

Annex J

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

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1. CONVENERS OPENING REMARKS AND TERMS OF REFERENCE

Berggren welcomed the participants and noted that the Commission has instructed the Scientific Committee that catch limits calculated under the Revised Management Procedure (RMP) shall be adjusted downwards to account for human-induced mortalities caused by aboriginal subsistence whaling, scientific whaling, whaling outside the IWC, bycatches and ship strikes. Further that each such adjustment shall be based on an estimate provided by the Scientific Committee of the size of adjustment required to ensure that total removals over time from each population and area do not exceed the limits set by the RMP. In order to address this task the Terms of Reference given in Appendix 1 has been developed by the Scientific Committee convener group. Further, the task primarily applies to areas where the RMP is likely to be implemented, the northeast Atlantic and the western North Pacific.

2. ELECTION OF CHAIRPERSON AND APPOINTMENT OF RAPORTEURS

Berggren was elected Chair. Northridge and Leaper agreed to act as rapporteurs.

3. ADOPTION OF AGENDA

The adopted Agenda is given as Appendix 2.

4. REVIEW OF DOCUMENTS

The following documents were relevant to the sub-committee: SC/58/BC1-8, SC/58/BRG12, Fernandez *et al.*, 2005 [SC/58/For Info 8], Panigada *et al.*, 2006 [SC/58/For Info 12], Baker *et al.*, 2006 [SC/58/For Info 34].

5. ESTIMATION OF BYCATCH BASED FISHERIES DATA AND OBSERVER PROGRAMMES

5.1 Co-operation with FAO on fishing fleet data and the Fishery Resources Monitoring System partnership (FIRMS)

Intersessional progress on data sharing with FAO has proceeded steadily. Allison visited Rome in December 2005 to participate in the Technical Working Group of the FIRMS partnership. The appropriate memorandum of understanding have been drawn up but these await signatures, pending a further elaboration of the data structures that are required for the IWC to provide bycatch data in an appropriate format for inclusion into the FIRMS data structure.

This year National Progress Reports of bycaught whales have been augmented by the inclusion of a description of the gear category involved in the bycatch event, according to FAO gear descriptors. This will make linking records of whale bycatch with the FAO fishery inventory much easier, though much work remains to be done to see exactly how successful this linkage will be.

Northridge is working on elaborating the links between the data held by the IWC and those of the FAO fishery inventory. The primary issue is to be able to associate bycatches reported to the IWC with the fisheries that are described in the FAO's global inventory of fisheries. Now that gear category and target species are provided in national reporting forms for whale bycatch events this should be possible, but it remains to be determined how easy it will be. Furthermore, any attempt at retrospective linkages using data from previous years Progress Reports, will require some assistance from members of the Committee who have authored meeting documents relating to bycatch events or those responsible for compiling National Progress Reports.

The sub-committee **recommended** that this work should be continued intersessionally.

5.2 Review progress on standardising reporting in Progress Reports

The sub-committee welcomed the provision of more detailed information in the National Progress Reports of most member states, enabling a clearer understanding of the fisheries involved in whale bycatch events. The sub-committee **recommended** that the target fish should be identified by scientific name, at whatever is the appropriate taxonomic level, to avoid confusion among common names. The sub-committee also recognised that because there have been a number of changes to the format of the annual reporting form in recent years, some anomalies in the layout had crept in. For example, some redundant items were left in the form, while an additional column for the number of animals reported would help to minimise the number of rows that need to be completed in the bycatch table. The sub-committee **recommended** use of the revised template in Appendix 3. Tables for 'Non-natural mortalities' (6.2) and 'Strandings or dead whales encountered at sea' (6.2.1) have been removed as these have been superseded by tables for

Ship Strikes (6.2.2, now 6.2.1) and Bycatches (6.2.3, now 6.2.2). An additional column for the number of animals involved has been added in each case. It was also **recommended** that an additional code for derelict fishing gear be added to the list of fishing gears.

5.3 Information on new European Union bycatch monitoring schemes

Northridge reported to the sub-committee that under European Commission Regulation 812/2004, EU Member States are required to monitor certain fisheries so as to ensure that they are able to provide accurate estimates of bycatch. To achieve this, minimum sampling levels of 5% in certain fisheries, and 10% in others, are stipulated in the Regulation. These levels appear to be arbitrary and are intended to enable member states to acquire sufficient information on underlying bycatch rates in order to design more rigorous sampling protocols in the years to come.

Progress in implementing the monitoring aspects of regulation 812/2004 needs to be reported to the European Commission by June 1st of 2006. At present it is not possible to say how well Member States have met the targets laid down in the Regulation, but the Working Group on Marine Mammal Ecology (WGMME) which met at ICES headquarters in Copenhagen, Denmark from 30 January - 2 February 2006, has reviewed progress in work to address the regulation requirements up until that time. The WGMME provided an overview from Member States tabulating their intended levels of monitoring over the coming year, broken down by each of the fisheries that are stipulated in the regulation. Over 100 days of observation are planned by Member states over the next year. This information is available in the WGMME 2006 Report at the ICES Website (www.ices.dk)

It should be noted that the sampling requirements are restricted to gill/tangle net fisheries and to pelagic trawls. While both of these fishing methods have been known occasionally to entangle large whales, in northern Europe a greater number are likely to become entangled in lobster pot lines (see previous years reports of large whale entanglements in the Northeastern Atlantic), and there are no requirements to monitor such fisheries. It should also be noted that EC Reg 812/2004 does not specify any monitoring for EU distant water fleets which include longliners, pelagic and demersal trawlers and purse seiners.

5.4 Methods to determine appropriate observer coverage levels needed in a fishery to estimate bycatch

There had been no new papers presented on this topic this year, but it was noted that this issue was on the agenda of member states of the European Union, when implementing the monitoring aspects of regulation 812/2004. It was suggested that members of the sub-committee involved in such schemes might report back to the sub-committee next year.

5.5 Other

SC/58/BC2 reviewed what is known about the entanglement of large whales in lost or abandoned (ghost) fishing gear through a search of the literature and examination of official reports in the U.S. over the past ten years. Laist (1996) listed reports of six species of large whale entangled in marine debris, but the determination was inferred from records listing rope and net of undetermined origin, and the author did note that the status of the gear was unknown at the time the whale encountered it. Indeed, although a high percentage (20% or more) of rope and net reported on or removed from large whales in the U.S. is of undetermined origin, in only one recent case was it clearly determined to be marine debris. Without better methods to determine the origin and status of the material that entangles whales, the percentage that is ghost gear will remain unclear. However, it was noted that some ghost fishing gear can continue to 'fish' as designed for several years and as such will continue to represent a component of the overall risk of entanglement for whales in a given area. Some fishing gear, that might not pose a risk while actively fished, can become a risk when lost or abandoned. In addition, fishing gear that becomes derelict in one area may drift thousands of miles from its point of origin, to become an unpredicted threat in another area. Some whales may become entangled in both actively fished and ghost gear through intentional interaction (e.g. play), and that this may be one of the mechanisms by which animals can become entangled on migratory routes and breeding grounds when they are presumed to be at lower risk due to the reduction in feeding and the often improved underwater visibility.

During discussion, the sub-committee noted that deciding what was derelict fishing gear and what had been actively fishing when entanglement occurred is not necessarily straightforward. Mattila suggested that in some cases, where debris attached to a whale was clearly of foreign origin and from an area where the whales would not be expected, it could be inferred that the debris had drifted into contact with the whale. In other cases encrusting growth on the ropes might point to the same conclusion, though some ropes are known to have remained on individual whales for years.

SC/58/BC7 gave a synthesis of new evidence that baleen whales are extraordinarily susceptible to oral entanglement. That evidence indicates that a hydrostatic oral seal probably is a critical locomotor adaptation in all mysticetes as it enables the maintenance of mouth closure by means of suction rather than muscle contraction (Lambertsen and Hintz, 2004; Lambertsen *et al.*, 2005). It was argued from basic principles of fluid dynamics that any permanent breach of the oral seal identified would result in impaired locomotor performance, depletion of energy reserves, reproductive failure, and death. This substantiated the contention of Kraus *et al.* (2005) that entanglement-related mortality in the North Atlantic right whale is being underestimated. Mattila noted that he knew of several right whales that had survived for several years with ropes in their mouths. It was further noted that small lines may depress the skin and need not necessarily break the oral seal.

The sub-committee welcomed this information. It **agreed** that it would be useful to gather data on survival rates of whales with entanglements to the mouth and **recommended** that the agenda for next year's meeting include consideration of survival rates of entangled whales. The sub-committee noted that the U.S. National Oceanographic and Atmospheric Administration (NOAA), U.S., is planning to hold a workshop in November 2006 to look at the bases for determining serious injuries in whales. The sub-committee looked forward to reviewing the report of this workshop at next year's meeting.

6. ESTIMATION OF BYCATCH BASED ON GENETIC WORK

6.1 Review of Intersessional work related to market sampling

6.1.1 Data from market surveys

Following the Workshop on Market Sampling that was held in Ulsan in 2005 (IWC, 2006), Williams was tasked with describing the structure of the Japanese market for whale meat in order to assist in the development of a sampling design for markets in Japan to reduce potential sources of bias.

SC/58/BC3 described the results of a series of structured interviews of key sources working in whale meat marketing in Japan. Interview results were cross-checked with other sources by a process of triangulation. All interviews were conducted in strict confidence. Further information was obtained opportunistically from other participants in the trade as the opportunity arose and through direct observation. Official publications were also consulted for statistics on whale meat consumption by region.

Results from the interviews, and from the official statistics, suggest that consumption is most important in the Osaka and Tokyo areas, as well as northern Kyushu. Traditional whaling towns and adjacent areas are also important on a per capita basis. Different regions have different histories of whale meat consumption and consequently have different preferences for the cuts of meat and cooking styles. The main outlets for whale meat are the department stores and larger supermarkets, with restaurants coming second and the school lunch programme third. The major consumers appear to be people in their 50s and 60s, who grew up at a time when whale meat was more widely consumed and promoted when other meats were more scarce. According to Williams, among younger Japanese people there seemed to be little awareness of domestic whale meat consumption at all. Around 50% of whale meat is consumed fresh, 40% is consumed as processed product (such as whale bacon) and 10% is consumed by the school lunch programme. Processed whale meat, which traditionally included much canned product is being augmented by the development of new processed products, such as low fat whale meat with vegetables and sauce in retortable foil pouches. Some of these new products may not be listed in official statistics.

Prices for whale meat are considered high by most people, though wholesale prices have declined in recent years, as supply has increased. There are attempts to increase demand through promotion of whale meat as a healthy alternative to beef and other meats. Kyodo Senpaku, Tokyo, has opened two new shops as a promotional effort to help increase sales volume and for market research.

Aside from any regional structure to the market, some seasonal affects were also determined. Festivals were targeted as a possible period of high consumption, but a poor correlation was found between whale festivals and whale meat consumption: such festivals do not appear to be linked to any local increased consumption of whale meat. Indeed seasonality does not seem to be an important factor in retail sales outside of Osaka. The major distribution routes were described from six primary sources (including traditional whaling, bycatches and the government research program). Different sources and different species have different pathways into the market. The distribution of by-caught whale meat suggests that the preferred routes for sale are via the whaling communities or via the wholesale markets (Port and/or Central) near to major whale meat consumption areas. The implication for sampling for by-caught whale meat is that port and city wholesale markets in or near whaling communities and major consumption centres should be included. SC/58/BC3 concluded by suggesting that it would be useful to map out the locations of whale entanglements (see below), and also to determine how and where these whales had been disposed of. Archived newspaper articles are useful for this.

Williams confirmed that the original notes are confidential to protect the anonymity of sources, but that some summary information could be made available to the Committee. The distribution pathways are not particularly complex, and follow those for general seafood distribution. Nevertheless, Bass reported that there are now increased Internet sales of whale meat. Bass also reported that many of the canned products were code-stamped to indicate the species and area of origin of the product, which might help in implementing a sampling programme. Fresh meat is usually distributed locally, whereas frozen or processed whale meat can end up anywhere in within Japan.

Brownell questioned whether or not bycaught whales were deliberately caught, but Williams pointed out that trap nets are very expensive structures and that a whale entering one might cause a considerable amount of damage and cost to the owner. With no official compensation for such damage, the sale of an entrapped whale may offset the costs of the damage to a greater or lesser extent.

The sub-committee discussed the observation made by Williams during his visit to Japan, that people within the trade reported that a substantial amount of whale meat was coming into the country, and notably into Fukuoka, from neighbouring Korea. Taiwan was also mentioned as a possible external source of whale meat.

Williams stated that different parts of the same whale would be likely to end up in different distribution networks, with some cuts of meat going to fresh meat sales and other parts for processing. The exact distribution would depend on a number of factors including the species, the freshness and the location. Processors do not and cannot rely on bycatches as these are sporadic, whereas frozen blocks of meat from the Antarctic are more reliable and make for simpler processing. Frozen whale meat can be stored for many years, but is not necessarily sold frozen at the retail level, but is more likely to be thawed out in small amounts as required. There are in addition about 50 processed products that are to some extent geographically dependent, as there are geographical preferences for the different products.

Funahashi confirmed that geographical distribution patterns are hard to describe, because although traditional whaling areas may consume more whale meat per capita, bycatches are not limited to traditional whaling areas. Bycatches may be consumed locally, but can also end up anywhere in the country.

The number and extent of retail outlets should be available in official statistical publications, which could be accessed for example through University libraries.

Kasuya noted that whale movements and transport patterns can change very quickly and advised that William's report should clearly state the time period for which the data were applicable, as things may be rather different in a few years time.

In response to the recommendation from the Initial Workshop in Ulsan (SC/57/Rep 4) that bycatch locations should be mapped, Funahashi produced a map of the distribution of whales reported to have been bycaught in Japanese waters, from July 2001 to September 2005. This is reproduced in Figure 1. The map shows that certain communities appear to have a higher bycatch rate than others. Funahashi suggested that these geo-referenced data might be used to link the catch location to the nearest market, and that the distance to the nearest large town or major whale consumption area could also be calculated. She suggested that these data, with further processing, might be useful in parameterising simulation models of whale meat distribution. Perrin commented that it would also be useful to determine the number of trap nets in each of the areas highlighted in Figure 1.

Funahashi also presented Baker *et al.* (2006) [SC/58/ForInfo34], in which the genetic analysis of cetacean meat products purchased in Korean markets between February 2003 and February 2005 is described. The majority of major whale meat outlets in Pohan, Busan and Ulsan were sampled over the

two-year period. DNA extractions from the whale meat products and subsequent PCR amplification were conducted in Korea. Amplified products were isolated from native DNA by biotin labelling of one primer and binding to streptavidin-coated plates. Species-origins of the samples were then determined using the usual phylogenetic methods. A total of 368 products were purchased during nine surveys, of which 357 were identified as whale products and 11 failed to amplify and were not considered. Three species of baleen whales (Bryde's, minke and humpback whale) were identified and 12 species of odontocetes. The species distribution was then compared with the expected distribution based on the numbers of each of the species recorded in the Korean Progress Reports to the IWC, weighted by their approximate average body mass. A number of discrepancies between the official records of cetacean bycatches and what was being sold on the market were found.

Of the 15 species found in the market samples, four were not recorded in the official statistics. These were Bryde's whale, Cuvier's and Blainville's beaked whales and short-finned pilot whales. Several other species were present either in greater or lesser numbers than expected from the official records. Finless porpoises and false killer whales were over-represented in the market samples and under-represented in the official statistics, while the opposite was true for common dolphins. Two Baird's beaked whales and a fin whale were reported in the official statistics and were not found in the market samples.

These discrepancies could have been caused by a number of factors. It is possible that the fin whale and the Baird's beaked whales were simply missed because sampling was not intensive enough. Kim queried the possibility, based on biological grounds, that Bryde's whale bycatch occurs in Korean waters. He would investigate this by checking the reporting system and other sources. Kim noted that the Korean reporting system has been initially focused mainly on the recording of minke whales for conducting assessment work by the Committee for providing management advice. Some of the discrepancies in the small cetacean records might be due to some missing records in the Korean National Progress report compared to the official records. Simmonds asked whether Baird's beaked whales or fin whales were particularly sought-after, but Funahashi replied that beaked whale meat was not a particularly attractive product, and in any event whale meat was generally sold simply as whale meat.

6.1.2 Initial simulations for testing market sampling design

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. SC/58/BC8 describes a simple simulation model developed in order to evaluate the bias and precision of mark-recapture methods for estimates of bycatch based on market surveys. The model allowed for variable pathways and timing of products through the market from wholesale to retail level. However, the simulation did not attempt to model detailed characteristics of specific whale meat markets. Results covering a wide range of simulated market scenarios showed that when the sampling level is sufficient, the estimation method using all of the recaptures yields consistent but invariably negatively biased estimates of the number of whales caught and marketed. The estimation method based on excluding within-survey recaptures produced estimates with less bias but greater variance. In addition, the bias of such estimates could be either positive or negative. Simulation results may also assist in designing survey sample sizes and survey frequency and also selecting the functional form for the length of time that products from an individual remain on the market.

The sub-committee discussed how this approach might be taken forward. Leaper suggested that it would be useful to explore certain parameters such as the geographical spread and the length of time that animals spend in the market and distribution system. On the other hand, he suggested that the results of these simulations would be relatively insensitive to the number of wholesale levels within the distribution network. The simulations had captured much of the realistic range of possibilities suggested by the qualitative understanding of market pathways in Japan presented in SC/58/BC3. The new information presented in SC/57/BC3 indicated a rather simpler market structure than had been assumed at the workshop last year. The sub-committee **recommended** that this work should be continued intersessionally.

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.

6.1.3 Planning for a follow-up workshop on the use of market sampling to estimate bycatch

At last year's meeting the Scientific Committee (SC) **agreed** that the planned follow-up workshop would be very valuable in order to evaluate whether market surveys would provide reliable estimates of bycatch. The SC also **agreed** that such a workshop would be more successful if progress had been made on addressing the data requirement needs, and on developing simulation frameworks for sensitivity analyses and to test sampling designs prior to the workshop. Before holding the follow-up Workshop the following tasks were first to be completed:

(1) Improve information on pathways for markets through short contracts to market experts to conduct appropriate studies to address the data needs outlined in section 8 of the report of the Workshop on Market Sampling held in Ulsan in 2005 (IWC, 2006).

At this year's meeting, SC/58/BC3 had addressed this and provided updated information on market pathways in Japan from intersessional research carried out.

(2) Improve classification and estimates of number of wholesalers and outlets according to the data needs outlined in section 8 of the report of the Workshop on Market Sampling held in Ulsan in 2005 (IWC, 2006).

No new information had been presented. However, according to SC/58/BC3, statistics on the number of retail and restaurant establishments in Japan could likely be obtained with further investigation.

(3) Collate available temporal and spatial information on bycaught whales destined for markets.

Some data on temporal and spatial distribution of bycaught whales in Japan was presented at this year's meeting (Figure 1).

(4) Conduct further concordance analysis between labelling and genetic identification of whale products.

At last year's meeting some data were presented. Funahashi continued the work intersessionally but new information was limited and would not change any of the conclusions based on the data presented in 2005.

(5) Simulation trials

(i) Conduct initial simulations to investigate the performance of different sampling designs and sensitivity to assumptions about market structure based on current knowledge.

SC/58/BC8 presented results on initial simulations to evaluate the bias and precision of using a mark-recapture method for estimating the number of bycaught animals entering a market over time. The results of the simulations also help in choosing survey intervals and sample sizes.

(ii) Based on results of initial simulations and improved data from items 1-4 above, specify the development of a simulation framework to be contracted to appropriate specialists. Such a framework would need to be adaptable to incorporate new data as they became available. In addition, the simulation framework would be intended to allow an iterative process to both identifying critical information needs and testing sampling designs. The simulation framework would be reviewed further at the follow-up Workshop and any suggested changes would be included.

The sub-committee noted that considerable progress had been made towards the objective of providing advice as to whether market-sampling-based methods can be used to reliably estimate bycatch for use in addressing the Commission's objectives regarding total removals over time. The best estimates of bycatch based on market data would be obtained if the work would be done in conjunction with DNA registers. Estimates from market surveys could be improved through a collaborative approach using a combination of official statistics and market surveys. If data from DNA registers were available then the statistical precision of estimates would be improved considerably and only a relatively low level of sampling would be required. In addition, market surveys would not need to be conducted continuously, particularly if the estimates were in agreement with the reported figures.

In the absence of data from the DNA registers there are possible options for obtaining bycatch estimates from market surveys that could be applied or developed further. One of the methods based on mark-recapture techniques was investigated by simulations (SC/58/BC8) and gave consistent but negatively biased estimates over a range of scenarios. Negatively biased estimates may still provide useful data in the context of the RMP. This could be in situations where there are no reported data, or for comparison with reported results. It appears that current understanding of markets is adequate for application of such methods.

Obtaining reliable unbiased estimates may require more detailed information on markets which could be developed further by holding a 2nd stage Workshop.

The 2nd stage Workshop would focus on the following aspects:

(1) Further research on markets:

(a) Quantitative description of market pathways. Although updated and improved information were presented at this year's meeting, additional information are needed to describe pathways in quantitative terms e.g. to include the number of whole sellers and outlets.

(b) More data on the length of time individual whales remain on the market in relation to different product types

(c) The geographic distribution patterns of different product types from initial source location to final retailer

(d) Further simulation trials of estimation methods based on improved market data. Such simulation trials would be based on specific market situations. Where uncertainties in the market data remained, the simulations would need to cover the range of possible scenarios.

The sub-committee **recommended** that considerable new data would have to be available before holding a 2nd stage Workshop. These data are unlikely to be available before next year's meeting. The sub-committee should review progress on intersessional work at next year's meeting and then decide on the need for, and the optimum timing of, the 2nd stage Workshop.

6.2 Analytical tests for assignment to stocks and/or areas

No papers were submitted on this topic.

7. ESTIMATION OF CETACEAN MORTALITY FROM SHIP STRIKES

7.1 Review report from the ACCOBAMS workshop on ship strikes

Panigada introduced the report of a workshop on large whale ship strikes in the Mediterranean Sea held jointly by CMS-ACCOBAMS¹ and Pelagos². The objectives of the workshop were (i) to synthesize the knowledge of ship strikes of fin, sperm, and other large whales in the Mediterranean Sea, and to place these in a global and local context; (ii) to determine data needed for a more comprehensive assessment of the issue; (iii) to discuss whether mitigation and management measures were necessary; and (iv) to discuss what mitigation and management measures might effectively be employed to address the issue.

Reporting and detection methods used to obtain estimates of strikes and mortality were discussed. These included reports from vessels and examination of carcasses. As has been frequently noted elsewhere, merchant ships would not be able to accurately report strikes unless the whale

¹ The Convention on Migratory Species (CMS) and the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS).

² The Pelagos Sanctuary is an agreement for a protected area in the NW Mediterranean Sea by France, Italy and Monaco.

lodged on the bow, as vessel crews are often unaware of collisions that take place. The fin whale was the species most frequently reported involved in collisions. These data were discussed by the sub-committee in more detail following the presentation of Panigada *et al.* (2006) [SC/58/ForInfo12]. Podestà indicated that in her database, six sperm whales out of 125 total strandings (4.8%) during 1986-2005 were animals that were likely killed by ship collisions. The 125 strandings occurred during a period when a large number of sperm whales were reported bycaught, thus the proportion attributed to ship collisions in this data is likely to underestimate the true ratio of ship strikes to natural mortalities.

The ACCOBAMS workshop had made the following recommendations related to estimating the number of ship strikes (the recommendations made by ACCOBAMS in relation to mitigation were not discussed by the sub-committee):

(a) *Test acoustic propagation models through seasons* to try and understand if there may be seasonal changes in the ability of whales to detect approaching vessels in time to avoid a collision.

(b) *Conduct thorough necropsies of carcasses to determine true cause of death.* This was viewed as critical in order to establish cause of death. Cetacean carcasses should be flensed to the bone wherever possible. Other methodologies for establishing whether collision injuries occurred pre- or post-mortem should also be investigated, including the histopathology methods. Data would then be reviewed by an expert panel for an unbiased and conclusive cause of death. Training for scientists conducting necropsies in all countries should be conducted to ensure consistency; a pilot program to do this is currently underway in France.

(c) *Undertake a feasibility study to examine whether information from cases where carcasses are lodged on bulbous bows can be used to model likelihood that struck whales become lodged and if this can be used to obtain estimates of true strikes.* While some workshop participants felt this was a very important and worthwhile effort, some felt this would be a very hard model to prepare, as it requires a lot of data and infers a large number of variables.

(d) *Interview captain and crews to obtain all information on known ship strikes using an agreed protocol.*

(e) *Conduct a feasibility study to assess the efficiency of dedicated observers to detect ship strikes* (this was also considered in the context of mitigation measures).

The sub-committee **endorsed** all these recommendations. In addition, some recommendations from the Workshop included projects where there may be collaboration between IWC Scientific and Conservation Committee, and the Secretariats of the abovementioned Agreements. Developing an international database of vessel strikes is critical, and these should also be interfaced to sighting databases (e.g. the ACCOBAMS sightings database that is currently under development). The Workshop also recommended that ACCOBAMS should liaise with the IWC on issues related to ship strikes and that the ACCOBAMS Secretariat should do everything possible to encourage all countries within the ACCOBAMS region to report all strikes, and the circumstances surrounding those strikes, whenever possible. The workshop further recommended that the ACCOBAMS Secretariat should investigate the most appropriate way in which it can bring cetacean issues to the International Maritime Organisation (IMO) and obtain relevant information from them. It was also suggested to liaise with the Ship Strike Working Group of the IWC's Conservation Committee in cases where IMO may be approached. The sub-committee **endorsed** these recommendations for joint work. During discussion it was also noted that the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS), another regional agreement under the Convention on Migratory Species (CMS), also routinely considers ship strikes. Wider collaboration with CMS might therefore be appropriate.

7.2 Other

SC/58/BC1 describes surveys aimed at evaluating the proportion of cetacean strandings in Italy between 1995 and 2005 that could be attributed to human induced mortality. Of 111 cetacean strandings, the cause of death was established in 70% of cases with 53% of mortality attributed to natural causes and 17% to human induced causes. Collisions with vessels, together with entanglement in fishing gear, represented the two most frequently encountered sources of human induced mortality. The authors noted that they had funding from the Ministry of Environment in Italy to provide a rapid investigation of future strandings of large cetaceans, but that this was limited to investigation along the Italian coast.

Data on fin whale ship strikes in the Mediterranean up until 2001 were presented in Panigada *et al.* (2006) [SC/58/ForInfo12] with an update on ship strike events in Italian waters between 2002 and 2005 in SC/58/BC4. The analysis in Panigada *et al.* (2006) [SC/58/ForInfo12] showed that out of 287 carcasses, 46 individuals (16.0%) were certainly killed by vessels. If records, including animals that were presumed killed by vessels, and large specimens when no species was listed, were included then this percentage rose to 20%. Over 80% of the strike events were reported in or adjacent to the waters of the Pelagos Sanctuary. Gender was identified in 26 incidents of which 19 were male. Analysis of a catalogue of 383 photo-identified whales showed that 9 (2.4%) had marks that were attributable to a vessel impact that the whale had survived. The mean annual number of whales killed due to vessel strikes was estimated as a minimum of 1.43 individuals. For the population estimate of Mediterranean fin whales of 3,583 individuals this would suggest a minimum annual mortality of 0.0004. The estimated mean annual collision mortality rate for the Pelagos Sanctuary, Gulf of Lyon and adjacent waters is three times higher than for the Western basin of the Mediterranean as a whole. Collisions are more frequent between April and September than between October and March. The seasonal peak could be related to levels of vessel traffic, whale abundance and foraging behavior, or a combination of these factors. Almost half of the known cases involving fatally struck fin whales were found lodged on the bow of the ship. In the majority of these collisions the whale was discovered only once the vessel was in port, suggesting that in cases where the carcass did not become lodged, or fell off prior to arrival at the ship's destination, the strike could have gone unnoticed. Many of these whales showed no noticeable external lesions, confirming that such fatalities might be missed if complete necropsies are not performed regularly. Such complete necropsies are also critical to ascertain whether the collision occurred after the whale was already dead. The sub-committee **recommended** that collection and analysis of data on fin whale collisions due to vessel strikes in the Mediterranean should continue.

It was noted that high speed ferries were introduced into the area in 1996. In the six years following that period they accounted for almost 50% of total collisions. However, no significant difference was found in the total annual number of fatal ship strikes before and after this period. The sub-committee noted the further data presented in SC/58/BC4 and **recommended** updating the statistical analyses with the new data. 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. Ritter commented that in the Canary Islands there had been a substantial increase in the number of collision incidents following the introduction of fast ferries. Urban noted that there is also

a resident population of fin whales in the Gulf of California. In that area, out of a catalogue of 350 photo-identified whales, 4 show scars from propellers. It was noted that there was less traffic of large ships in the Gulf of California compared to the Mediterranean.

Fernandez reported on a study of lesions associated with gas bubbles and fat embolism in stranded beaked whales (Fernandez *et al.*, 2005 [SC/58/ForInfo8]) and suggested that fat embolism in the lungs may be indicative of ante-mortem trauma, such as collision with a vessel. The sub-committee **recommended** further work on the histopathology techniques described by Fernandez (see Annex K item 6.2) that might help to determine whether recovered carcasses had been struck by a ship pre- or post-mortem. In particular, investigation of whether these techniques were applicable to baleen whales was **recommended**. The intersessional group formed by the Standing Working Group on Environmental Concerns to examine necropsy procedures should also include ship strikes within its remit. The sub-committee also **recommended** the examination of bycaught whales for such lesions in order to determine how symptomatic they are of particular events such as exposure to sonar or collisions with vessels.

Collisions between ships and cetaceans in Spanish waters were analysed in SC/58/BC5. Collisions with sperm and fin whales have been reported from the Straits of Gibraltar which has a very high level of maritime traffic with more than 90,000 vessel transits annually. Data on sperm whale density in the Straits of Gibraltar indicate that new shipping routes to a port due to open in 2007 in the north of Morocco will cross areas of highest sperm whale density. A total of 37 strandings with indications of vessel collisions have been recorded in the Canary Islands between 1985 and 2005. In the Canary Islands, fast ferries began operating in 1999 and 30 out of the 37 reports have occurred since then. Following a collision between a jet foil and a sperm whale in 1999 in which a passenger died, a forward looking sonar system was installed to detect whales. No further collisions were reported from this vessel which was withdrawn in 2005. None of the fast ferries currently operating around the Canary Islands have been equipped with forward looking sonar to detect whales.

The sub-committee **recommended** studies relating patterns of whale distribution to shipping lanes and high use shipping corridors for assessing both current collision risk and likely future risks related to new port and ferry route developments around the world.

Work to build a world-wide standardised database of vessel collisions with cetaceans was described in SC/58/BC6. The initial research had focussed on the Southern Hemisphere and a total of 248 cases of reported vessel collisions had been compiled and reviewed. These reports varied greatly in terms of the quality of evidence, sources, details and degree of authentication. The authors propose 25 standardised parameters for a dataset template. This includes a 'probability tag' that categorises the likelihood of vessel strike as evaluated by the original reporter. Ship collisions have definitely accounted for the deaths of southern right, blue, sei, fin, Bryde's, humpback and sperm whales in the Southern Hemisphere and 19 species of small cetaceans world wide. Based on analysis of strandings of southern right whales in South Africa, an estimated 20% of mortality has been attributed to vessel collisions (Best *et al.*, 2001). Elsewhere, small sample sizes and lack of data generally preclude such estimates.

Van Waerebeek drew attention to the report of the Conservation Committee Ship Strikes Working Group. One of the recommendations from this group is the development of a single international database of collisions between whales and vessels along the lines developed in SC/58/BC6 for the Southern Hemisphere.

The sub-committee **agreed** that development of such a database would be extremely valuable and that particular attention should be given to standardisation of information and data quality control. Van Waerebeek agreed to convene an intersessional email group on database issues. The terms of reference of the group would be 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 identified the level of uncertainty in the data.

Funahashi described a search of a database of news articles using key words such as 'whale', 'ship' and 'collision' in an attempt to investigate ship strikes in Japanese waters. A total of 21 incidents from Japan and two from Korea were identified, going back to 1978. The whale species involved had been identified in two of these incidents but the majority of the incidents were only identified as possible collisions with whales and were not confirmed. In addition, these reports only include incidents where there was damage to the vessel or injuries to passengers and so many collisions might not be included. Nevertheless, the sub-committee noted that the search of newspaper archives had revealed incidents that had not been previously identified and **recommended** similar searches in other areas.

Kim described measures in Korea established following a collision incident with a whale in 2004. The government has now established a system for reporting collisions, including genetic analysis of samples recovered from collisions. Observers have also been placed on the ferry route where the collision occurred.

Hyugaji noted that in most of the incidents with high speed vessels the causes of the collision have not yet been confirmed. The Ministry of Land, Infrastructure and Transport of the Government of Japan convened a working group in 2006. This working group (see www.mlit.go.jp/english/index) was established to ensure safe navigation and considers collisions between vessels and both whales and marine debris. Hyugaji also noted that although the work of this working group was largely outside the remit of IWC, the Government of Japan is making efforts to collect and review data on collisions with such vessels. Funahashi noted that her search of news articles had revealed 12 incidents from the last four years and that this number matched the number of incidents considered by the working group.

A preliminary analysis of anthropogenic scarring of western gray whales presented in SC/58/BRG12 indicated that 32 (23.1%) of the whales identified had visible scarring from an anthropogenic interaction, with 30 (20.0%) presumed to have been entangled in fishing gear at least once and three (2.0%) to have survived at least one vessel collision. The scarring patterns differed slightly to those observed in humpback and right whales, possibly related to different types of gear, and further analysis of scar determinations is planned. It was noted that photos in SC/58/O14 of a 6-7 month old gray whale calf entrapped in Japan showed healed scars that indicated that the whale had come into contact with some man made structure early in life. It was noted that there are several records of ship collisions with eastern Pacific gray whales and also that entanglement rates in this population show a bias towards young animals (Heyning and Lewis, 1990).

Mattila described recent data from Hawaii which showed an increase in the number of reported collisions between humpback whales and vessels in recent years. The reasons for this increase have not been determined but are thought to be related to an increasing population and better reporting by mariners following education and outreach programmes to mariners. In all the incidents, it was reported that the whale was not seen prior to the collision. In several incidents, the whale had been reported as apparently without serious injury and behaving normally. However, underwater

observations and photographs had subsequently indicated severe injuries. There are currently no fast ferry routes in the area, but one is planned to start operations next year.

The sub-committee welcomed these outreach programmes and **recommended** more such work both to encourage better reporting of collisions and to determine the effectiveness of outreach programmes in improving reporting. Mattila noted that evaluating the effectiveness of outreach efforts was very difficult but some follow-up studies were planned.

As in previous years, the sub-committee reviewed the information on ship strikes provided in National Progress Reports. It was noted that some known incidents were lacking and the sub-committee encouraged all efforts to include as much data as possible in Progress reports using the new template. The sub-committee also noted some sources of confusion in the information requested in National Progress reports and recommended some changes to the template (see Appendix 3). In particular, it is also useful if cases where there are no reports are also indicated rather than just leaving fields blank.

8. ESTIMATION OF MORTALITY FROM OTHER HUMAN ACTIVITIES

The sub-committee had a joint session with the standing working group on environmental concerns (see Annex K item 6.2). Fernandez described a study of lesions in a mass stranding of beaked whales in the Canary Islands following naval exercises (Fernandez *et al.*, 2005 [SC/58/ForInfo8]). The study provided a possible explanation of the relationship between anthropogenic sonar activities and the stranding and death of marine mammals. Aspects of these histopathological techniques relevant to determination of vessel strikes were discussed under Item 7.2. The sub-committee **recommended** that the applicability of these techniques to baleen whales should be investigated.

9. WORKPLAN

The Sub-Committee discussed the priority items for consideration at the next year's meeting and beyond. The following work plan for next year's meeting was agreed:

- (1) Further review of information and methods to estimate bycatch based on fisheries data and observer programmes
 - (a) Continue collaboration with FAO on collation of relevant fisheries data
 - (b) Progress on joining the Fishery Resource Monitoring System (FIRMS) partnership
 - (c) Report back on EU bycatch monitoring schemes
 - (d) Review modelling to determine observer coverage needed in a fishery to estimate bycatch
 - (e) Review report from NOAA, U.S., Workshop on the bases for determining serious injuries in whales
 - (f) Review other methods of determining survival of previously entangled whales
- (2) Further consider methods to estimate bycatch based on genetic data
 - (a) Review progress on intersessional work related to market sampling
- (3) Further review of information and methods to estimate mortality from ship strikes
 - (a) Review results of data collected on vessels relevant to ship strikes
- (4) Consider methods for estimating additional human induced mortalities e.g. from acoustic sources and marine debris.

10. ADOPTION OF REPORT

The sub-committee report was adopted at 16:59 on 2 June 2006.

REFERENCES

- Baker, C.S., Lukoshek, V., Lavery, S., Dalebout, M.L., Yong-Un, M., Endo, T. and Funahashi, N. 2006. Incomplete reporting of whale, dolphin and porpoise 'bycatch' revealed by molecular monitoring of Korean markets. In review. [SC/58/For Info 34]
- Best, P.B., Peddemors, V.M., Cockcroft, V.G. and Rice, N. 2001. Mortalities of right whales and related anthropogenic factors in South African waters, 1963-1998. *J. Cetacean Res. Manage.* (special issue) 2: 171-176.
- Fernandez, A., Edwards, J.F., Rodriguez, F., Espinosa de los Monteros, A., Herraiez, P., Castro, P., Jaber, J.R., Martin, V. and Arbelo, M. 2005. 'Gas and Fat Embolic Syndrome' involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. 2005. *Vet Pathol.* 42: 446-457. [SC/58/For Info 8]
- Heyning, J.E. and Lewis, T.D. 1990. Entanglements of baleen whales in fishing gear off southern California. *Rep. int. Whal. Commn.* 40:427-431
- International Whaling Commission. 2006. Report of the Initial Workshop in the use of Market Sampling to Estimate Bycatch of Large Whales. *J. Cetacean Res. Manage.* (Suppl.) 8: 357-363.
- Kraus, S.D., Brown, M.W., Caswell, H., Clark, C.W., Fujiwara, M., Hamilton, P.K., Denney, R.D., Knowlton, A.R., Landry, S., Mayo, C.A., McLellan, W.A., Moore, M.J., Nowachek, D.P., Pabst, D.A., Read, A.J. and Rolland, R.M. 2005. North Atlantic right whales in crisis. *Science* 309:561-562.
- Laist, D.W. 1996. Impacts of marine debris: Entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records. In: J. M. Coe and D. R. Rogers (eds.). *Marine Debris Sources, Impacts, and Solutions*, pp. 99-139. Springer-Verlag, New York, NY. 163
- Lambertsen, R.H. and Hintz, R.J. 2004. Maxillomandibular cam articulation discovered in North Atlantic minke whale. *J. Mammalogy* 85:446-452.
- Lambertsen, R.H., Rasmussen, K.J., Lancaster, W.C. and Hintz, R.J. 2005. Functional morphology of the mouth of the bowhead whale and its implications for conservation. *J. Mammalogy* 86:342-352.
- Panigada, S., Pesante, G., Zanardelli, M., Capoulade, G., Gannier, A. and Weinrich, M.T. 2006. Mediterranean fin whales at risk from fatal ship strikes. *Mar. Poll. Bull.*: In press. [SC/58/For Info 12]

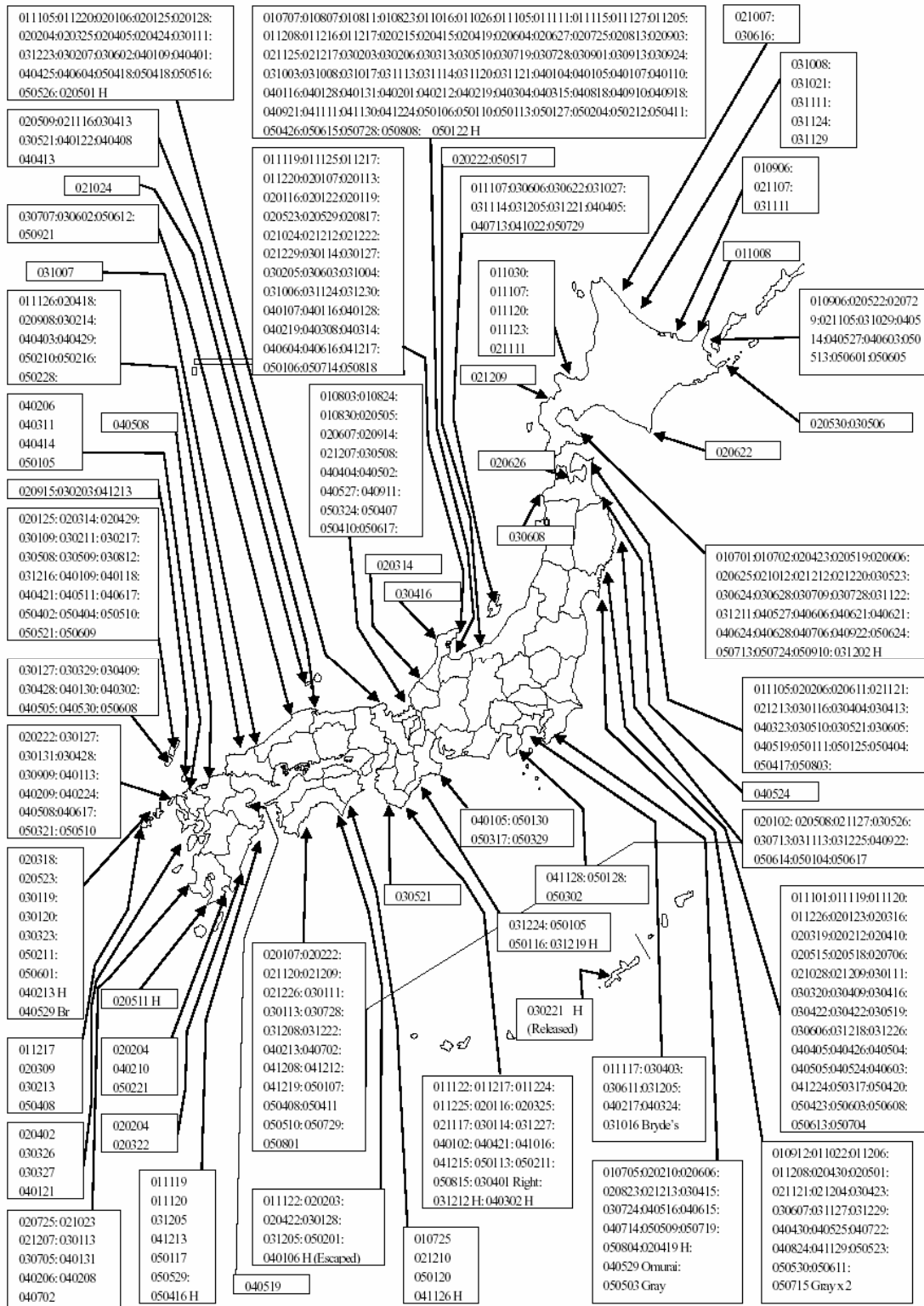


Figure 1. Map of reported bycatch locations for period July 2001 to September 2005. Compiled by Funahashi based on data from the website and newsletter of the Institute of Cetacean Research. Each 6 digit number represents an individual whale in the form *yymmdd*. All records refer to minke whales except records followed by H (humpback whale) or species name.

Appendix 1

TERMS OF REFERENCE OF THE SUB-COMMITTEE ON ESTIMATION OF BYCATCH AND OTHER HUMAN-INDUCED MORTALITY

At its 52nd meeting, under agenda item 12.1.2, the Commission instructed the Scientific Committee (SC) that catch limits calculated under the Revised Management Procedure (RMP) shall be adjusted downwards to account for human-induced mortalities caused by aboriginal subsistence whaling, scientific whaling, whaling outside IWC, bycatches and ship strikes. The Commission stated that each such adjustment shall be based on an estimate provided by the SC of the size of adjustment required to ensure that total removals over time from each population and area do not exceed the limits set by the RMP. Total removals include commercial catches and the human-induced mortalities listed above to the extent that these are known or can be reasonably estimated.

Terms of reference of the Working Group appointed to this task are:

- (1) Examine methods that have been used to estimate bycatch, and describe acceptable estimators and measures of their precision.
- (2) Consider requirements for sampling to obtain unbiased estimates of specified precision.
- (3) Consider confidence or probability intervals for such estimates that provide reasonable assurance that the Commission's objective regarding total removals over time is met.
- (4) Examine methods for estimating mortalities caused by ship strikes similarly.
- (5) Consider methods for summarising known and estimating unknown mortalities from the types of mortalities listed.
- (6) Consider establishing and maintaining a data base containing the requested information.
- (7) Consider how best to communicate this information to the Commission.

Appendix 2

AGENDA

1. Conveners opening remarks and terms of reference
2. Election of chairperson and appointment of rapporteurs
3. Adoption of agenda
4. Review of documents
5. Estimation of bycatch based on fisheries data and observer programmes
 - 5.1 Cooperation with FAO on fishing fleet data and the Fishery Resource Monitor System partnership (FIRMS)
 - 5.2 Review progress on standardized reporting in Progress Reports
 - 5.3 Information on new EU bycatch monitoring schemes
 - 5.4 Methods to determine appropriate observer coverage levels needed in a fishery to estimate bycatch
 - 5.5 Other
6. Estimation of bycatch based on genetic data
 - 6.1 Review progress on intersessional work related to market sampling
 - 6.1.1 Data from market surveys
 - 6.1.2 Initial simulations for testing market sampling design
 - 6.1.3 Planning for a follow-up workshop on the use of market sampling to estimate bycatch
 - 6.2 Analytical tests for assignment to stocks and/or areas
 - 6.3 Other
7. Estimation of cetacean mortality from ship strikes
 - 7.1 Review report from the ACCOBAMS workshop on ship strikes
 - 7.2 Other
8. Estimation of cetacean mortality from other human activities
9. Work plan
10. Adoption of report

Appendix 3

COUNTRY. PROGRESS REPORT ON CETACEAN RESEARCH, MONTH 20XX TO MONTH 20XX, WITH STATISTICAL DATA FOR THE CALENDAR YEAR 20XX OR SEASON 20XX/XX

COMPILED BY GIVE NAME

Compiler's affiliation and address

This report summarises information obtained from: INCLUDE THE NAMES OF THE AGENCIES OR INSTITUTIONS ETC. HERE, PLUS ANY ABBREVIATIONS. Institution focal person's e.mail addresses can be given in a tabulated form.

6. Statistics for large cetaceans

6.1 Direct catches (commercial, aboriginal and scientific permits) for the calendar year 20XX or the season 20XX/XX

It is helpful if these statistics are included here. A table is probably the most convenient way to do this. However, it must be noted that this summary is not considered to fulfil the obligation to supply data to the Commission as specified in the Schedule.

Species	Type of catch	Area/stock	Males	Females	Total landed	Struck and lost
Gray whale	Aboriginal	E.N. Pacific	21	23	44	4

6.2 Non-natural mortality for the calendar year 20XX or the season 20XX/XX

6.2.1 OBSERVED OR REPORTED SHIP STRIKES (INCLUDING NON-FATAL EVENTS)

The inclusion of this data was agreed by the Committee in 2004 (IWC, 2005a). If available, please use Latitude and Longitude for location or else specify as much detail as possible. Please indicate type of vessel, e.g. High-speed Ferry (HSF), Large Cargo (LC), Military, Fishing Vessel (FV), Passenger Carrying Excursion (PC), Other (O). Fate: Indicate if the whale swam away (X), appeared seriously injured (I), killed (D). Example given.

Whale species	Sex	No.	Date	Location	Vessel type	Speed	Fate	How observed	Source or contact
A. Humpback whale	U	xx	xx/xx	4 km off coast Savannah, GA. Position classified	Military	40kts	D		Give abbreviate form of institution (e.mail available in front page of ProgRep)
Comments: A. Cut clean in half.									

6.2.2 FISHERY BYCATCH (INCLUDING NON-FATAL EVENTS)

The inclusion of this data was agreed by the Committee in 2004 (IWC, 2005a). If available, please use Latitude and Longitude for location. Indicate fate of whale (R = released alive, D = discarded dead or seriously injured, K = kept for sale or specimen), targeted fish species (e.g. tuna, herring, etc.). The Committee also agreed that types of fishing gear involved in bycatch should be documented (IWC, 2005a). Please use the internationally recognised standard gear description codes from FAO (given below), although more detail can be supplied if known. More detailed information and illustrations of the different types of fishing gear can be found on the FAO/FIGIS website³. Please also include any instances of entanglement in shark exclusion nets, which are another important source of bycatch. Please indicate how observed: M = dedicated marine mammal observer, F = Fishery onboard observer, V = vessel logbook, A = anecdotal, DA = documented anecdotal, photos, etc. Example given.

Whale species	Sex	Nb.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact	
A. Minke whale	F	xx	xx/xx	54°14'N; 29°43'W	D	<i>Thunnus</i>	LLD	F	Same format as above	
Comments: A. Entangled in gear, cut off and sank.										
FAO FISHING DESCRIPTION AND CODES										
FAO FISHING GEAR CATEGORIES:					FALLING GEAR					
SURROUNDING NETS					Cast nets					FCN
With purse lines					Falling gear (not specified)					FG
One-boat operated purse seines					GILLNETS AND ENTANGLING GEAR					
Two-boat operated purse seines					Set gillnets (anchored)					GNS
Without purse lines (lampara)					Driftnets					GND
SEINE NETS					Encircling gillnets					GNC
Beach seines					Fixed gillnets (on stakes)					GNF
Boat seines					Trammel nets					GTR
Danish seines					Combined gillnet-trammel nets					GTN
Scottish seines					Gillnets and entangling gillnets (not specified)					GEN
Pair seines					Gillnets (not specified)					GN
Seine nets (not specified)					TRAPS					
TRAWLS					Stationary uncovered pounds nets					FPN
Bottom trawls					Pots					FPO
Beam trawl					Fyke nets					FYK
Otter trawls (side or stern)					Stow nets					FSN
Pair trawls					Barriers, fences, weirs, etc					FWR
Nephrops trawls					Aerial traps					FAR
Shrimp trawls (not specified)					Traps (not specified)					FIX
Midwater trawls										
Otter trawls (side or stern)					HOOKS AND LINES					
Pair trawls					Handlines and pole-lines (hand operated)					LHP
Shrimp trawls					Handlines and pole-lines (mechanised)					LHM
Midwater trawls (not specified)					Set longlines					LLS
Otter twin trawls					Drifting longlines					LLD
Otter trawls (not specified)					Longlines (not specified)					LL
Pair trawls (not specified)					Trolling lines					LTL
Other trawls (not specified)					Hooks and lines (not specified)					LX
DREDGES					GRAPPLING AND WOUNDING					
Boat dredges					Harpoons					HAR
Hand dredges					HARVESTING MACHINES					
LIFT NETS					Pumps					HMP
Portable lift nets					Mechanised dredges					HMD
Boat-operated lift nets					Harvesting machines (not specified)					HMX
Shore operated stationary lift nets					MISCELLANEOUS GEAR					MIS
Lift nets (not specified)					RECREATIONAL FISHING GEAR					RG
					GEAR NOT KNOWN OR NOT SPECIFIED					NK
					SHARK CONTROL NETS					NSC
					DERELICT FISHING GEAR					

6.3 Earlier years' statistics

This would be a place to include any corrections to statistics presented in earlier years. It may also be appropriate to include references to studies that utilise time series of data here.

³ http://www.fao.org/figis/servlet/static?dom=root&xml=tech/gears_search.xml