Annex J

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

Members: Berggren (Chair), Amaha-Ozturk, Baba, Baker, Birtles, Bjørge, Bräger, Brownell, Childerhouse, Cipriano, Clapham, Cooke, Deimer, Diake, Diaz, Donovan, Fortuna, Fukui, Funahashi, Gales, Gidding, Goodman, Goto, Groch, Haug, Hayashi, Hester, Iñiguez, Kanda, Kasuya, Kawahara, Kell, Kim, K., Kim, Z., Kitakado, Kock, Krivokhizhin, Lauriano, Lawrence, Leaper, Lee, Lens, Lima, Lyrholm, Magloire, Manzanilla, Minton, Morishita, Nagatomo, Nakatsuka, Nishiwaki, Northridge, Ohsumi, Olafsdottir, Oosthuizen, Ozturk, Palazzo, Palka, Pantoja, Park, Parsons, Pastene, Perrin, Perry, Pike, Rambally, Read, Reijnders, Rennie, Ridoux, Robbins, Rogan, Rojas-Bracho, Rose, Sadler, Senn, Simmonds, Sohn, Stachowitsch, Stanev, Tanaka, Taylor, Thiele, Tomita, Tsidulko, Urban, Urquiola, Vikingsson, Walløe, Walters, Weinrich, Williams, Wilson, Yamakage, Yamamura, Yoshida.

1. CONVENER'S OPENING REMARKS AND TERMS OF REFERENCE

Berggren welcomed the members of the sub-committee and referred to 52nd meeting of the Commission when the Scientific Committee (SC) was instructed 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. 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 be exceed the limits set by the RMP. In order to address this task the Terms of Reference given in Appendix 1 were developed for the sub-committee by the SC 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. Berggren also reported that the conveners of the Scientific Committee had given the sub-committee instructions to focus its activities at this meeting on estimation of bycatch only and that other human induced mortalities (e.g. ship strikes) will be dealt with at future meetings.

2. ELECTION OF CHAIR AND APPOINTMENT OF RAPPORTEURS

Berggren was elected chair. Leaper and Northridge 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/55/BC1-6, SC/55/RMP 7, 11.

5. ESTIMATION OF BYCATCH BASED ON FISHERIES DATA AND OBSERVER PROGRAMMES

5.1 Collation of information from fisheries.

At IWC/SC/54 the Committee had requested the Secretary to contact relevant authorities in member states to request a list of fisheries, broken down by gear type, target species and geographical area to the extent that this is routinely done in each country. The aim of this exercise was to provide some initial information on the nature of available fishery data so that the sub-committee could then try to obtain more precise figures to address acceptable measures of large whale bycatch estimation.

The Secretary had approached FAO to assist in this task and had learned that as a part of the expansion of the FIGIS database (Fisheries Global Information System), FAO are currently in the process of collating detailed information on the gear types and fishing effort deployed globally on a country-by-country basis. The Secretary in consultation with FAO and the Chair of the sub-committee had proposed that a collaborative approach with FAO would be the most effective and productive means of obtaining the information required by the sub-committee.

FAO had provided tabular information describing the data types and descriptions for the updated FIGIS database, and these were tabled for the sub-committee to consider. FAO had contracted consultants on a regional basis to try to collate the required data, and they hoped to have a significant portion of the database completed by the end of 2003. Questions were raised as to whether FAO would be able to obtain complete data, including information on small-scale fisheries, and whether these data would be updated regularly. Northridge replied that the information provided by FAO suggested that they were trying to collect as detailed information as possible, including that relating to small scale fisheries, and that the database would be maintained and updated in future. FAO is the appropriate inter-governmental body to address this task. Read noted that the existing FIGIS database, providing a more limited amount of information, is already available online, but it was not clear how much of the information currently being collated would ultimately be made available in the same way.

It was noted in discussion that although discards are mentioned in the FAO data table, bycatch of cetaceans is not explicitly referred to. Existing FIGIS data does include some mention of cetacean bycatch, though such information is likely to be patchy and incomplete. Examination of these databases of detailed fishery effort data may allow consideration of likely fisheries and areas in which bycatch might be occurring but not being recorded. The potential for estimation of bycatch in these fisheries could also be evaluated from such data.

Kim re-iterated his view of last year that in those countries where bycatch is recorded, there is no need to estimate bycatch from fishery statistics. Furthermore, fishery statistics are very complicated and would need to be simplified. Cipriano responded that the point of the exercise was to try to

work out which kinds of fishing gear were most likely to be causing bycatch. Such an exercise would hopefully simplify the process of examining the fishery data relevant to cetacean bycatch.

The sub-committee agreed that it would be appropriate to try to develop collaboration with FAO on this subject, and requested Northridge to continue contacts with FAO, in order to see what fishery data could be obtained for consideration at IWC SC/56. This might best be achieved if Northridge could travel to the FAO office in Rome. The sub-committee agreed that a funding request be made to cover the cost of this visit.

It was also noted that FAO is now addressing an ecosystem approach to fishery management, and as such, marine mammal bycatch should be of concern. It would be useful therefore to try to encourage FAO to collate any such existing data, even if this was simply the fact that certain gear types are known to be involved in marine mammal bycatch. Northridge was asked to discuss this possibility with the appropriate people in FAO. In addition, it would be valuable to initiate a discussion with FAO about including more data relevant to cetacean bycatch in future revisions of the data collection process.

The sub-committee recommended that contact with FAO should be maintained and that data on fishing gear and effort should be obtained when it became available. In addition, a glossary of gear types should be produced, along with pictures, to enable compilers of the National Progress reports to be specific about types of fishing gears involved in bycatch and to use a common descriptor. The FAO fishery categories should be used in this glossary. Berggren and Northridge agreed to undertake this task.

5.2 Other

Read presented BC5 in which the authors used existing bycatch data from published marine mammal stock assessments to calculate total cetacean and pinniped bycatches for US gillnet, trawl and other fisheries. Mean annual marine mammal bycatches were around 6000 animals per year for the period 1990-1999, with approximately equal numbers of pinnipeds and cetaceans, with the vast majority of such bycatches attributed to gillnet fisheries. There was a significant downward trend in the numbers of cetaceans caught through the decade, as bycatch mitigation strategies, especially for the Gulf of Maine harbour porpoise, became effective. US bycatch figures were used to generate very rough approximations of possible global marine mammal bycatches. Using the number of vessels by category (trawl, gillnet and other) in the US fleet and the total number of vessels in each of the same categories in the FAO FIGIS database provided one means of scaling up the total US bycatch to an estimate of global marine mammal bycatch. This method suggested that around 650,000 marine mammals might be taken every year. Another estimate can be obtained by scaling up US marine mammal bycatches based on the proportion of global landings recorded in US fisheries, typically around 5% of the total. This method suggests that around 130,000 marine mammals might be taken globally. Clearly both estimates may be biased in one way or another, but these figures provide an initial idea of the likely scale of marine mammal bycatch globally, which if it is measured in the hundreds of thousands is likely to be impacting populations.

During discussion it was pointed out that US fisheries are unlikely to be representative of fisheries worldwide, and that better stratification by area, species and gear type would improve this crude estimate. The fact, however, that in some countries marine mammal bycatch has evolved into a secondary target for some fisheries might suggest that in such cases bycatch rates (per tonne of fish landed or per vessel) may be much higher than those recorded in the USA. On the other hand, to the extent that the average size of vessels might be greater in the US than elsewhere, bycatch rates per vessel may be lower - particularly in developing countries – than in the USA.

Some concordance in the bycatch rates (animals per net km.hour) of porpoises among gillnet fisheries in different countries was noted in SC/55/BC5, and it was suggested that it would be useful to see if any similar concordance could be established for large whales taken in similar fishery types in different parts of the world.

Two further difficulties were also noted. First, certain gear types such as pelagic trawls and trap nets are known to have high cetacean bycatch rates in some countries, but these gears are very little used in the US. Secondly, small cetacean bycatches are more likely to be recorded in US observer schemes (on which the estimates are mainly based) than large whales, which tend to escape from fishing gear in the short term, but may however die from injuries or entanglement beyond the sight of any observers on the fleet. Nevertheless, estimates of large whale bycatch have been made for the USA, which would make it possible to extrapolate for this group alone.

The sub-committee recommended that the extrapolation exercise undertaken in BC5 should be taken further by breaking down the total cetacean bycatches into large and small cetaceans and by stratifying by area to the extent that this is possible. Read indicated that this task would be undertaken for next years meeting.

Weinrich presented SC/55/BC3 in which a photographic technique is described to provide minimum estimates of entanglement rates for large whales. This study builds on earlier work of Robbins and Mattila (2001) who developed a technique to monitor entanglements of humpback whales (*Megaptera novaeangliae*) in the Gulf of Maine using caudal peduncle scar analysis. While promising, photographs suitable for this technique are currently limited and its use requires the collection of additional data. SC/55/BC3 described the development of a technique to analyse scars on standard humpback whale fluke identification photographs to detect entanglements of enough severity to cause substantial tissue damage. Scarring usually occurred at the anterior portion of the flukes, at the insertion of the peduncle. Using the same data as used in Robbins and Mattila (2001), blind coding with this technique detected over half (66%; n=6) of the whales in this particular category found in the earlier study, and showed a high degree of repeatability among a sample group of researchers. Therefore, it was suggested that fluke scar analysis may be used to screen humpback, and possibly other, whale populations for those at risk from serious entanglements by identifying a minimum proportion of individuals exhibiting characteristic scarring in regional fluke catalogues.

As an example the technique was applied to a published photo-identification catalogue from Eastern Australia (southern hemisphere breeding stock E) and Western Australia (breeding stock D; Kaufman et al. 1993). In Eastern Australia, 5.03% (15/298) of catalogued whales whose fluke photographs were deemed suitable for analysis showed scarring consistent with serious entanglement, as compared with 1.06% (1/94) in Western Australia. Although these were not significantly different, the level detected in the Eastern Australian catalogue approaches that of the Gulf of Maine, where entanglements are known to be a management problem. However, examination of the catalogue did not allow any distinction between consistent levels of risk over a long term, or episodic periods where entanglement risk might have been unusually high. Further, only 32.7% (298/912) of the eastern and 37.5% of the western Australia photos in the catalogue were considered to be useful for the analysis, due to the limited number of good quality complete fluke photographs. While this technique may be used in comparisons of risk of severe, but survivable, entanglements between two or more populations, it should not be used to exclude populations from further study of entanglement impacts.

Discussion was centred on how large whales are likely to become entangled, as this technique will work best for animals that become entangled around their tails. Animals in Korea are usually found with scars around the mouth, presumably as they are trying to feed among the lines of trap fisheries in coastal waters. Similar scaring on the rostrums and even over the blowhole had been noted in minke whales in Scotland too. However, Weinrich reported that whales may also often twist and roll when they become entangled and this can end up with a loop of rope or netting over their tail.

It was also suggested that it would be useful to use photographic catalogues to see whether healing rates of entanglement scar tissues were similar among populations before any comparisons were drawn between populations. Higher entanglement scarring rates in one population compared to another might be the result of slower healing rates in that population rather than higher entanglement rates.

There was a brief discussion on the terminology used to describe various types of fishing gear. Korean 'Set Nets' are similar to the Japanese 'Trap Nets'. Fish meet a leader net and are guided into a pound. Usually minke whales will become entangled in the rope of the leader, but they may also become entrapped in the pound. Japanese 'Trap Nets' similarly have a leader and a box shaped pound net. This discussion again highlighted the problem that Annual Progress Reports do not adhere to a standard definition of gear types, as the term 'Set Net' is also used by some countries to describe a fixed gillnet. It was suggested that standard terminology should be used in the Progress Reports, and to this end the FAO fishing gear category codes are appended to this report as Appendix 3.

No papers had been received this year that assessed the monitoring requirements necessary to produce estimates of bycatch in specific fisheries with a certain level of confidence. The sub-committee re-iterated last year's recommendation that modelling exercises should be undertaken to assess the levels of coverage required for reliable estimation of large whale bycatch from observer programmes. The Chair stated that he would solicit papers on this subject for next year

Summary information on large whale bycatches reported in Annual Progress Reports is given in table 1. It was noted that entanglement of whales is not always defined in the same way in all countries. In the US, for example, large whale entanglements are reviewed by a committee, including evaluation of the likely fate of animals that are sighted at sea with ropes or gear attached. There may be a need in the future to agree on common definitions for use in Progress Reports. It was suggested that the data from Progress Reports might be improved if whales that were known to have become entangled but subsequently broke free, were also recorded. Photo-identification studies could potentially also be used routinely to assess possible entanglement rates. The sub-committee welcomed the increased detail on fishing gear involved in bycatch in some Progress Reports and re-iterated the recommendation that member states be encouraged to report more details about the type of fishing gear involved in large whale entanglements.

SC/55/BC4 examined the type and parts of fishing gear involved in right and humpback whale entanglements in the Northwest Atlantic in cases where gear had been removed. Over the period 1986 to 2002, documented entanglements were assessed to determine the type and part of gear involved (buoyline, endline, floatline, groundline, and lines involved with the surface system), as well as each whale's fate, and the location of the entangling gear on the animal. The conclusion was that any type and part of fixed gear is capable of entangling a whale, and that any body part can be involved. Of the 43 right whales observed entangled, 16 were known or presumed dead, 19 were resighted free of gear, 6 remained entangled and the fate of 2 was unknown. Of 38 humpback whales observed entangled, 3 were known to have died, 20 were resighted free of gear, 8 remained entangled, 2 shed gear and the fate of 5 was unknown. Of the 16 entangled right whales known or presumed to be dead, four were entangled in lobster gear, one in sink gillnet, one in a Danish seine, and 10 in unidentified or unknown gear. For fifteen right whales where age was known, that were either observed dead or presumed dead, ten were juveniles and five were adult. These results supported earlier conclusions that juveniles were more vulnerable to entanglement. Three humpback whales were known to have died, two in sink gillnet and one in lobster gear. Sample sizes were too small to detect any trends in the type of gear involved in lethal entanglements, although lobster and gillnet gear appear to be the most common. Vertical lines in the water column (buoylines/endlines) are believed to pose potentially high risks of entanglement irrespective of whether the line involved is made of floating or sinking line. In this analysis, no whales were found entangled in floating buoyline/endline, whereas four right and no humpback whales were entangled in buoyline/endline made of sinking line. However, two right and seven humpback whales were entangled in buoyline/endline made of both floating and sinking line. Groundlines made of sinking rope may reduce entanglement risk: no whales in the analysis were entangled in this type of line, while three right and three humpback whales were entangled in floating groundline. However, the authors also noted that these apparent entanglement rates are subject to unknown and potentially large sources of bias related to both fishing effort and observer reporting.
Clapham clarified the terminology used in this paper relating to different types of line. The fisheries described involve a number of rigid traps on the seabed joined by 'groundline' which are attached to a floating buoy on the surface by the 'buoyline/endline', subsequently joined to an additional floating marker by the 'floatline'. Experiments with different line types have been undertaken using video cameras to monitor line behaviour underwater. These have shown that sinking groundline tends to lie closer to the sea bed, however it is not known how these observations relate to entanglement risk.

The sub-committee welcomed the information presented in SC/55/BC4 and in particular the statistics on the proportion of whales that had died or were presumed dead as a result from entanglement given that the sub-committee last year had suggested that information on this should be gathered.

6. ESTIMATION OF BYCATCH BASED ON GENETIC DATA

6.1 Report of Bycatch Workshop Feasibility Steering Group

A Steering Group to investigate the feasibility of holding a workshop to review the use of genetic methods to provide information on bycatch had been established in 2001. This group had reported to the Committee at the annual meeting in 2002 that it would be feasible to hold the workshop at some time in the future. The Steering Group had continued its efforts inter-sessionally. Several market sampling specialists who have conducted research on food product market surveillance and food product distribution in Japan were identified. It had proven more difficult to identify individuals with detailed knowledge of the different pathways for whale bycatch products. The Steering Group noted that assistance in this task from other members of the sub-committee, particularly those from the relevant region, would be appreciated. The following five-stage approach was suggested:

(1) A letter explaining the issues and objectives to be sent to market sampling specialists from the Chair of the sub-committee/Secretary of the Commission asking whether they can assist in assessing the nature and level of information that would be needed to design a sampling programme

to provide estimates of bycatch with a known degree precision. The specialists will also be asked to participate in a planning meeting and, if recommended, a workshop to discuss this issue and develop the method in detail.

(2) The planning meeting will be held comprising of a small group (10-12 participants) that will identify the information needed to design a sampling programme that would allow estimation of total bycatch with a suitable precision. Two specialists familiar with each of the following areas will be invited to the meeting: food/markets surveillance systems, statistical design and analysis of market sampling, the outlets for whale meat in specified countries and the pathways to those outlets, whale bycatch and fisheries involved.

(3) The outcome and report of the planning meeting will decide whether it appears possible to obtain the necessary information and expertise needed to hold the full workshop. If so, a proposal for the workshop will be finalised by the Steering Group, including Terms of Reference, a draft Agenda, a list of participants and suggestions for workshop papers, dates, venue and budget for the workshop.

(4) Submit proposal for workshop to the IWC and other potential funding sources

(5) Hold workshop

Baker commented that reported bycatch from Japan and Korea indicated a growing problem. He noted that progress that had been made towards the workshop and that the workshop should not be delayed by placing too much emphasis on the need for market survey experts. He also suggested that the workshop could benefit from participation by scientists with expertise in capture-recapture estimates.

Nakatsuka explained the position of Japan that had been stated by Morishita in 2001. At that time Morishita had drawn attention to the statement of Japan appended to the report of the DNA Working Group (J. Cetacean Res. Manage. 2002: 4 (Suppl):374) and stated that he could not support a recommendation for such a workshop. In 2001 Morishita had also stated the following; "*that aside from legal issues and the position of Japan he had a great doubt about the utility of such a workshop. The participation of people with expertise on the Japanese market for whale products is essential for the objectives of the workshop. Such experts work in industry and are not employed by the Government. In addition, those involved in the marketing of whale products in Japan may have doubts about the competence of the IWC. Japan would not block such a workshop but participation would be limited. However, he would try to help with identifying relevant contacts and sources of data*." (J. Cetacean Res. Manage. 2002: 4 (Suppl):367-368).

Nakatsuka stated that Japan does not support the workshop being held under the authority of the IWC because it is Japan's understanding that DNA market surveys are outside of the jurisdiction of the IWC.

Nagatomo also questioned the focus of the workshop on the markets in Japan and another certain region and noted that markets for whale products also existed in other countries such as the US. The Chair reminded the sub-Committee of the agreement in 2001 to focus on considering methods to estimate bycatch in two areas, the Northwest Pacific and Northeast Atlantic. These two areas were considered most important to the work of the RMP sub-committee. Others noted that consideration of market sampling as a means to estimate bycatch is also only possible in countries with a substantial market for whale meat.

The sub-committee agreed that the Steering Group should continue its work. However, Nakatsuka noted his reservation to this agreement due to the position of Japan regarding DNA market surveys mentioned above. Most members believed that there was a need to move forward with the workshop and favoured the approach suggested by the Steering Group. They also felt that the process should be accelerated wherever possible.

6.2 Data from market surveys

SC/55/BC1 reported species and stock identification of whale and dolphin products available on commercial markets of Japan and the Republic of Korea between June 2002 and February 2003. Identification of species was based on phylogenetic analysis of mitochondrial DNA sequences. In Japan, a total of 88 products included six species of baleen whale and in Korea a total of 70 products included two baleen whale species. Five products purchased in Japan were identified as sei whale. All five products had distinct mitochondrial haplotypes, indicating that they come from five different individuals. All new sei whale haplotypes from the current series of surveys fall within one of two distinct clades (i.e., phylogenetic group) of haplotypes representing sei whales found previously on the Japanese market. Three of the older market products grouped closely in one clade with reference sequences from two North Atlantic sei whales. The other thirteen market products grouped together with one of two sei whales from New Zealand and one from South Africa. All recently purchased products fall within this group. These results suggest that while three of the market products likely represent animals taken in the North Atlantic (based on their close grouping with reference sequences from this region), the other 13 products may represent animals taken in the North Pacific or Southern Hemisphere. Of these, 9 could not have been derived from the JARPNII hunt given the date of purchase. One common-form pelagic Bryde's whale product was found on the Korean market in 2003. The sequence of this product differed from two common-form Bryde' whales and two coastal-form ('Kochi') Bryde's found previously on the Korean markets.

It was noted that using haplotype analysis to identify the stock of origin of sei and Bryde's whales is difficult and that lack of reference sequences from other regions hinders an exact geographic assignment of these market products. Genetic information from the 2002 JARPNII hunt of sei whales in the North Pacific and from the earlier Icelandic scientific hunt of sei in the North Atlantic would help resolve this issue. Danielsdottir noted that some products may be from stockpiles and that meat from whales caught over 14 years ago was still on sale in Iceland. Nakatsuka commented that he was not sure that the methods described in SC/55/BC1 and SC/55/RMP7 would provide more accurate estimates of bycatch for Japan than reported in the Progress Report.

Kim noted surprise that Bryde's whale products had been found on the Korean market. He did not think that this was bycatch because Bryde's whales are not known to regularly habit coastal waters of Korea. He also questioned the effectiveness of market surveys to estimate bycatch because products from a fin whale reported as bycatch in 2002 had not been detected. Attempts are being made in Korea to ensure bycatch is accurately reported and that DNA samples are collected with the aim of 100% sampling.

Details of the 2002-03 market surveys and the fine-scale analysis of North Pacific minke whales were presented in SC/55/RMP7. In previous surveys, whale products were purchased throughout Japan during a number of short sampling trips at different times of the year. For the 2002-03 surveys of Japan, sampling methods were modified to examine potential changes in market availability of bycatch following changes in reporting regulations (revision to Ministerial Ordinance No. 92). North Pacific minke products were purchased from shops and restaurants in three selected prefectures. Purchases were conducted synoptically to control for potential differences in seasonal availability of bycatch. The intent was to

investigate potential differences in J- and O- stock frequencies that might be attributable to local access and migratory patterns. On the basis of two polymorphic sites, mtDNA haplotypes of North Pacific minke whales were grouped into four haplotype classes highly characteristic of the presumed O and J stocks (Baker *et al*., 2000). Based on this classification, 65% (n = 24) of products identified as North Pacific minke whales from the Japanese markets and 81% of such products from the Korean market (n = 48) were classified as having originated from the J stock in the East Sea/Sea of Japan. Considerable heterogeneity was observed between Japan and Korea in the frequencies of the three J-type haplotype classes and the sex ratios of J-type products. In conclusion, SC/55/RMP7 considers the difference in sex ratios and the highly significant difference in mtDNA haplotype frequencies over many years' sampling could only be explained, by the existence of one or more additional coastal stocks, which are yet to be accounted for in most population models of this species. SC/55/RMP7 and SC/55/BC1 also demonstrate that changes in sampling methodology can be used to investigate the dynamics of whale meat markets, showing preliminary evidence that the availability and distribution of North Pacific minke whale bycatch might be changing due to recent modification of Japanese Whale Meat Regulations. SC/55/BC1 further shows that products from some species, such as sei whales in Japan prior to 2003 and common-form Bryde's whales in Korea, are difficult to attribute to coastal bycatch.

Goto pointed out that the results reported in SC/55/RMP7 had not involved microsatellite analysis for individual identification. He considered that the results revealed by SC/55/RMP7 should be interpreted carefully. Funahashi responded that in the first of the two surveys described, microsatellites had been used to identify 13 samples to individual level. Of these, 3 were from one individual and 2 from another, resulting in 10 individual whales from the 13 samples.

Baker acknowledged that the change in sampling scheme in SC/55/RMP7 and SC/55/BC1 compared to previous surveys (Dalebout *et al.,* 2002) would make it more likely that replicate samples from the same individual might be purchased than in previous surveys. He considered that the inclusion of a small but unknown number of multiple products from the same individual (replicates) was unlikely to have biased the primary conclusions. Firstly, efforts were made in the market sampling to reduce the possibility of replicates. Secondly, no one haplotype class is more likely to be affected than others, so that no specific bias would be introduced. Thirdly, previous analyses have incorporated an adjustment for multiple samples by using multi-locus microsatellite genotyping to remove replicate products, with the result of no significant change in haplotype frequencies. The possible error in estimating frequencies introduced by replicate products will be similar to the normal stochastic sampling error.

The difficulty of sampling markets had been discussed in detail at previous meetings with an extensive discussion about sampling design. Goto commented that more analysis and description of the sampling methods in SC/55/BC1 and SC/55/RMP7 was needed. Baker responded that results from similar market surveys by the Fisheries Agency, Japan had also been reported without full details of sampling design. Sampling design would be one of the main issues addressed at the proposed workshop.

In terms of a better understanding of markets to improve sampling design, it was noted that regulations for fresh food labelling in Japan had recently changed. Funahashi noted that discrepancies in labelling still remained. She reported that 35 samples labelled as minke whale were purchased on the Japanese market between June 2002 and February 2003. These samples comprised of 26 minke whale, 6 Bryde's whale, 1 humpback whale, 1 pilot whale and 1 Hubb's beaked whale. Morishita noted that food labelling was a difficult problem and attempts were being made to improve this in Japan. He described the general requirements for labelling under the general standard agricultural law in Japan. All fresh food products are required to be labelled with the species and if imported, the country of origin. However, different regions have different names for the same species and different life stages may also have different names. The Government of Japan is now trying to create a dictionary of standard names for all seafood products. There is no evidence that mislabelling is a result of smuggling or illegal hunting.

6.3 Analytical tests for assignment to stocks and/or areas

No new information was submitted on analytical tests for assignment to stocks and/or areas.

6.4 Use of capture-recapture methods for estimating bycatches from market data

No new information was submitted on use of capture-recapture methods for estimating bycatches from market data.

6.5 Other

SC/55/BC2 described a new DNA extraction method and PCR primers used to amplify a small fragment of mitochondrial control region sequence used for species identification of whale products. Technical details of the methodology were also presented to the DNA Standing Working Group. The new methodology was developed in order to be able to analyze some kinds of commercial products in which the DNA has been degraded during processing and/or which contain chemical inhibitors that prevent or limit amplification. The method may also be applicable to poorly preserved and unpreserved samples from strandings and museum collections. The method is of significance to the sub-committee because it increases the range of commercial products that can be analysed. The method has been successful in some initial tests with highly processed and canned products. The small fragment amplified using the new primers was sufficient for precise analysis of products from some whale species at high bootstrap values (e.g. southern minke whales), but additional primers would need to be developed in order to provide enough data for precise identification of other species (e.g. sei and Bryde's whales and delphinids). These methods had not yet been tested on formalin-fixed or chemically bleached whale products (which are known to be difficult to amplify) or on cetacean tooth and bone extracts.

Sohn presented SC/55/BC6 which described a preliminary genetic analysis of minke whales in Korean waters based on estimated haplotype diversity of the mitochondrial control region (487 base pairs). Haplotypes estimated using samples from bycaught minke whales in Korean waters from 2000 and 2003 were substantially different from past commercial samples. The calculated haplotypic diversity value of the 2003 and Yellow Sea samples were higher than that of the other samples in period and location respectively. The haplotype diversity of minke whales distributed in Korean waters decreased in 2001 but increased from 2002. From these results the authors deduced the possibility of mixing of different populations (e.g. 'O' stock) with the unique 'J' stock and/or the increase of genetic diversity in Korean waters.

The sub-committee thanked the authors for this work, and noted that it will also be discussed further in the RMP sub-committee.

Tanaka described a length-based VPA conducted for bycaught minke whales from the Sea of Japan- Yellow Sea – East China Sea Stock of minke whales. The minke whale population was assumed to be in equilibrium or to be increasing, and the number of calves was assumed to be related to the number of females by a Pella-Tomlinson stock recruitment relationship. Results from the VPA analysis suggested minimum estimates of the 1+ population ranging from 9,700 to 66,000 animals.

The sub-committee did not discuss the analysis in detail, noting that this would be done in the RMP sub-committee. Discussion focused on the apparently high catchability rates for small or young minke whales in this fishery. Parsons noted that live stranded minke whales in the UK tended to be young animals and suggested that these might be more prone to come close to shore. Nagatomo noted that strandings of minke whales in Japan are quite rare and that the lengths of these animals is unknown. Most of the animals taken as bycatch in Japanese trap nets are between 4 and 5 metres in length.

Nakatsuka described the procedures and practices associated with the retrieval and sale of bycaught minke whales in Japan. When animals are caught in a net, fishermen must inform the Institute of Cetacean Research, who must receive a DNA sample, photograph or confirmation from a third party before a receipt can be issued. Only then can the animal be sent to market and legally sold.

Simmonds asked whether an animal that was caught in an offshore fishery and could not be retrieved or brought to shore would be reported. Nakatsuka replied that the revised Ministry of Agriculture, Forrestry and Fisheries (MAFF) Ministerial Ordinance No. 92 regarding fishery regulations which was implemented on 1 July 2001 (http://maff.go.jp/mud/410.html) had been designed primarily to ensure whales in the trap net fishery would be reported. This is where the great majority of records of minke whale bycatches come from. It was very unlikely that any whales would be caught in any other Japanese fisheries.

Cipriano noted that the description of these regulations state that a DNA registry for bycaught animals will be instituted and that information from DNA analysis will be made available to the public. Nagatomo replied that it would be necessary to ask the relevant authority to determine what information this might be.

Nagatomo suggested that the purpose of the sub-committee is to obtain more accurate estimates of bycatch so that whale resources can be managed properly. Therefore some incentives to report bycatch could be critical factors in obtaining more appropriate information on bycatch. Cipriano noted that, as certain members of the sub-committee had repeatedly stressed in the past, it was inappropriate for the sub-committee to recommend management options to sovereign nations with regard to their domestic policies.

The sub-committee recommended that governments of member nations should improve their bycatch reporting systems and encourage fishermen to report bycatches of large whales in order to gain a better understanding of the nature and scale of bycatch.

7. OTHER

There was no other business.

8. WORK PLAN

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 contacts with FAO to get more information on fisheries and fishery data

(b) Review modeling to determine observer coverage needed in a fishery to estimate bycatch

(2) Further review of methods to estimate bycatch based on genetic data

(a) Steering Committee will report back on intersessional activities in preparation for the Workshop to review the use of genetic methods to provide information on bycatch

(3) Further review of information and methods to estimate mortality from ship strikes

(a) Review results of data collected on high-speed vessels relevant to ship strikes including results from the intersessional group established in 2002 and chaired by Weinrich

(4) Consider methods for estimating additional human induced mortalities

9. ADOPTION OF REPORT

The report was adopted at 18:50 on 1 June 2003. Berggren thanked the Rapporteurs for their hard work. The sub-committee expressed its appreciation for the work by the Rapporteurs and the Chair.

REFERENCES

Baker, C.S., Lento, G.L., Cipriano, F., & Palumbi, S.R. 2000. Predicted decline of protected whales based on molecular genetic monitoring of Japanese and Korean markets. *Proceedings of the Royal Society, London B* 267:1191-1199.

Dalebout, M.L., Lento, G.M., Cipriano, F., Funahshi, N., & Baker, C.S. 2002. How many protected minke whales are sold in Japan and Korea? A census by DNA profiling. *Animal Conservation* 5:143-152.

Kaufmann, G., Lagerquist, B., Forrestell, P., and Osmond, M. 1993. Humpback whales of Australia: A catalougue of individual whales identified by fluke photographs. Queensland Department of Environment and Heritage, Brisbane.

Robbins, J., and Mattila, D. 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.

Appendix 1

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

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 Sub-Committee 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 database 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 Collation of information from fisheries data and observer programmes
    - 5.2 Other
6. Estimation of bycatch based on genetic data
    - 6.1 Report of Bycatch Workshop Feasibility Steering Group
    - 6.2 Data from market surveys
    - 6.3 Analytical tests for assignment to stocks and/or areas
    - 6.4 Use of capture-recapture methods for estimating bycatches from market data
    - 6.5 Other
7. Other
8. Work plan
9. Adoption of report

Appendix 3

FAO FISHING GEAR CATEGORY CODES

Gear Description	Standard FAO Abbreviation	ISSCFG CODE
Barriers corrals		08.5.0
Surrounding nets	SN	01.0.0
Purse seines	PS	01.1.0
Lampara nets	LA	01.2.0
Ring nets	RN	01.3.0
Seine nets	SE	02.0.0
Beach seines	SB	02.1.0
Boat seines	SV	02.2.0
Seine nets (not specified)	SX	02.9.0
Trawl nets	TN	03.0.0
Bottom trawls	TB	03.1.0
Bottom trawls (not specified)	TB	03.1.9
Midwater trawls	TM	03.2.0
Midwater trawls (not specified)	TMX	03.2.9
Otter twin trawls	OTT	03.3.0
Otter trawls (not specified)	OT	03.4.9
Pair trawls (not specified)	PT	03.5.9
Other trawls (not specified)	TX	03.9.0
Dredges	DR	04.0.0
Boat dredges	DRB	04.1.0
Hand dredges	DRH	04.2.0
Lift nets	LN	05.0.0
Portable hand lift nets	LNP	05.1.0
Boat-operated lift nets	LNB	05.2.0
Shore operated stationary lift nets	LNS	05.3.0
Lift nets (not specified)	LF	05.9.0
Falling gears	FS	06.0.0
Cast nets	FCN	06.1.0
Cover pots	FCP	06.2.0
Falling gears (not specified)	FG	06.9.0
Gillnets and entangling nets	GE	07.0.0
Set gillnets	GNS	07.1.0
Driftnets	GND	07.2.0
Encircling gillnets	GNC	07.3.0
Fixed gillnets (on stakes)	GNF	07.4.0
Trammel nets	GTR	07.5.0
Combined gillnets-trammel nets	GTN	07.6.0
Gillnets and entangling nets (not specified)	GEN	07.9.0
Gillnets (not specified)	GN	07.9.1
Traps	FN	08.0.0
Stationary uncovered pound nets	FPN	08.1.0
Pots	FPO	08.2.0
Fyke nets	FYK	08.3.0
Stow nets	FSN	08.4.0
Aerial traps	FAR	08.6.0
Traps (not specified)	FIX	08.9.0
Hooks and lines	LL	09.0.0
Handline and pole-lines (hand operated)	LHP	09.1.0
Handline and pole-lines (mechanized)	LHM	09.2.0
Set longlines	LLS	09.3.0
Drifting longlines	LLD	09.4.0
Longlines (not specified)	LL	09.5.0
Trolling lines	LTL	09.6.0
Pole and lines	PL	09.7.0
Vertical lines	VL	09.8.0
Hooks and lines (not specified)	LX	09.9.0
Grappling and wounding gears	GAW	10.0.0
Harpoons	HAR	10.1.0
Clamps	CLA	10.2.0
Rakes	RAK	10.3.0

Tongs	TON	10.4.0
Spears	SPE	10.5.0
Wrenching gears	WRG	10.6.0
Harvesting machines	HM	11.0.0
Pumps	HMP	11.1.0
Mechanized dredges	HMD	11.2.0
Harvesting machines (not specified)	HMX	11.9.0
Miscellaneous	MIS	20.0.0
Push nets	PUN	20.1.0
Scoop nets	SCN	20.2.0
Drive in nets	DIN	20.3.0
Electrical fishing	ELE	20.4.0
Diving	DIV	20.5.0
Destructive gears	SD	20.6.0
Explosives	EXP	20.6.1
Chemicals	CHE	20.6.2
Recreational fishing gears	RG	25.0.0
Gear not known or not specified	NK	99.0.0

Table 1. Large whale entanglements reported in Progress Reports, 2003

Nation	Area	Year	Species	No.	Description
Australia	West Australia	2002	humpback whale	1	lobster/cray pot line or other nylon rope
Brazil	Rio Grande do Norte	2002	humpback whale	1	fishery interaction or collision with ship
	Rio Grande do Sul	2002	humpback whale	1	gillnet
Denmark	West Greenland	2002	minke whale	1	bycatch in fishing gear
	West Greenland	2002	fin whale	1	bycatch in fishing gear
	West Greenland	2002	humpback whale	3	bycatch in fishing gear
Iceland	Iceland	2002	minke whale	2	entangled
	Iceland	2002	humpback whale	2	entangled
Japan		2002	minke whale	109	trap net
		2002	humpback whale	3	trap net
Korea	East Sea	2002	fin whale	1	gillnet
	East Sea	2002	minke whale	28	gillnet
	East Sea	2002	minke whale	25	set net
	East Sea	2002	minke whale	1	squid jigging
	East Sea	2002	minke whale	17	trap net
	East Sea	2002	minke whale	1	trawl
	South Sea	2002	minke whale	4	set net
	Yellow Sea	2002	minke whale	7	stow net
Mexico	Gulf of California	2003	humpback whale	1	gillnet
New Zealand		2002	unidentified large baleen whale	1	marine farm
Oman	Arabian Sea	2001+	Bryde's whale	1	entanglement in gill net
		2002*	Bryde's whale	1	entanglement in gill net
South Africa	KwaZulu-Natal	2002	humpback whale	3**	shark nets
	KwaZulu-Natal	2002	southern right whale	1**	shark nets
Spain	Mediterranean	2002	minke whale	2	fishing interaction
Tanzania***	Zanzibar	2002	humpback whale	1	driftnet
UK	UK	2001	minke whale	2	entanglement: rope marks around caudal peduncle – gear type unknown
USA	Bering Sea	2000	minke whale	2	groundfish trawl fishery
	Gulf of Alaska	2000	sperm whale	3	groundfish longline fishery
	Rockland, Maine	2000	minke whale	1	entanglement

+Refers to period March 2002 - March 2003

*Refers to period March 2001 – March 2002

** Released alive

***Information taken from Swedish Progress Report