch data and collaboration with FAO through the FIRMS partnership. A lack of available time during this intersessional period (06-07) has limited progress towards integrating IWC whale bycatch data with the FAO fishery database under the FIRMS agreement. Work has begun to consolidate the records submitted to the IWC on whale bycatch through national progress reports, dating back to 1979. This is a time-consuming task and the Secretariat has agreed to assist in getting these data entered. The data reporting format for IWC progress reports has changed considerably over the years and it will be necessary to adopt a flexible approach to the design of the database as earlier data are entered. The Secretariat has also agreed to enter future data on whale bycatch directly into a database, rather than storing such data as Word tables.

5.2 The FIRMS Partnership

The MoU with the FAO has yet to be completed, as an agreed data format will need to be in place before an Annex to the Memorandum can be completed. Allison has been in contact with the FIRMS Secretariat on this matter, and once existing data have been entered and a complete data series is in place in a stable format, the data structure can be specified in the Annex to the MoU. A meeting of the FIRMS Partnership is being planned for later in 2007, by which time it is hoped a stable data structure will have been arrived at so that the MoU can be concluded.

5.3 Feedback on EU bycatch monitoring schemes

European Member states are obliged under the EU Council Regulation 812/2004 to monitor certain specified fisheries for cetacean bycatch, and report to the Commission in June of each year. The first Annual Reports were due in June 2006. The Commission has not made these reports public, and it is not clear whether all member states have actually complied with the reporting requirements. Nor is it clear to what extent the monitoring requirements have been met. Some member states have made their reports to the Commission public through the regional cetacean conservation organisation ASCOBANS. These reports are available online (http://www.service-board/ascobans_neu/files/ac14-14.pdf). The Commission will convene a meeting in September 2007 to review Members States reports and the ICES WGMME has also been asked to review whatever data are available by then at its next meeting in early 2008.

5.4 Modelling approaches to determining appropriate levels of observer coverage

No documents were submitted on this subject. Northridge noted that as part of the EU Reporting requirements under EU Council Regulation 812/2004, member states would need to propose and justify sampling levels for observer monitoring in certain specified fisheries by June 2007. Presentations of work in this area may therefore be expected at SC60.

5.5 Entanglement

5.5.1 Information to be gained

SC/59/BC1 reviewed the scientific information that can be gathered during the process of releasing (or disentangling) large whales from entanglements in manmade materials, primarily ropes and net. Several aspects of this study were relevant to estimating mortality due to entanglement. Information collected must be done carefully and preferably by trained, authorized individuals, and if done thoroughly, the documentation should include images and/or genetic material that will allow later identification of the released individual in order to determine its fate. This may be useful in the short-term if the animal dies and the carcass is found either floating or ashore, but may be even more valuable if contributed to existing identification catalogues for the region(s) that the animal may frequent. Doing the latter may not only determine the outcome for that particular individual, but other documentation (*e.g.* of scars and visual health characteristics) may help to inform studies that attempt to estimate rates of entanglement and survival based on these indices. In addition, the process of disentanglement can provide opportunities to attach telemetry devices (with careful consideration to the potential impact on the animal) to the released whales in order to determine survival.

5.5.2 Review methods of determining survival of released entangled whales

Robbins described the use of mark-recapture techniques to estimate the survival of entangled whales and work already underway for the Gulf of Maine humpback whale population. The Gulf of Maine is expected to provide useful data on this subject because of its well-established entanglement reporting network and annually intense photo-identification research on the overall population. However, several limitations and sources of bias were discussed. Despite the reporting network, entanglements are thought to be under-reported (Robbins and Mattila, 2001). Photographs are not available for all reported entanglement cases, nor are those data always adequate to re-identify the animal. Thus, sample sizes for documented events remain relatively low and some animals in the population have been involved in undetected events. Indirect evidence of entanglement, such as scars, can improve the accuracy of individual entanglement histories and improve comparison to non-entangled whales. The magnitude of disentanglement efforts in the Gulf of Maine also leave relatively few data with which to assess impacts on survival in the absence of intervention. She also noted the potential for bias in mark-recapture analyses of entanglement survival. There is typically better photo-ID documentation of the entangled whales that were disentangled compared to those that were not, because of the additional time spent during disentanglement. Similarly, animals with less serious entanglements tend to be better documented than animals with more serious entanglements, because the latter typically present less of their body above the water surface. In the latter situation, biopsy sampling for molecular genetic re-identification may be possible in some areas and underwater photography or videography can be attempted where water clarity and other field conditions permit. Finally, it was noted that survival estimates based on documented reports will likely overestimate survival because animals will have already survived the first (anchoring) phase of the entanglement.

The sub-committee noted that this was a potentially valuable approach and encouraged further work. Robbins expects entanglement survival estimates for this population to be available at the next meeting.

5.5.3 Reliability of eyewitness reports

The reliability of eyewitness reports of large whale entanglement was analysed in SC/59/BC2. Large whale entanglement reports were studied in two US regions (the East Coast and Hawaii), each with a formal reporting network and disentanglement response program. Reports were provided by fishers, recreational boaters, commercial whale watching vessels, whale researchers and shore observers. In both areas, eyewitnesses were asked a series of non-leading questions designed to confirm the entanglement, the species in question and other details prior to mounting a disentanglement effort. Disentanglement then provided data to directly evaluate the accuracy of the information received. Fewer than half of reported cases in both areas actually involved entangled cetaceans. However, for those that were confirmed there was a low species error rate, even on the US East Coast (8.6%) where multiple large whale species were present. When the location in which the gear was set was known, US East Coast humpback whales were found significantly closer to the likely site of entanglement than North Atlantic right whales. The greatest displacements involved humpback whales reported entangled around Hawaii. Most were likely entangled on feeding grounds more than 2000 miles away. Only 26.5% of US East Coast humpback whale entanglements were considered life threatening at the time of disentanglement, whereas 90.5% of Hawaii entanglements met this description. This difference was thought to reflect the fact that some animals had been disentangled on their feeding ground and minor entanglements had been shed by the time of arrival on the breeding ground. Thus, caution should be used when extrapolating characteristics of entanglement between species and areas. Overall, results indicated that careful questioning can produce reliable information on whether a whale is truly entangled and the species affected. However, even with screening, eyewitness reports were not reliable sources of information on the site of entanglement. Errors in descriptions of gear can also cause an error in the total number of reports, but this is likely to be balanced by the fact that reports typically underestimate the true number of entanglements. Preferential use of eyewitness reports from fishermen and whale experts will reduce, but not eliminate eyewitness error. However, once areas of concern are identified, the magnitude and extent should be explored by other techniques.

It was noted that the whales that became most severely entangled on the feeding grounds might not survive to return to the breeding grounds around Hawaii. Rowles described recent outreach initiatives to improve the reporting rate of entangled whales on the feeding grounds in Alaska and the close co-ordination with researchers in Hawaii.

5.5.4 Estimating risks and rates

SC/59/BC15 described an on-going study of entanglement among 10 humpback whale feeding grounds and four breeding grounds in the North Pacific. The study is part of the SPLASH project and uses scar interpretation techniques developed and tested on humpback whales in the US Gulf of Maine (Robbins and Mattila, 2001). SPLASH researchers had other photo-ID priority, but were instructed to photograph the caudal peduncle whenever possible for scar-based entanglement inference. A total of 1,484 images obtained during the first year of the project were screened for use and the highest quality images (n=437) were examined for scar evidence of a previous entanglement. The minimum entanglement scarring rate at Southeast Alaska (50.0%, 95% CI: 43.3 - 57.8%) was comparable to reports from the US Gulf of Maine, where entanglement in fishing gear is a documented source of management concern. Comparable minimum estimates for Southeast Alaska were found in a recent, parallel study using the same methods (Neilson, 2006). However, significantly lower estimates were produced from data from the Hawaiian breeding grounds (31.6%, 95% CI: 22.6 - 41.8%), where Southeast Alaskan whales mix with other feeding populations. Sample sizes from the remaining areas in 2004 were too small for rigorous comparison, but no areas were free of scarring. The authors anticipate that the addition of SPLASH data from 2005 and 2006 will improve insight into entanglement risk among North Pacific areas.

It was noted that analysis of entanglement scars had potential to provide information relevant to estimating mortality rates. The sub-committee welcomed this study and encouraged further work.

SC/59/BC17 examined records of minke whale entanglement and sightings in Scotland and linked these with fishing effort by vessels using lobster pots (creels). Between 1992 and early 2007, 159 minke whale carcasses recorded in Scottish waters, and 16 (10%) of these were diagnosed as probable or known entanglements, though cause of death was not attributed in 135 (85%) of instances. Creel fishing is the most commonly used method of fishing in Scottish waters, with over 160,000 boat days fishing recorded for 2006. Creel fishing is the most likely source of ropes involved in minke whale entanglements in Scottish waters. Using data on the spatial distribution of fishing effort in 2006 and previously published records of minke whale sighting rates (expressed as sightings per hour from data collected from a number of sources between 1979-1998) an index of overlap was defined and used to identify areas of highest risk of entanglement. These included areas in the Hebrides (west coast of Scotland) and off the southeast coast of Scotland.

The sub-committee noted that this approach may also be applicable to other areas. It was suggested that it would be instructive to compare spatial predictions of risk with locations of reported entanglements. Northridge noted that he was planning such an analysis. Read noted similar analyses to compare relative distribution patterns of whales and fishing gear, currently underway for the Gulf of Maine on the east coast of the US. Obtaining accurate information on fishing effort is a potential problem for such studies. The Gulf of Maine study used data from aerial surveys to estimate gear density.

SC/59/BC17 also highlighted the difficulties of estimating the relative proportions of strandings due to entanglement compared to natural causes. In the majority of cases, cause of death was not identified. Entanglement is likely to be easier to determine than other causes, and in other areas, 20-30% of large whale strandings were attributed to entanglement. It was noted that minke whales in New England that become entangled and subsequently strand may be more likely to have full stomachs than those that strand due to natural causes. Stomach contents should be examined wherever possible as a potential indicator of sudden death (see also Item 5.8).

5.6 Project GloBAL and other global and regional bycatch projects

SC/59/BC5 described an initiative co-ordinated by Duke University (NC, USA) which is addressing the fact that little information exists about the magnitude or impact of bycatch outside of a relatively few well-studied areas. Information is especially sparse in many fisheries of the developing world. Project GloBAL is addressing this information need by synthesizing existing data, coordinating ongoing research efforts and testing novel approaches to data collection. All of these activities are being conducted on a regional scale. The objective is to assess the magnitude and impact of bycatch of whales, as well as other marine mammals, sea birds and sea turtles, across gear types and taxonomic boundaries, particularly in areas where such assessments have not yet been conducted. SC/59/BC5 described the status of the project and highlighted some recent initiatives, including the development of a rapid assessment protocol to assess the magnitude of bycatch in typical fisheries of the developing world. This rapid assessment protocol is currently being field tested in several sites around the world.

During discussions it was pointed out that for large whale entanglement an important issue to investigate during rapid appraisal would be the extent to which fishermen experience loss of static gear. Whales becoming entangled in artisanal fishing nets or pot lines are most likely to swim away with the gear and entanglement events are therefore unlikely to be recorded. Loss rates of gear may provide some insight into the plausible frequency of whale entanglement in a given area.

It was suggested that the Rapid Appraisal results should be compared with estimates of bycatch in one or more areas where good information on bycatch levels already exists. Read replied that the Appraisal methodology would also be tested in North Carolina and compared with pre-existing estimates of bycatch derived from on board observer programmes.

The sub-committee noted other regional and global initiatives that are being directed at bycatch assessment and mitigation. Fortuna reported that the ACCOBAMS Secretariat and Scientific Committee are collaborating with the General Fisheries Council for the Mediterranean (GFCM) and in particular with its Sub-Committee on Marine Environment and Ecosystems (SCMEE) in order to address bycatch issues in the Mediterranean. They have developed a very basic and descriptive "Questionnaire on cetacean-fishery interactions" that has the aim of gathering existing information on bycatch and depredation in the Mediterranean from researchers. This questionnaire was initially circulated last summer. A total of 16 researchers sent back replies relating to studies carried out in 9 Mediterranean countries. At the last GFCM Meeting Contracting Parties endorsed the recommendations of the GFCM-SCMEE, and agreed to establish a Transversal Working Group[1] on by-catch (particularly, marine mammals, turtles and elasmobranches), to extend the GFCM/ACCOBAMS questionnaire survey to non-cetacean species, and to hold a GFCM meeting on bycatch in 2008.

ACCOBAMS has is also coordinating two bycatch projects on its own. The first is investigating the extent of cetacean by-catch and strandings in the Romanian Black Sea and coast. The second project, "BYCBAMS", aims to compile and verify the workability of a standard methodology for data collection on bycatch and depredation, and to define the status of interactions in Italian and international waters (within the Agreement area). Initial funding is from the Italian Ministry of Agriculture, Food and Forestry (MiPAAF) who have agreed to support a part of the project. This support will include funds for drafting standard procedures for data collection on cetacean bycatch and depredation in the ACCOBAMS area and for holding an Italian Workshop on cetacean bycatch and depredation (Rome, September 2007) and an ACCOBAMS area International Workshop on cetacean bycatch and depredation (at FAO Rome, November 2007). MiPAAF have also funded a pilot data collection scheme on cetacean bycatches in Italy (focused on the Tyrrhenian Sea). The BYCBAMS project framework is intended to develop similar activities (workshops and field work based on agreed standard procedures) in all ACCOBAMS Range States

Perrin described recent developments and activities on bycatch in the Convention on Migratory Species of Wild Animals (CMS). The CMS is the designated intergovernmental organization (IGO) under the Convention on Biological Diversity (CBD) for migratory species. Therefore it has turned its

[1] GFCM Transversal Working Groups are "*ad hoc*" groups populated by experts from all Scientific Advisory sub-Committees. In this case, this means that not only experts attending SCMEE will be involved in this WG.

attention to effects of anthropogenic activities on diversity and conservation of migratory species of wildlife. Its Strategic Implementation Plan 2006-2011 adopted at the last COP in 2005 provides for a series of reviews of the impact of various threats to migratory species, particularly of marine mammals, large marine fish, marine turtles and albatrosses/petrels. In addition, a resolution was passed at the same COP on "Adverse Human Induced Impacts on Cetaceans." In response to these policy initiatives, an Appointed Councilor for Bycatch was added to the Scientific Council; Barry Baker of Australia was appointed to the post. A draft plan for assessment of bycatch in global fisheries was circulated at the meeting of the Scientific Council in March 2007 and will be further developed in coming months. The objectives is to carry out a comprehensive review of all global commercial and artisanal fisheries to assess the available information on bycatch of seabirds, marine turtles, sharks and marine mammals. The report of the investigation will identify priority fisheries, regions and species which will benefit from international action through the CMS.

Van Waerebeek noted that CMS is also planning to hold a meeting to develop a plan of action for small cetaceans in West Africa. The sub-committee recommended close coordination between the IWC and the CMS to ensure that their efforts along these lines are complementary. The sub-committee asked to be kept informed of the results of the GloBAL project and encouraged the co-ordinators to collaborate with other organisations involved in similar initiatives.

5.7 Annual Progress Reports

The sub-committee noted that the new gear codes were being used in National Progress reports, which greatly improves their utility. It was noted, however, that there still appears to be some confusion over the codes used to describe the origin of bycatch accounts ("How Observed" field). Because the IWC assumes that bycatch reports listed in the national progress reports are reliable, the codes are supposed to enable a distinction to be made between initial reports that were collected as a part of a planned cetacean monitoring programme (M), records collected by on-board fishery monitoring schemes (F), by fishermen through vessel logbooks (V), and anecdotal reports from any reliable source (A), with a further distinction of (DA) if the latter were documented (*e.g.,* photos, rescue teams, *etc.*). The sub-committee recommended that the Secretariat clarify the instructions for this part of the form.

5.8 Other

SC/59/ForInfo58 presented some novel findings on the pathology of bycaught cetaceans that may be useful for identifying bycatch as the cause of death in stranded whales. Morphological changes (detected histologically) associated with acute phase proteins were detected in stranded harbour porpoises that had been diagnosed from external signs as having died in fishing operations. Intracytoplasmic hyaline eosinophilic globules containing fibrinogen were detected immunohistochemically in 26 out of 27 porpoises that had been bycaught (the 27th animal was a neonate), but the accompanying acute severe liver congestion usually found in stranded animals that died of other causes were not detected. The differential symptoms could be a promising way to make diagnoses of bycatch. The group welcomed this very interesting result and agreed that it has the potential to help identify bycaught animals. It was suggested that samples from bycaught large cetaceans also be examined by the authors in a blind study to determine whether the findings hold true for whales as well as porpoises.

6. METHODS TO ESTIMATE BYCATCH BASED ON GENETIC DATA

6.1 Review of Intersessional work related to market sampling

The Initial Workshop in the use of Market Sampling to estimate bycatch of large whales held in 2005 had concluded that market sampling is a potentially useful method to supplement bycatch reporting schemes and made a number of recommendations for further work. These recommendations included the use of simulations to investigate the performance of different sampling designs and their sensitivity to the assumptions that have been made regarding market characteristics. Following discussion of results presented at the 2006 meeting, the Committee had recommended further continuation of these studies to investigate the sensitivity of estimates of bycatch based on mark-recapture techniques. SC/59/BC4 reported on further simulations based on the same simulation model and estimation procedures presented in 2006 (SC/58/BC8 = IWC, 2007, p.218). The new scenarios included heterogeneity in throughput at retail level and heterogeneity in sampling probability of different retail outlets. Two estimation methods were used, either using all recaptures or excluding within-survey recaptures. The simulations were designed to challenge the estimation procedures, and there were a number of scenarios where the estimation failed. However this was always apparent from the data. Where estimates were obtained, biases on estimates excluding within-survey recaptures could go either way. However, unlike the previous results where all estimates based on including within-survey recaptures were negatively biased, two scenarios did show small positive bias. Nevertheless, the overall results indicate a much greater chance of negative bias and the positive biases that were observed were small (a maximum of 10%). Overall, including within-survey recaptures would appear to be the more reliable method for estimating the number of individuals entering the market.

It was agreed that nothing in the new results would change the conclusions reached in 2006 that the mark-recapture method using all recaptures gave consistent but negatively biased estimates of the number of whales entering the market and that current understanding of markets is adequate for application of such methods. Previous Committee discussions had also noted that the best estimates of bycatch based on market data will be obtained if the work is undertaken in conjunction with DNA registers. If data from DNA registers were used then the statistical precision of estimates would be improved considerably. In further discussion, it was also noted that tracking individual whales from entering the market to retail level, through the use of market surveys in conjunction with DNA registers, could provide valuable data on market characteristics and structure.

One task identified by the Committee prior to a 2nd stage workshop was to collate available temporal and spatial information on bycaught whales destined for markets. Funahashi presented information using the ArcView GIS software to describe locations of bycatch in relation to set nets and locations of major fish markets in Japan. Bycatch locations were obtained from the Marine Mammal Information website of the National Science Museum and the website and newsletters of the Institute for Cetacean Research. Locations of Large Type set nets were taken from nautical charts prepared by the Japanese Coast Guard. Locations of major fish markets and places of whale meat sales were based on personal experience and industry guidebooks. However, Funahashi noted that further work was needed to refine this information. These data are shown in figures 1-3.

Hyugaji noted that the retail distribution network in Japan is complex and that there is potential for substantial bias in estimates based on market surveys. He re-iterated the position of the Government of Japan that estimation of bycatch from market sampling is doubtful and that market related issues are a domestic matter and in view of this, the contribution from Japan to these discussions would be limited.

6.2 Plans for 2nd workshop: scope, need and timing

While the methods discussed may generate negatively biased estimates, obtaining reliable unbiased estimates of the number of whales entering the market may require more detailed information on markets. The Committee had previously recommended that considerable new data would need to be available before holding a 2nd stage workshop. In reviewing the progress on intersessional work, the sub-committee agreed that the 2nd stage workshop would still be valuable but that more data would still be required before such a workshop could take place and again emphasized that if data from DNA registers were used in any modelling or estimation attempt, then the statistical precision of estimates would be improved considerably.

6.3 Other

SC/59/BC9 reported on species identification of whale products purchased via the internet from commercial markets in Japan from mid-September to early November 2006. A total of 31 products labelled as fin and humpback whale were selected for purchase and identified to species level. These included humpback whale (n=3), fin whale (n=15), sei whale (n=6), North Pacific minke whale (n=5) and Antarctic minke whale (n=2). The oceanic origins of fin whale products was further considered by comparison to fin whale products purchased on Japanese markets from 1993 to 2004 and available reference sequences from the North Pacific and North Atlantic. Of the 36 products purchased from 1993 to 2004, 14 showed a closer genetic relationship with the 2006 products and with some reference sequences available from the North Pacific, than to the reference sequences available from the North Atlantic. These result suggested that some fin whale products sold on Japanese markets prior to 2006 originated from the North Pacific or Antarctic rather than from long-term storage of products from Icelandic scientific whaling in the North Atlantic. A similar pattern of unexpected oceanic origins has also been reported previously for sei whales purchased prior to the JARPN II hunt (SC/56/BC3 = IWC, 2005 p.259).

Hyugaji noted that the sale of whale products via the internet introduced a further level of complication into understanding of market structure. He believed that the use of portable equipment for genetic analysis (PCR) may affect the reliability of analyses compared to permanent laboratory facilities. In response, Funahashi noted that very few of the retailers sold exclusively over the internet; most also sold from shop premises. It was also noted that portable PCR equipment had been used for a large number of studies published in the primary literature and that authors and reviewers of these studies were clearly satisfied with the reliability of the analyses.

Funahashi also presented data on the concordance of product labelling with species identification by genetic methods. This followed a request by the Committee at previous meetings. Around 20% of the samples were not correctly labelled to species level. This proportion was comparable with data presented in previous years. Hyugaji stated that Food labelling is a strictly domestic matter that is regulated by the Japanese Agricultural Standards law (Ministry of Agriculture, Forestry and Fisheries of Japan). And he told the authors that if they provide any information regarding the illegal labelling, MAFF will deal with it with this law.

The sub-committee also noted paper SC/59/ForInfo32 (Baker *et al.* 2007). This paper described estimates of whales entering the Korean market that had been discussed previously by the Committee and had now been published; the published version contains updated analyses.

A discussion ensued of the Japanese Ministerial Ordinance relating to disposition of entangled whales. An query was made whether a translation of the ordinance was available, but such was not the case. Hyugaji noted that (a) whale meat legally imported in the past as well as that from bycaught animals before the revision of the ministerial order are still in the Japanese market, and (b) while descriptions in SC/59/BC9 and Baker *et al.* (2007) can be read as if a Japanese law sanctions commercial sale of meat from whales that died after being bycaught, this is not the case. The ministerial order says that for whales (IWC managed species) bycaught in set nets, if dead when found or not believed to survive even when released, may be used on the condition that DNA information be registered in view of effective use of resources. It does not, however, encourage such use. The Fisheries Agency has issued a notice to Fisheries Associations through the local governments that effort should be made to release whales bycaught in set nets as far as possible. There are indeed many cetaceans released as such. The ministerial order does not refer to commercial sale. It applies only to whales bycaught in set nets. Whales bycaught by other fishing gears are not allowed to be utilized.

Other members of the sub-committee noted that although the regulations indicate that wherever possible efforts should be made to release whales entangled in set nets, this is rarely achieved. Of 139 common minke whales reported by Japan as entangled in 2006, only one was released alive (SC/59/ProgRepJapan). It was noted that international sharing of experiences in disentanglement techniques would be valuable. With regard to back stocks of whale meat, Funahashi commented that at a meeting convened by the Government of Japan in 1995 to exchange information among experts involved in regulating trade in whale products, Japan had noted that whale meat could be stored for up to 10 years[2] (suggesting that recent sales of fin whale meat were likely not from stocks imported from Iceland more than 10 years ago).

7. REVIEW OF INFORMATION AND METHODS TO ESTIMATE MORTALITY FROM SHIP STRIKES

7.1 Results from data collected on vessels

SC/59/BC11 presented a test of the common suggestion that collision risk with whales can be reduced by placing dedicated spotters on vessels in order to increase the chance of a whale being detected, with appropriate avoidance manoeuvres taking place if deemed necessary. Experienced, dedicated observers were placed aboard a high-speed ferry operating between Boston and Cape Cod, MA from 2002 to 2006, both to determine the level of risk (by gathering data on sighting frequency) and to aid crews in avoiding collisions. Whales were sighted on 39.7% of the 2,053 transits. Sightings included three species (humpback, fin, and North Atlantic right whales) known to be vulnerable to collisions. Levels of sightings were consistent through the period for right whales, higher in the last three years of the study as opposed to the first two years for fin whales, and increased throughout the period for humpbacks. These trends were consistent with the abundance of whales measured throughout the known high-use areas near the ferry transect line. The dedicated observer was the first to spot the whale in 56.4% of cases, significantly more often than any other crew member ($P<0.001$). Observers

[2] CITES document 10.40.1 available from www.cites.org/eng/cop/10/doc/e10-40.pdf

spotted whales at distances of more than 400m significantly more often than the vessel's captain (P=0.021). There was no significant difference between the observer categories based on the target species or its general size. No collisions took place with the ferry when observers were present; however, another high speed ferry that transited the same route was seen to collide with a fin whale. The findings suggest that experienced dedicated observers could play an important role in detecting marine mammals (for both assessing whale use of the ferry transit route and to alert the captain to their presence) and reducing the risk of collision with them. Given the number of high-speed ferries operating in habitats of species and populations of concern, this paper shows the utility of dedicated observers on such vessels.

The sub-committee welcomed the paper and agreed with its conclusions. It was noted that despite a dedicated observer, the captain still made 36% of first observations. Queried whether more observers might be needed, Weinrich replied that two observers (one on each side) would be helpful, especially on wide ships, but that this would depend on resources. On the question whether the observer programme was designed for the purpose of vessel damage control or conservation, Weinrich replied that conservation was the main driver, although safety of passengers was also a concern. It remained unclear whether the collision on the unmonitored vessel was reported, and generally how accurate the ferry industry is with reporting. Apparently vessels do not slow speed at night or in fog. Weinrich indicated the work would be continued.

Mattila presented a summary of SC/59/BC14, on behalf of the authors, who examined both official records and news-print archives for whale collisions in the waters surrounding the Hawaiian Islands between 1975 and 2006. They also distributed a questionnaire to professional mariners asking them about their knowledge of both reported and unreported collisions. Finding a thirteen-fold increase in the numbers of reports between the first decade of their data and the last, and noting that only 27.5% of the respondents to their questionnaire believed that all collisions during the time period were reported and in fact 47.1% estimated that less than 25% of collisions were reported, the authors limited further analyses to the time period 1997-2006. The authors chose this period because the Hawaiian Islands Humpback Whale National Marine Sanctuary was designated in 1997, and they suggested that this marked the beginning of a period of greater awareness of whale-vessel interactions. They then examined whether there was a linear correlation between an observed humpback population growth rate of 7%, extrapolated over this time period, and the coinciding increase in the number of collision reports. The results suggested that this assumed population increase alone could not explain the increasing number of reports.

The important question was raised of to what extent whale-watching vessels pay attention as they approach and move around whales. Mattila suggested that based on his extensive experience whale-watching boats sometimes failed to look carefully enough, especially when departing an observation site. Weinrich confirmed this and added that in all collision cases he was aware of it was not a whale being watched that had been struck, but some unnoticed whale within 1-2 km. There was agreement that this might be satisfactorily addressed by establishing a slow-speed zone around the target whale's location, when closing in, during and after the encounter when departing. Mattila confirmed that the number of whale-watching trips per year had increased over the years. It was noted that this very dynamic industry is subject to a lot of changes generating high levels of uncertainty for analysis, a sobering thought with regard to prospects of accurately estimating ship strike rates in other types of shipping which do not carry observers. He added that in Hawaii, considering the whale sanctuary, dedicated monitoring effort is feasible, but otherwise monitoring such rare events as collisions are may be perceived not cost-effective. The sub-committee agreed that underreporting of collisions is problematic in the whale-watching. Alternatively, over-reporting is also possible when *e.g.* bycatch victims are attributed to vessel strikes.

SC/59/BC16 compiled, from a variety of sources, all available reports of whale-vessel collisions in Alaska since 1978, totalling 62 records. These reports were opportunistically collected by the authors since 1978 and systematically collected by NMFS since the mid-1980s; they were subsequently entered in the Alaska Marine Mammal Stranding Database. The authors error-checked the data, ensured that there were no duplicates and clarified any ambiguities. The intent of the paper was descriptive; salient points were noted. Most vessel strikes involved humpback whales in Southeast Alaska. The outcome of most collisions was unknown (n=45), but 11 cases were confirmed whale deaths and two individually-identified whales were documented to survive over many years. The frequency of whale-vessel collision reports seems increasing, but additional analysis would be necessary to evaluate any possible trend. The number of reported vessel strikes undergoes marked annual variability. There may be a geographical bias toward Southeast Alaska, but the high number of collisions there also reflects an area where vessels and a population of over 1,000 humpback whales overlap. Small private vessels were the most commonly documented in whale-vessel collisions, although several factors can affect the reporting rates of different vessel types (Jensen and Silber, 2003). The paper also made several recommendations for improving data collection and recording.

During the discussion of SC/59/BC16, some members pointed out the importance of determining the condition of the whale prior to collision, including health issues that might have predisposed the whale to become a victim of a vessel strike. The author noted that none were found in two cases. Collisions resulting in confirmed death had all been by large vessels (*e.g.,* container ships and cruise ships). Collisions with small vessels may be less consequential..

On the question of whether photographic evidence was available to determine collision type, Gabriele affirmed this and added that only two propeller strike cases had been recorded. It was noted that, like manatees, cetaceans are very resilient and can survive even severe propeller wounds by small propellers if they do not penetrate beyond the blubber. Blunt traumas and injuries caused by larger propellers are often more lethal. Post-trauma survival rate of course is a critical factor in correctly estimating mortality from collisions. Many whales sink quickly after being hit, which makes evaluation difficult. The two bow-draped whales were believed to have been hit alive. Follow-up studies were recommended to obtain the long-term view.

SC/59/WW21 reported cetacean sightings made during a journey on the North Atlantic Ocean on board a commercial cruise ship. Besides the documentation of general sighting data, the behaviour of whales was grouped into four categories related to their reaction towards the vessel: avoidance, neutral, proximity, and interaction. For the 63 sightings made, during 36 the behaviour was categorized. Large whales (n=21) predominantly behaved neutrally (86% of sightings) and rarely showed avoidance or proximity, and no interaction was recorded. A fin whale and a sperm whale were detected in or close to the path of the vessel so that a collision appeared possible. Both whales behaved neutrally, despite the vessel's proximity. Quantifying different behavioural reactions thus can help to identify species/stocks especially vulnerable to collisions with vessels. SC/59/WW21 recommended incorporation of systematic efforts into more commercial operations and standardisation of cetacean sightings data collection on commercial cruise ships. Such an approach could be tested with the *International Association of Antarctic Tour Operators* (IAATO), which has demonstrated a remarkable co-operation with cetacean researchers.

7.2 Report of the IWC Vessel Strike Data Standardisation Group

The convenor (Van Waerebeek) of the Vessel Strike Data Standardisation Group summarized the report of the Group (Appendix 2), focusing on the background, rationale and the steps taken intersessionally in the development of a relational database template. Leaper gave a PowerPoint presentation to illustrate the design and inner workings of the database. Members of the sub-committee were invited to request a copy of the template to test run it for themselves. Van Waerebeek suggested that organisational issues, e.g. how the database should be populated with data, its access, overview and funding should perhaps best be dealt with by the Ship Strike Working Group (SSWG) of the Commission's Conservation Committee, which first recommended the development of a centralized international database on ship strikes (Recommendation 2, IWC/58/CC3).

The sub-committee commended the working group for their hard work and strongly recommended that the database be further fine-tuned. Hester indicated that if also mariners will entry data, it would be worthwhile to explore whether it could be linked to additional information, *e.g.* photos of species. Leaper replied that a reduced, simpler version could be developed for use by mariners which however would maintain the same internal structure as to keep versions compatible. It was noted that there are several entry boxes available that accept narrative text, *e.g.,* descriptions of animals seen or struck. It was recommended that the database should be forwarded to the Commission's SSWG /CC for comment.

7.3 Summary of activities of the Conservation Committee on ship strikes

Considering the document was not yet available at the time of meeting of this sub-committee, Van Waerebeek broadly summarized the Second Progress Report of the Ship Strikes Working Group to the Conservation Committee (SC/59/CC3). Two issues that may be of particular interest to this sub-committee were emphasized. The International Maritime Organisation (IMO) reportedly does not archive the detailed vessel traffic data to which access was anticipated, but IMO and in particular their Marine Environment Protection Committee (MEPC) could assist IWC to contact the appropriate entities that may provide such information. Secondly, a global stranding networks listing that is being compiled by the CC to identify gaps in monitoring coverage could be enhanced as a scientific tool through a qualitative and quantitative evaluation of spatial and temporal coverage of coasts. However such an evaluation should be properly designed (*e.g.* incorporate a series of measurable criteria). For global coverage it would be work-intensive and require considerable resources.

7.4 Progress on 2006 SC recommendations

7.4.1 Update of data on ship strikes in Italian waters.

Panigada presented an update of ship-strike events with large whales reported in Italian waters in 2006, including data both from stranded animals and photo-identified free-ranging individuals. Data on stranded animals were collected and analysed by the Natural History Museum of Milan, while information on live whales presenting evidence of collisions was gathered by contacting research institutes involved in photo-identification projects. Animals with large wounds or propeller scars were considered to be victims of ship collisions. Analysis of the stranding data is still in progress, but so far no evidence of ship strikes was encountered. One full necropsy on a stranded fin whale (see SC/59/DW5) was conducted as part of a dedicated project to create a "task force" to conduct detailed necropsies on stranded large cetaceans to assess the cause of death, but the result was negative and the likely cause of death was disease. Two live animals (fin whales) with clear and evident signs of collision were photographed at sea during 2006; additional data are being pursued for analysis.

The sub-committee noted again that the time series of reported ship strikes in this region is a particularly valuable data set for evaluating the relative risk posed by high speed vessels and looked forward to an update next year.

7.4.2 Applicability of histopathology techniques to explore fat embolism

No new information was available in the documents.

7.4.3 Are gas bubble lesions associated with exposure to sonar and/or collisions with vessels?

No new information was available in the documents. However, noise-associated matters were considered by the Standing Working Group on Environment Concerns (see Annex K).

7.4.4 Relation of patterns of whale distribution to shipping lanes for assessing current collision risk and new development of port and ferry routes.

SC/59/BC7 described results of research to determine the extent of inter-island ferry traffic in the Canary Islands. Routes within the archipelago were identified and the total distance travelled by all ferries operating on the same route (both ways) was calculated per day, per week and per year. A distinction was made between normal ferries (speeds of 15-20 kn), fast ferries (21-29 kn) and high-speed ferries (30 kn or more). Where known high cetacean abundance overlapped with ferry traffic concentrations, primary and secondary high-risk areas for ship strikes were identified. It was found that normal ferries travel 94 transits per week (4,888/year) and thus cover a distance of 1,269 km per week (65,988 km per year). Fast ferries travel an estimated 11,014 km per week (572,728 km/year) on a total of 110 transits per week (5,720 transits/year), while high-speed ferries perform 320 transits per week (18,720 transits/year) for a total distance of 16,267 km per week (845,884 km/year). These numbers add to more than 1.48 million km annually. A larger part of the fast and high-speed ferry traffic is concentrated around Tenerife and its neighbouring islands where important habitats for cetaceans are also located, some of which have been declared as Special Areas of Conservation (SACs) under the EU Habitat Directive. As ferry captains do not report collisions, carcasses will only be identified as ship strike victims if they are found floating at sea or washed ashore. Because both whale deaths and passenger injuries and one fatality have been reported, an effective policy to manage ferry traffic in the Canary Islands so as to secure both human and animal safety appears an urgent matter. The author therefore recommended that the authorities and/or the ferry operators

(a) install an obligatory reporting system, thereby making use of the database template developed by the IWC Vessel Strike Data Standardisation Group;

(b) implement shifts of transects away from primary high risk areas and/or speed restrictions;

(c) install on board observers on ferries operating in primary high risk areas;

(d) implement research projects assessing the actual number of collision or near collision events, preferably by placing researchers on board of the ferries, and

(e) develop a general strategy integrating different available mitigation measures.

The sub-committee endorsed these recommendations. Asked whether there was a possibility for follow-up efforts, Ritter was unsure considering that ferry operators are reluctant to even talk about collision issues. The group agreed that SC/59/BC7 offers a potentially useful approach to assessing collision risk and further to possibly developing a range of estimates of ship-strike mortality that may meet the needs of the RMP. Even though the objective of providing an unbiased estimate of numbers of ship strikes for subtraction from an allowed commercial catch may prove difficult, the Commission could receive advice on a range of numbers that could be combined with mortality from bycatch and other anthropogenic causes. The methodology of SC/59/BC7 may be considered as a way to estimate an index similar to "CPUE" for each stock, where ship-strike rate is stock-specific "Catch," and total distance travelled by each vessel class (e.g., high-speed ferry, fast container ship, etc.) is "Effort". In order for this approach to be very useful, better information on the species of whale struck and on the number of strikes must be had. How practical this would be is debatable. It was agreed that little is known about how to attempt to determine the true number of strikes and the fate of the whales struck. Another unknown and undoubtedly variable factor is the extent with which a collision is likely to be detected (either as it takes place or from discovery of struck carcasses or subsequent observation of wounded animals). Recognizing these gaps, the sub-committee encouraged more research on the rates and outcomes of ship strikes, including modelling with presently available data to take into account species of the whale, vessel type and speed, nature of the collision and severity and survival of the injury. Until these factors can be understood, estimation based solely on vessel miles and strike frequency may be unacceptably imprecise and/or inaccurate. It was noted that the charge to the Committee by the Commission is to consider ways to obtain "unbiased estimates of specified precision."

The group agreed that areas could be designated for concentrated research on species- and vessel-specific strike rates and their effects. Ship-strike mortality is a concern for management for two reasons: setting commercial and aboriginal/subsistence whaling catch limits, and evaluating threats to the survival of stocks known to be endangered. Present areas of RMP interest are the eastern North Atlantic and the western North Pacific. The list of endangered species and stocks would suggest that areas of concern might also include the northwest Atlantic for right whales, the area from the China Sea north to the Okhotsk Sea for western Pacific gray whales, and the Straits of Gibraltar and Mediterranean for fin whales, sperm whales and other species.

SC/59/BC13 reported that the Spanish Maritime Authorities in cooperation with the IMO in 2006 relocated the Cabo de Gata Traffic Separation Scheme in southern Spain from 5 to 20 nmi off the coast because of a high risk of ship collisions, oil spills, and other hazards in an area of high nature-conservation value and a proposed MPA for cetaceans. The new location has been published in the Notice to Mariners and International Nautical Charts. Subsequently, the Spanish Ministry of Environment coordinated with the Maritime Authorities to reduce the impact of ship strikes on cetaceans in the Strait of Gibraltar, and a Notice to Mariners was published in January 2007 establishing a security area owing to the presence of cetaceans (and especially sperm whales), in which it is recommended to limit speed to 13kt and to navigate with particular caution. These two actions may set a precedent for further collaboration with IMO and National Maritime Authorities in the task of preventing ship strikes.

These developments relate primarily to mitigation, but it was noted that an experimental opportunity exists in this situation. If data on ship strikes are available from before the Traffic Separation Scheme change, these could be compared to new data. Cañadas confirmed that such data were available on collisions with sperm, fin, and pilot whales. Concern was expressed that generally there is low compliance by vessels with recommended traffic regulations, but Cañadas indicated that the Strait of Gibraltar is very closely monitored by a ship traffic control centre, and that researchers experienced good collaboration from the centre.

7.5 Other

Ship strikes on large whales were reported in five Progress Reports (Annex Progress Reports). Twenty-six strikes were reported: humpback (9: 3 killed, 1 seriously injured, 6 of unknown fate), fin (6 killed), blue (2 killed), North Atlantic right (2 killed), Bryde's (1 killed), common minke (1 killed), sperm (2 killed) and species unknown (3 of unknown fate).

8. METHODS FOR ASSESSING ADDITIONAL MORTALITY FROM OTHER CAUSES

8.1 Acoustic sources

No new information was available in the documents. However, noise-related mortality was discussed in the Standing Working Group on Environmental Concerns (see Annex K).

8.2 Marine debris

No new information was available in the documents. Mattila noted that the results of a review may be available for next year's meeting.

9. OTHER

SC/59/BC6 presented a Bayesian approach for estimating demographic rates and impacts of bycatch on cetaceans for which data on the age-structure of strandings and observed bycatches are available. The example used in this analysis was for the harbour porpoise, a small cetacean, but the approach could be used with any species of cetacean for which such data exist. The approach combines mortality risk functions to estimate parameters that describe rates of both natural and by-catch mortality throughout life. Separate functions are simultaneously fit to the bycatch and strandings data, the latter of which results from a mixture of natural and by-catch mortality. Euler equations and empirical data on fertility are coupled to the data models, thereby constraining the set of plausible parameter estimates. The models are fit under multiple scenarios intended to correct for several sources of possible data bias. The approach allows estimation of potential population growth rate and the rate realized under bycatch mortality. Furthermore, the approach takes into account multiple sources of uncertainty in data and process and provides posterior distributions for a rich set of demographic rate parameters that are unknown for most cetaceans.

This paper was also discussed within the sub-committee on small cetaceans (see Annex L), but the potential for such methods to be applied to large whales was noted.

10. WORKPLAN

10.1 Carry-over items

The sub-committee agreed to carry over a number of items from this year's agenda and to give attention to the topics intersessionally:

(a) Collaboration with FAO on collation of relevant fisheries data

(b) Progress on joining the Fishery Resource Monitoring System (FIRMS)

(c) Feedback on EU monitoring scheme

(d) Modelling approaches to determine appropriate levels of observer coverage

(e) Review of methods of determining survival of released entangled whales

(f) Estimating risk and rates of entanglement

(g) Progress in including information in national progress reports

(h) Methods to estimate bycatch based on genetic data

(i) Review information and methods to estimate mortality from shipstrikes, including results from vessels, report of the IWC Vessel Strike Data Standardization Group, summary of activities of IWC Conservation Committee, and relation of patterns of whale distribution to shipping lanes for assessing risk

(j) New information on evidence for ship strikes from histopathology

(k) Methods for assessing mortality from acoustic sources and marine debris.

10.2 New items

One new item was proposed for next year's agenda, bycatch of large whales in longline fisheries. Other topics may emerge intersessionally.

11. ADOPTION OF REPORT

The report was adopted 2:15 pm on 13 May 2007.

REFERENCES

Baker, C.S., Cooke, J.G., Lavery, S., Dalebout, M., Ma, Y-U., Funahashi, N., Caraher, C., and Brownell, R.L. 2007. Estimating the number of whales entering trade using DNA profiling and capture-recapture analysis of market products. *Mol. Ecol.* in press.

International Whaling Commission. 2005. Report of the Scientific Committee. *J. Cetacean Res. Manage.* 7(Suppl.):1-391.

International Whaling Commission. 2007. Report of the Scientific Committee. *J. Cetacean Res. Manage* (suppl.) 9:1-401.

Neilson, J.N. 2006. Humpback whale (*Megaptera novaeangliae*) entanglements in fishing gear in northern Southeastern Alaska. M.S. Thesis, University of Alaska Fairbanks, Fairbanks, AK. 118 pp.

Robbins, J. and D.K. Mattila. 2001. Monitoring entanglements of humpback whales (*Megaptera novaeangliae*) in the Gulf of Maine on the basis of caudal peduncle scarring. Unpublished report to the Scientific Committee of the International Whaling Commission: SC/53/NAH25.

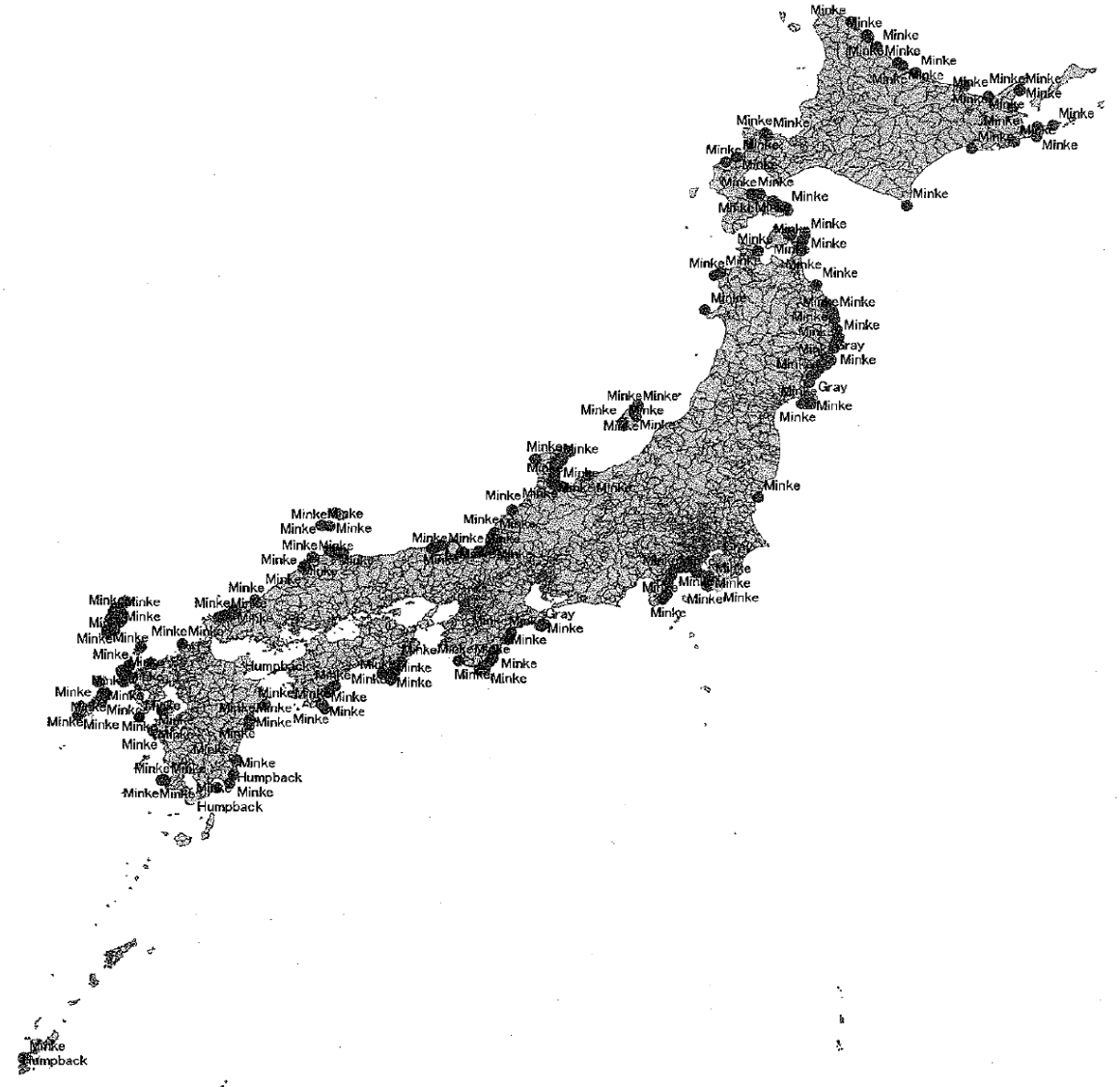

Fig. 1. Locations of bycatches of baleen whales in set nets in Japan since July 2001. Data from stranding records of Institute of Cetacean Research.

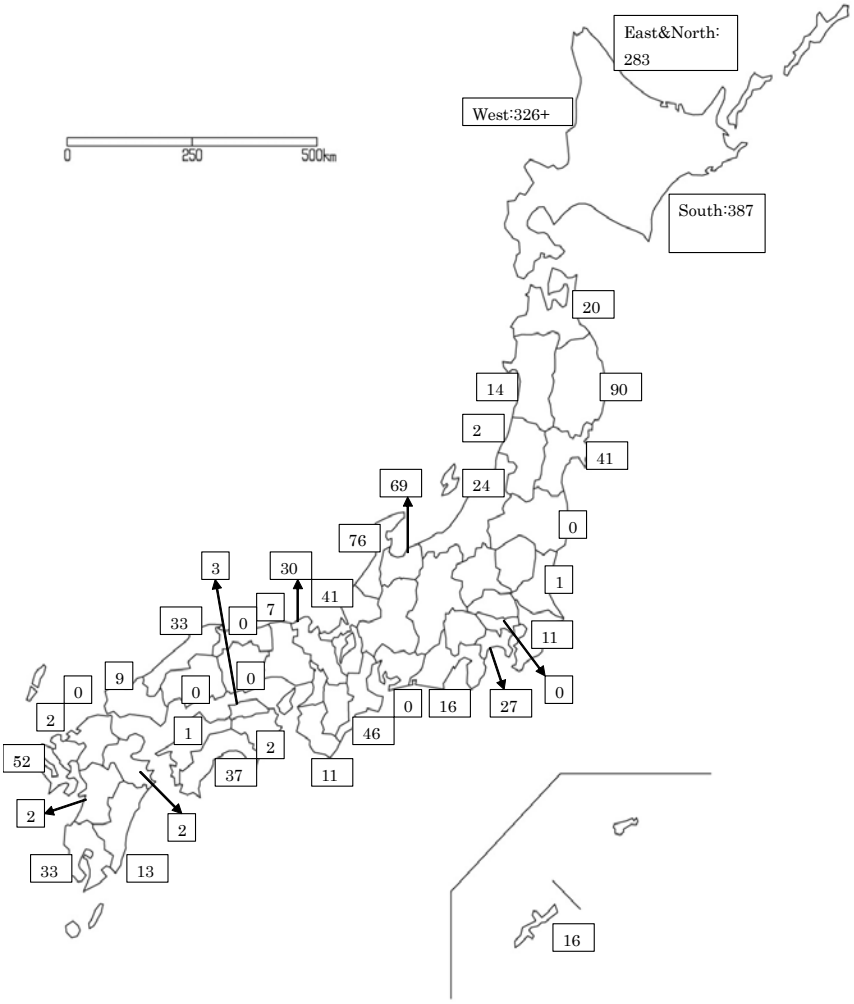

Fig. 2. Number of set nets by prefecture in Japan, set at less than 27m depth. Data from “Chart showing the position of set net fisheries” 6101-6117, published by Japan Coast Guard, Dec 2004-Jun 2006.

Figure 3. Locations of major fish markets for whale meat/products in Japan. Only markets individual customers can shop. Not comprehensive. From several guidebooks for fish markets in Japan; checked by Funahashi.

Appendix 1

AGENDA

1. Convenor's opening remarks and Terms of Reference
2. Election of chair and appointment of rapporteurs
3. Adoption of agenda
4. Review of documents

5. Information and methods to estimate bycatch based on fisheries data and observer programs.
    - 5.1 Collaboration with FAO on collation of relevant fisheries data
    - 5.2 Progress on joining the Fishery Resource Monitoring System (FIRMS)
    - 5.3 Feedback on EU bycatch monitoring scheme.
    - 5.4 Modelling approaches to determine appropriate levels of observer coverage.
        - 5.4.1 EU
        - 5.4.2 Other
    - 5.5 Entanglement
        - 5.5.1 Information to be gained
        - 5.5.2 Review methods of determining survival of released entangled whales
        - 5.5.3 Reliability of eyewitness reports
        - 5.5.4 Estimating risks and rates
        - 5.5.5 Other
    - 5.6 Project GloBAL and other global and regional bycatch projects
    - 5.7 Progress in inclusion of information on gear type for bycatches reported in National Progress Reports
    - 5.8 Other

6. Methods to estimate bycatch based on genetic data
    - 6.1 Progress on intersessional work related to market sampling
    - 6.2 Plans for 2nd workshop: scope, need and timing
    - 6.3 Other

7. Review of information and methods to estimate mortality from ship strikes.
    - 7.1 Results from data collected on vessels
    - 7.2. Report of the IWC Vessel Strike Data Standardization
    - 7.3 Summary of activities of Conservation Committee on ship strikes
    - 7.4 Progress on 2006 SC recommendations
        - 7.3.1 Update of data on ship strikes in Italian waters.
        - 7.3.2 Applicability of histopathology techniques to explore fat embolism associated with exposure to sonar and/or collisions with vessels?
        - 7.3.3 Are gas bubble lesions assessing current collision risk and new development of port and ferry routes.
        - 7.3.4 Relation of patterns of whale distribution to shipping lanes for
    - 7.5 Other

8. Methods for assessing additional mortality from other causes.
    - 8.1 Acoustic sources
    - 8.2 Marine debris

9. Other
10. Work plan
    - 9.1 Carry-over items
    - 9.2 New items
11. Adoption of report

Appendix 2

REPORT OF THE IWC VESSEL STRIKE DATA STANDARDIZATION GROUP

Koen Van Waerebeek[1] and Russell Leaper[2] (compilers)

Email group members

Robert Brownell, Renaud de Stephanis, Naoko Funahashi, Pierre Gallego, Miguel Iñiguez, Giancarlo Lauriano, Russell Leaper, David Mattila, Simone Panigada, Michela Podesta, Fabian Ritter, Teri Rowles, Koen Van Waerebeek (convenor), Mason Weinrich.

Background

During the IWC/58 Annual Meeting in St. Kitts & Nevis, the Scientific Committee established a group to prepare a standardized database template to record vessel collisions with cetaceans, with the ultimate aim of developing a global data repository. The Commission also endorsed the recommendation from the Committee. KVW was appointed convenor of the "Vessel Strike Data Standardization Group", an intersessional Email group that would report back to the SC at IWC/59 (the present report).

Although there have been previous attempts to draw together international data on collisions between whales and vessels (*e.g.* Laist *et al.* 2001; Jensen and Silber, 2003; Van Waerebeek *et al*., 2006) these authors had to spend considerable effort in collating information from varied sources, interpreting differing definitions for apparently the same variables. Current sample sizes are also small and biased towards those areas and countries where reporting systems currently exist (*e.g.* Weinrich, 2005; Félix and Van Waerebeek, 2006). Laist *et al.* (2001) and Jensen and Silber (2003) combined found 294 records of collisions between vessels and large whales of which 47 provided information on the vessel speed estimate and the severity of injury to the whale (Vanderlaan and Taggart, 2006). Van Waerebeek *et al.* (2006) in a preliminary review identified 78 collision records with small cetaceans worldwide.

The obvious utility of a global database of vessel strike events has been raised in several technical papers (*e.g.* ACCOBAMS, 2005; Van Waerebeek *et al*., 2006). The CMS/ACCOBAMS Workshop on Large Whale Ship Strikes in Monaco in November 2005 made a specific recommendation for the development of an international database. Currently available estimates of collision rates are thought to not reflect true incidence of mortality and severe trauma, both due to significant underreporting but also because hits by large vessels often remain unnoticed by crew members (Panigada *et al.,* 2006; Félix and Van Waerebeek, 2005). A comprehensive database with both biological and vessel information could hopefully be used to model specific probabilities of collision and of bow-draping (where the whale becomes stuck on the bow), hence allow better estimates of true mortality rates, as well as point to causative factors and unsuspected global hotspots of collisions.

The SC considered that in the first instance, particular attention should be given to the standardisation of variables and data quality control before proceeding with a discussion of organisational issues like how an actual database would function, its access and overview.

Terms of reference

The Vessel Strike Data Standardization Group's terms of reference were "to develop a process by which data provided from a range of sources could be stored in a database in a standardised way that clearly identifies the level of (un)certainty in the data. However, there is at this stage no decision on how and by whom such a database would be operated. A report will be available for review by the SC at IWC/59 and this will include a proposal for a draft structure of a ship strikes database".

Methodology

Initially the work of the group consisted in drafting and agreeing on a set of necessary parameters that can accurately document both biological and maritime aspects of collision events. A list was compiled containing 143 variables arranged in ten categories (status, specimen onshore/at sea, collision time/space, incident at sea, environmental conditions, vessel information, navigation info at collision, general navigation info, whale stuck on bow, report vessel) that typify each vessel strike record. The group recognized that in the majority of cases, data on many of these parameters would be incomplete. However, it was felt useful to maintain a comprehensive list to ensure that as much information as possible was recorded. Leaper created an initial relational database design in Microsoft Access based on this list of parameters for consideration by the group. Comments from group members were incorporated into the version now available from the Secretariat. I will be posted on the IWC website. The main focus of the design was on collecting and storing information in a way that would allow easy extraction of data relevant to the priorities of the IWC in the future.

Database design

A key element of the MS Access database design is the use of standardised lookup tables wherever possible to allow for simple queries based on these categories. An important consideration is also that there may be multiple reports of the same event. For example an incident may be reported at sea, the carcass may be subsequently spotted by a passing ship and later strand on shore. In some circumstances such duplicates may be identified with certainty, in others there may only be weak evidence linking different observations. The thinking behind the database structure is that each incident at sea resulting in a reported interaction between a whale and a vessel has a unique record number. This is linked to other records with particular information according to the structure in figure 1. For the sake of a simple database design it was assumed that a specimen stranded on shore would only be entered into the database once and that an incident at sea would also be entered only once. However, the database allows for multiple reports of floating carcasses or injured animals seen at sea.

There still remains an issue of assigning links where these are not certain. For example, if several strandings occur in a period following an observation of a carcass at sea there may be some uncertainty which, if any, of the strandings resulted from the at sea carcass. If the database is to be used to estimate total mortality from vessel collisions then these issues will need to be addressed. The problem is somewhat similar to mark-recapture estimates with uncertain matching. Where there is any doubt that separate reports were from the same incident, the user is asked to

create a new record. If subsequent examination shows these records to be duplicates then that is easily handled in the database. The opposite case of reports being incorrectly included as the same incident is much more difficult to unravel.

The database consists of five separate raw data tables plus some lookup tables for contact details, vessel details and species names. The raw data tables are Record Manager which contains a unique record for each potential incident with links to other reports in Incident at sea, Specimen on shore, Specimen at sea and Whale stuck on bow tables. The current complexity of the data entry forms may be off-putting to people without a scientific background. However, if desirable, it would be possible to generate simpler versions of these forms that still fed into the same main database structure. Further work is also planned to generate additional pop-up guidance notes for each data entry field. An example of one of the data entry forms (Specimen on shore) is shown in figure 2.

Global database

Obviously a discussion at some point should evolve (involving *e.g.* IWC, CMS-ACCOBAMS, IMO, SPREP,3 *etc.* as well as individual IWC Parties) on whether a centralised global database will be established, or whether there should be a series of regional, or even national, compatible databases. Either way, combining data sets will be greatly facilitated by using the same basic design. Nonetheless, the most appropriate approach appears to be having an intergovernmental organization to act as a formal repository for a global database. The main argument for the IWC to assume this role is its specialist Scientific Committee. However, not all maritime nations are IWC Parties and non-members may not be able, or willing, to contribute with vessel strike data. The International Maritime Organization (IMO) as a UN convention has the advantage of global membership but does not have a scientific committee nor a tradition of managing similar databases. CMS would also be hampered by the fact that some of the most important maritime nations with large fleets are not CMS Parties. National data subsets of incidents in EEZ zones could be compiled in the internationally agreed format ensuring full compatibility between subsets, and checked for accuracy by respective national authorities or regional IGOs (eg. ACCOBAMS for the Mediterranean). The subsets could then be submitted to be added to the global database after its managers have verified standardization and general compatibility.

Acknowledgements

The Austrian Government and the IWC supported work by KVW. RL was supported by IFAW.

References

ACCOBAMS. 2005. Report of the Workshop on large whale ship strikes in the Mediterranean Sea. Joint ACCOBAMS/Pelagos Workshops on fin whale and collisions, Monaco, 12-15 November 2005. ACCOBAMS Secretariat. 34pp.

Felix, F. and Van Waerebeek, K. 2005. Whale mortality from ship strikes in Ecuador and West Africa. *Latin Am. J. Aquat. Mam.* 4:55-60.

Jensen, A. S. and Silber, G.K. 2003. Large Whale Ship Strike Database. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-OPR-. 37 pp.

Laist, D. W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. 2001.Collision between ships and whales. Marine Mammal Science 17(1):35-75.

Panigada, S., Pesante, G., Zanardelli, M., Capoulade, F., Gannier, A., Weinrich, M.T. 2006. Mediterranean fin whales at risk from fatal ship strikes. Marine Pollution Bulletin 52: 1287-1298.

Vanderlaan, A. S. M. and Taggart, C.T. 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. Marine Mammal Science 23(1): 144-156.

Van Waerebeek, K., Baker, A.N., Félix, F., Iñiguez, M., Sanino, G.P., Secchi, E., Slocum, G., Sutaria, D., van Helden, A., Wang, Y. 2006. Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere: building a standardized database. Paper SC/58/BC6, submitted to Scientific Committee, 58th Annual Meeting of IWC, St Kitts, May-June 2006.

Weinrich, M.T. 2005. A review of collisions between whales and whale watch boats. Paper SC/57/WW8 presented to the IWC Scientific Committee, May 2005 (unpublished). 7 pp.

Footnotes:

[1] Head of scientific delegation for Federal Public Service - Public health, Food chain Security and Environment, International Affairs, Brussels, Belgium. Email: cepec@speedy.com.pe

[2] International Fund for Animal Welfare, UK

[3] SPREP: South Pacific Regional Environment Programme (See http://www.sprep.org/sprep/about.htm)