Report of the Scientific Committee

The meeting was held at the Marriott Hotel, St. Kitts and Nevis, from 26 May-6 June 2006, and was chaired by Arne Bjørge. A list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Chair's welcome and opening remarks
Bjørge welcomed the participants to the meeting. He thanked the Government of St. Kitts and Nevis for hosting the meeting and for providing the excellent facilities in such a beautiful setting. He was pleased that a number of new, young scientists were present at the meeting this year and expressed his hope that they would become valuable members of the Scientific Committee. With regret, Bjørge noted the loss of two important Scientific Committee members: Geoff Kirkwood who was instrumental in the introduction of the *Catch Limit Algorithm* and chaired both the Scientific Committee from 1986-88 and the sub-committee on the Revised Management Procedure (RMP) up to 1991; and Kjartan Magnússon who was prominent in developing the RMP and made a valuable contribution to the Standing Working Group (SWG) on an Aboriginal Whaling Management Procedure (AWMP), particularly with respect to the *Bowhead* and *Gray Whale Strike Limit Algorithm*s (*SLA*s). A moment of silence was held in memory of these two key members of the Scientific Committee.

1.2 Appointment of rapporteurs
Donovan was appointed rapporteur with assistance from Miller and various members of the Committee as appropriate. Chairs of sub-committees and Working Groups appointed rapporteurs for their individual meetings.

1.3 Meeting procedures and time schedule
Grandy summarised the meeting arrangements and information for participants. The Committee agreed to follow the work schedule prepared by the Chair.

1.4 Establishment of sub-committees and Working Groups
Three meetings preceded the start of the Scientific Committee during 24-25 May. Both the sub-committee on the RMP and the AWMP SWG met, in which agenda items covered were incorporated into their main agendas and reports (Annexes D and E respectively). A two-day pre-meeting on seismic surveys and their potential to impact cetaceans was held by the SWG on environmental concerns and its report is given in Annex K (item 6).

A number of sub-committees and Working Groups were established. Their reports were either made annexes (below) or subsumed into this report.
Annex D – Sub-Committee on the Revised Management Procedure (RMP);

Annex E – Standing Working Group on an Aboriginal Whaling Management Procedure (AWMP);
Annex F – Sub-Committee on Bowhead, Right and Gray Whales (BRG);
Annex G – Sub-Committee on In-Depth Assessments (IA);
Annex G1 – Working Group on the In-Depth Assessment of Western North Pacific Common Minke Whales, with a Focus on J Stock (IANP);
Annex H – Sub-Committee on Other Southern Hemisphere Whale Stocks (SH);
Annex I – Working Group on Stock Definition (SD);
Annex J – Sub-Committee on Estimation of Bycatch and other Human-induced Mortality (BC);
Annex K – Standing Working Group on Environmental Concerns (E);
Annex L – Standing Sub-Committee on Small Cetaceans (SM);
Annex M – Sub-Committee on Whalewatching (WW);
Annex N – Working Group on DNA (DNA); and
Annex O – Working Group on Scientific Permits (SP).

1.5 Computing arrangements
Allison outlined the computing and printing facilities available for delegate use. Requests for Secretariat computing would be addressed according to the priority assigned by the Convenors.

2. ADOPTION OF AGENDA
The adopted Agenda is given as Annex B1. Statements on the Agenda are given as Annex S. The Agenda took into account the priority items agreed last year and approved by the Commission (IWC, 2006c, pp.55-57). Annex B2 links the Committee's Agenda with that of the Commission.

3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

3.1 Documents submitted
Donovan noted that the pre-registration procedure, coupled with the availability of electronic papers had again been successful. With such a large number of documents, pre-specifying papers had reduced the amount of photocopying and unnecessary paper dramatically. The list of documents is given as Annex C.

3.2 National Progress Reports on research
Progress Reports presented at the 2001-06 meetings are accessible on the IWC website. Reports from previous years will also become available in this format in the future.

The Committee reaffirmed its view of the importance of national Progress Reports and **recommends** that the Commission continues to urge member nations to submit them following the approved guidelines (IWC, 1993a). Non-member nations wishing to submit progress reports are welcome to do so.

Table 1

List of data and programs received by the IWC Secretariat since the 2005 meeting.

Date	From	IWC ref.	Details
Catch data			
16-05-06	Norway: Øien	E61	Individual minke catch records from the Norwegian 2005 commercial catch Access restricted (specified 14/11/00)
12-05-06	Iceland: Víkingsson	E60	Icelandic catch data 2005
30-05-05	Japan	C05	Individual catch records from the Japanese 2005 North Pacific Special Permit catch (JARPN2) and 2005/06 Antarctic Special Permit catch (JARPA)
28-05-06	St.Vincent and The Grenadines: Punnett	C05	Details of the humpback whale taken by St. Vincent and The Grenadines, 2006
01-06-06	Russian Federation: Borodin	C05	Russian aboriginal subsistence catch data, 2005
Sightings data			
12-04-06	Ensor	CD54-59	2005/06 SOWER cruise data including blue whale data (sightings, effort, weather, ice edge, inter-Stratum etc.) + photographs
27-04-06	Burt	CD-61	DESS Version 3.6, April 2006
Other data			
03-02-06	USA: George	CD53	BCB bowhead data files for the *Implementation Review* (access restricted)
30-05-06	USA: Huebinger	E63	Preliminary microsatellite data for the bowhead *Implementation Review*
26-05-06	Palka	E62	Simulation data sets 2005-6

A summary of the information included in the reports presented this year is given as Annex Q; the modified report template, taking account of recent updates (e.g. see Item 7.1.2), will be made available on the IWC website (*www.iwcoffice.org*).

3.3 Data collection, storage and manipulation
3.3.1 Catch data and other statistical material
Table 1 lists data received by the Secretariat since the 2005 meeting.

3.3.2 Progress of data coding projects and computing tasks
Allison reported that catch data received from 2004 season has been entered into the IWC individual database and entry of North Atlantic catch data from the early 1900s, which was supplied by Bloch, has continued.

The basic validation of the revised individual Southern Hemisphere catch data for the period 1948/49-1971/72 and for vessels operated under the flag of the then USSR has been completed; the detailed biological data have not been coded in this first phase of the work. Hereafter these data are referred to as the revised 1948/49-1971/72 data.

The small technical Workshop on the revised 1948/49-1971/72 catch data (see IWC, 2004a, p.2 and p.55) met in Cambridge in November to consider how best to fill the gaps in the data. Several queries in the data were clarified and it was agreed that it would be valuable for Mikhalev to try and obtain copies of technical, administration and inspection reports which might help clarify some remaining inconsistencies in the data (and see Item 21). Tormosov has located individual catch data for the *Yury Dolgoruky* for the 1969/70 season. With these data, the records from the *Yury Dolgoruky* (one of the four USSR factory ships operating in the Southern Hemisphere) will be complete. Funding will be needed to enable Tormosov to transfer the data to the IWC (see Item 21). A minority statement is given in Annex S.

In addition, the technical Workshop agreed a method for allocating catches for which no new position data is available, by interpolation using the cruise tracks from the old official data together with the new numbers of catches, by month where available. The cruise tracks from the old official data are believed to be reliable, although they may not include data north of 40°S which may be problematic for some of the catches for some species.

Allison reported excellent progress on the summary catch database which now includes all known 20th century whaling catch data.

A catch series for Southern Hemisphere humpback whales was prepared for the intersessional Workshop (SC/58/Rep5) from the IWC individual and summary databases and using the agreed method of allocating revised 1948/9-1971/2 catches to area outlined above (SC/A06/HW47). Following the Workshop, a further catch series was prepared that detailed the data by 10° square.

Data from the 2004/05 SOWER sightings cruises has been validated and incorporated into the Database and Estimation System Software (DESS) database. In addition, the remaining re-sightings data have been added into DESS and the dive time data for the 2004/05 cruise have been encoded.

The control program to run the western North Pacific Bryde's whale *Implementation Simulation Trials* has been developed and most of the trials specified at the intersessional Workshop have been conditioned and are discussed under Item 6.1.

4. COOPERATION WITH OTHER ORGANISATIONS

4.1 Convention on the Conservation of Migratory Species (CMS)
4.1.1 Scientific Council
Two CMS meetings were held in Nairobi during November 2005; a meeting of the Scientific Council and a Conference of the Parties (COP). The report of the observer at both meetings is given in IWC/58/4D. The following recommendations were adopted:

(1) listing of the Mediterranean population of short-beaked common dolphins on Appendices I and II;
(2) listing of the Mediterranean population of striped dolphins on Appendix II;
(3) support development of a Memorandum of Understanding (MOU) for cetaceans in the South Pacific;

(4) adoption of a resolution on bycatch promoting cooperation with FAO;

(5) work with the Whale and Dolphin Conservation Society; and

(6) a resolution addressing human-induced impacts on cetaceans.

Funding was requested for:

(1) a workshop to build capacity and assess cetaceans in the South Pacific;

(2) a Bangladesh workshop to build capacity in south and southeast Asia to address bycatch; and

(3) a workshop in Bangkok to build capacity in south and southeast Asia to address the status of small cetaceans in the western Indian Ocean.

The Committee thanked Perrin for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next meeting of the Scientific Council in late 2006/early 2007 and the meeting of COP in 2008.

4.1.2 Agreement on Small Cetaceans of the Baltic and North Sea (ASCOBANS)
The report of the IWC observer at the 13th Meeting of the ASCOBANS Advisory Committee held in Tampere, Finland, during 25-27 April 2006 is given as IWC/58/4J. Two new countries, France and Lithuania, acceded in 2006, bringing the number of Parties to ten. The meeting supported a proposal for two workshops on bottlenose dolphins aiming to:

(1) identify fine-scale population structure and distribution;

(2) determine population structure and distribution; and

(3) quantify reasons for decreases in range.

It was recommended that the organisers should try to cooperate with the IWC on this matter.

Preliminary results from the Small Cetaceans in the North Sea (SCANS) II survey suggest that many more porpoises are present in the southern North Sea and eastern Channel than previously, with a possible decrease in abundance further north and east. The final results are expected to be available late 2006/early 2007.

The drafting of a Recovery Plan for harbour porpoises in the North Sea has entered its final stage. A generic Recovery Plan was called for by the North Sea ministers, as it was considered more appropriate to recommend tailored measures for specific stocks. This new 'Conservation Plan' will be submitted to the next Meeting of Parties in September in The Netherlands. The Jastarnia Plan is progressing and the first steps include:

(1) development of a database of opportunistic sightings, strandings and bycatch;

(2) investigation of fishing effort;

(3) a study on genetics of harbour porpoises; and

(4) a workshop on establishment of criteria for identifying sites important to harbour porpoises.

Anthropogenic factors potentially affecting small cetaceans, including high speed ferries, military activities, offshore extractive activities, wind farms and pollution, were discussed.

The Advisory Committee recognised the activities of the IWC Scientific Committee, in particular the POLLUTION 2000+ programme and looks forward to collaboration on bycatch modelling.

The Committee thanked Reijnders for attending on its behalf and **agrees** that he or Donovan should represent the Committee as an observer at the next meeting.

4.1.3 Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)
No formal meetings of ACCOBAMS occurred during the intersessional period, however Donovan had attended two ACCOBAMS and Pelagos Sanctuary sponsored Workshops concerning: (1) Mediterranean fin whales; and (2) the issue of ship strikes in the ACCOBAMS region. The latter report is discussed in Annex J. There had also been a workshop on Mediterranean cetaceans in the context of the Red List, held jointly with IUCN. A summary of the workshop held in 2004 to plan a major synoptic survey of the ACCOBAMS region is available as SC/58/O12. The survey was discussed under Annexes H and L and is **endorsed** by the Committee. Further information on ACCOBAMS activities can be found on *www.accobams.org*.

The Committee thanked Donovan and **agrees** that he should represent the Committee at the next ACCOBAMS Scientific Committee meeting.

4.2 International Council for the Exploration of the Sea (ICES)
The report of the IWC observer documenting the 2004 activities of ICES is given as IWC/58/4A. During the year, the ICES Working Group on Marine Mammal Ecology (WGMME) met and of relevance to the IWC was discussion of the impact of fisheries on small cetaceans. Preparations were initiated for a workshop on marine mammal health and immune status, disease agents and links to environmental factors.

During the Annual Science Conference held in Aberdeen, Scotland, from 20-24 September 2004, two themed sessions incorporated discussions on marine mammals: (1) monitoring techniques, abundance estimation and interactions with fisheries; and (2) mitigation methods for reduction of marine mammals and sea turtle bycatch in fisheries.

The Committee thanked Haug for the report and **agrees** that he should represent the Committee as an observer at the next ICES meeting.

4.3 Inter-American Tropical Tuna Commission (IATTC)
The report of the IWC observer at the 73rd Meeting of the IATTC was held in Lanzarote, Spain during 20-27 June 2005 is given as IWC/58/4E. The report of the eastern Pacific tuna fishery for 2004 indicated that a total of 1,469 dolphins were killed during purse seine fishing operations, comprising 498 spotted dolphins (two stocks), 434 spinner dolphins (two stocks), 481 common dolphins (three stocks) and 56 dolphins of other species. The proportion of common dolphins was noted to be higher than normal. A proposal to link the issuance of dolphin mortality limits to compliance with tuna conservation measures was discussed, but consensus could not be reached. A full report of the IATTC meeting can be found on its website (*www.iattc.org*). The Committee thanked Reilly for his report and **agrees** that he should represent the Committee as an observer at the next IATTC meeting.

4.4 International Commission for the Conservation of Atlantic Tunas (ICCAT)

The report of the IWC observer at the 2005 Meeting of the Standing Committee on Research and Statistics of ICCAT was held in Madrid, Spain 3-7 October and is given as IWC/58/4H. Many topics were discussed but none were directly relevant to cetaceans. The Committee thanked Kell for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next ICCAT meeting.

4.5 Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR)

The report of the IWC observer at the 24th Meeting of the CCAMLR Scientific Committee, held in Hobart, Australia during 24-28 October 2005 is given as IWC/58/4B. Results from the 2005 IWC meeting relevant to CCAMLR were presented by Kock, including results from the IWC Workshop on Sea Ice which preceded the meeting. Details of whale catches within the CCAMLR Convention Area were also reported. The main items considered at the CCAMLR meeting of relevance to the IWC included:

(1) status and trends of Antarctic fish stocks and krill;
(2) incidental mortality of marine mammals;
(3) ecosystem monitoring and management;
(4) management under conditions of uncertainty; and
(5) possible joint activities with respect to ecosystem modelling in the Southern Ocean.

The CCAMLR Scientific Committee agreed that a joint workshop with the IWC would be useful to review the state and characteristics of information, including knowledge on abundance, trends in populations and parameters, required for ecosystem models being developed to provide management advice on krill predation in the Antarctic marine ecosystem. A steering committee will develop a workplan, with the intention of holding the workshop in 2008.

CCAMLR will be participating in the International Polar Year (IPY), 2007/08. Formal recognition of the CCAMLR 2008 Survey as the 'lead project' for the topic 'Natural Resources, Antarctic' was received. The Scientific Committee of CCAMLR encouraged the participation of the IWC in both the planning and implementation of the cruise.

Little new information on cetacean-fisheries interactions has become available. South Africa reported that in the Prince Edward Islands two out of every three Patagonian toothfish (*Dissoctichus eleginoides*) are taken by killer whales before they can be hauled onboard. The further development of a pot fishery was considered as an alternative to longlining, in order to avoid predation. The Working Group on Fish Stock Assessment reported that the interaction between cetaceans and Southern Ocean fisheries appears to present a limited incidental mortality risk to cetaceans. So far the death of one smaller baleen whale (probably a minke whale) in 2003 is known of.

Discussion of the IWC-CCAMLR collaboration appears under Item 12.3 and in Annex K. Reports of the CCAMLR Scientific Committee and its Working Groups are available through the CCAMLR secretariat and on its website (*www.ccamlr.org*). The Committee thanked Kock for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next meeting of the CCAMLR Scientific Committee.

4.6 Southern Ocean GLOBEC (SO-GLOBEC)

Details of SO-GLOBEC activities and collaboration with the IWC are given under Item 12.3 and in Annex K. The Committee thanked Thiele for promoting and coordinating the collaboration and **agrees** that she should continue in this work in conjunction with the intersessional Steering Group (Annex R20).

4.7 North Atlantic Marine Mammal Commission (NAMMCO)

4.7.1 Scientific Committee

The report of the IWC observer at the 13th Annual Meeting of the NAMMCO Scientific Committee held 24-27 October 2005 in Lofoten, Norway is given as IWC/58/4I. The full report of the meeting will shortly be published in the NAMMCO annual report and is presently available on the NAMMCO website (*www.nammco.no*). The species of interest to the IWC discussed were: harbour porpoises; narwhals; white whales; minke and fin whales; and common dolphins.

At a joint meeting of the NAMMCO Working Group on the Population Status of Narwhal and Beluga in the North Atlantic and the Canada-Greenland Joint Commission Scientific Working Group, new results on age determination were discussed. Catch statistics for narwhals were updated. A model-based assessment for West Greenland narwhals strengthened the 2004 conclusion that this stock is heavily depleted and that substantial reductions in catch are required immediately to halt the decline in numbers. A reliable assessment of narwhals in East Greenland was not possible due to a lack of information. A risk analysis on narwhal hunting in the Canadian High Arctic gave an initial result that the situation was less serious than in West Greenland.

An assessment model for West Greenland white whales showed that the stock is severely depleted.

Norwegian surveys for minke whales north of Iceland and around Jan Maya have been conducted in 2005 as part of its sightings survey programme. The Icelandic research programme continued in 2005, 39 minke whales were taken. An aerial survey, focussing on minke and fin whales was conducted in West Greenland during September 2005.

The NAMMCO Working Group on fin whales also met in October and discussed available data and a new assessment model for the East Greenland population. Much discussion was focused on preparations for the joint Workshop with the IWC on the Catch History, Stock Structure and Abundance of North Atlantic Fin Whales. The report of the Joint Workshop forms SC/58/Rep3 and is discussed in Annex D.

Using data from the North Atlantic sightings surveys (NASS) and other surveys, an analysis of the distribution and abundance of common dolphins was conducted. No sightings were made north of 57ºN in any year. The next are planned for 2007 and efforts have been made to coordinate these with other surveys taking place the same year. Both surveys plan to cover European Atlantic offshore waters outside the continental shelf area and possibly Canadian and US waters. Progress in the TNASS survey was discussed under Annex D and the Committee **endorses** the survey.

The NAMMCO Scientific Committee stated that better estimates of harbour porpoise bycatch are needed in order to estimate the ongoing sustainability of bycatch, particularly

given the likely substantial bycatch in Norwegian and Icelandic fisheries.

The Committee thanked Walløe for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next NAMMCO Scientific Committee meeting.

4.7.2 Council
The 15th Annual Council Meeting of NAMMCO took place in Selfoss, Iceland from 14-16 March 2006. The report of the IWC observer is given as IWC/58/4C. Preliminary results from the Icelandic research programme on minke whales were presented and were particularly related to their life history and biology. Discussion of the North Atlantic Sightings Suvey (NASS) confirmed that there will be trans-Atlantic coverage from the European to the North American coast for the first time. Further discussion of NASS can be found under Item 4.7.1. The NAMMCO international observer scheme will this year focus on Greenlandic and Norwegian whaling. The Chair (Kate Sanderson) and vice-Chair (Halvard Johansen) were both re-elected for a further two years.

4.8 World Conservation Union (IUCN)
IUCN remains engaged in the conservation of the western gray whale. Following the report of its Independent Scientific Review Panel published last year, IUCN is currently negotiating with various stakeholders over the creation of a Western Gray Whale Advisory Panel whose initial role will be to advise on issues associated with the effects on gray whales of oil and gas developments off Sakhalin, but which may be extended to cover more of the western gray whale's range. In the meantime, an Interim Independent Scientists Group has been advising on mitigation measures for the Sakhalin II development. More information is available from the IUCN website (*www.iucn.org*). Together with other organisations, IUCN is engaged in the Global Mammal Assessment, the cetacean part of which will be drafted at a workshop to be held in San Diego in January 2007. More information is available from the IUCN website.

The Committee thanked Cooke for his report and **agrees** that he should continue to represent the Committee as an observer to the IUCN.

4.9 Food and Agriculture Organisation (FAO)
No meeting of FAO occurred during the intersessional period. The Committee **agrees** that Mae should represent the Committee as an observer at the next meeting. Cooperation with FAO with respect to ecosystem modelling is discussed under Annex E.

4.10 North Pacific Marine Science Organisation (PICES)
The report of the IWC observer at the 14th annual meeting of PICES held 29 September-9 October 2005 in Vladivostok, Russia is given as IWC/58/4G. The Marine Birds and Marine Mammals Advisory Panel (MBM-AP) addressed factors affecting distribution, foraging ecology and life histories of top predators in the western North Pacific and its Marginal Seas. Highlights included information on the occurrence of extremely rare northern right whales in the Sea of Okhotsk and interactions between Sakhalin Island oil exploration and endangered grey whales.

Differences in the scale of responses to climate variability between marine mammals were also discussed.

At next years meeting of PICES, the MBM-AP proposed to have a full day workshop on 'synchrony in responses of marine top predators to large-scale climate variability: mechanisms of environmental forcing'.

Kato had been unable to attend the meeting and prepared his report through correspondence with Sydenman, the MBM-AP co-Chair. The Committee thanked Kato for his report and **agrees** that he should represent the Committee as an observer at the next PICES meeting.

4.11 Eastern Caribbean Cetacean Commission (ECCO)
Since IWC/58 is being held in St. Kitts and Nevis, it was deemed necessary for the work programme of the ECCO for the year 2005/06 to focus mainly on related public relations exercises and promotion of public awareness. In this vein, plans and programmes of a scientific nature were deferred to the following year. A report on further developments will be ready for presentation to the next IWC Scientific Committee meeting in 2007.

4.12 Protocol on Specially Protected Areas and Wildlife (SPAW) of the Cartagena Convention for the Wider Caribbean
As this organisation, which is of relevance to the Caribbean region, represents a novel relation to IWC, Bjørge invited Anselme to make a short presentation. Anselme expressed his pleasure at being involved with the IWC and hoped this new relationship would continue for many years to come. Background on the organisation and its relevance to the IWC can be found in IWC/58/4F. A regional Workshop on the Development of the Marine Mammal Action Plan for the Wider Caribbean Region was convened in Barbados, 18-21 July 2005, during which a draft action plan for the conservation of Marine Mammals in the wider Caribbean region was prepared. The plan is intended to assist Governments in the region in their efforts to develop and improve marine mammal conservation polices.

The Committee thanked Anselme for his report.

5. REVISED MANAGEMENT PROCEDURE (RMP) – GENERAL ISSUES

5.1 Finalise the guidelines and requirements for implementing the RMP
5.1.1 Develop the thresholds for defining 'acceptable' and 'borderline' performance for classifying the performance of RMP variants for Implementation Simulation Trials
When it had developed the 'Requirements and Guidelines for *Implementation*s' two years ago (IWC, 2005d), the Committee had not specified the exact numerical guidelines for the thresholds that define 'acceptable', 'borderline' and 'unacceptable' conservation performance for classifying the performance of RMP variants for *Implementation Simulation Trials* (*IST*s). It had indicated that further work was required to achieve this, and had agreed the following way to determine the conservation performance of an RMP variant for each stock in an *IST* for which $MSYR=1\%$.

(1) Construct a single stock trial, which is 'equivalent' to the *IST*. For example, if a particular *IST* involved carrying capacity halving over the 100-year projection

period, the 'equivalent single stock trial' will also involve carrying capacity halving over the next 100 years.

(2) Conduct two sets of 100 simulations based on this single stock trial in which future catch limits are set by the *Catch Limit Algorithm* (*CLA*). The two sets of simulations correspond to the 0.6 and 0.72 tunings of the *CLA*. Rather than basing these calculations on a single initial depletion, the simulations for each stock to be conducted for the set of initial depletions for the stock concerned in the *IST*.

(3) The cumulative distributions for the final depletion and for the depletion ratio (the minimum over each of the 100 years of the ratio of the population size to that when there are only incidental catches) to be constructed for each tuning of the *CLA*.

(4) The lower 5%-ile of these distributions to form the basis for determining whether the performance of the RMP for the *IST* is 'acceptable', 'borderline' or 'unacceptable'.

The results of this work were reported in SC/58/RMP2 and are given in Appendix 2 of Annex D.

A draft amendment to the 'Requirements and Guidelines for *Implementation*s' (IWC, 2005d) is given in Appendix 3 of Annex D. The Committee **agrees** that some further work is needed to fully evaluate these criteria, particularly with respect to the consequences of judging performance to be acceptable or borderline based on just one of two risk criteria. The Committee will reconsider the criteria next year after their properties have been examined in a wider range of contexts.

5.1.2 Develop a list of agreed stock structure archetypes
SC/58/RMP3 reviewed the process for defining stocks during RMP *Implementation*s of North Pacific common minke and Bryde's whales. It concluded that discussion on stock structure for different *Implementation*s should be carried out on a consistent basis, following normal scientific practice, and that the same criteria should be used to define stocks in different *Implementation*s.

One problem identified in SC/58/RMP3 concerned the need for peer-review of new methods for the analysis of genetic data. The Committee concurred with this view and **agrees** that this can best be achieved through the Committee itself. Such reviews should be undertaken by a Working Group separate from the Working Group undertaking the *Implementation*. The Committee noted that the purpose of the TOSSM project being developed under the stock definition sub-committee (see Annex I) was to test such methods; however, this will not be completed for a number of years.

In the absence of a framework such as TOSSM, the Committee has developed a number of stock structure hypotheses or archetypes in *Implementation*s conducted to date. Details of these are available for North Atlantic (IWC, 2004c), Southern Hemisphere (IWC, 1993b, pp.104-05) and western North Pacific minke whales (IWC, 2004b, pp.77-89), western North Pacific Bryde's whales (SC/58/Rep1) and North Atlantic fin whales (SC/58/Rep3).

5.2 Proposal for revision of the *CLA*
5.2.1 General approach to such considerations
The Committee noted that IWC (1994, p.47) specifies the protocol for evaluating proposed amendments to the RMP. For a proposal for an amendment to be considered, there needs to be some evidence, in the form of simulation trial results or otherwise, that the proposed amendment would result in improved performance in at least some respect. The complete protocol is given in Annex D (item 2.2.1).

5.2.2 Consideration of the Norwegian proposal
At the Committee's 2004 meeting, Norway had notified four possible changes to the 'base-case' and robustness trials and to the *CLA* (IWC, 2005c, pp.79-80). SC/58/RMP7 explored two of these as the authors summarised below.

(1) To run the simulations for more than a hundred years and until equilibrium abundance is reached. Exploratory simulations showed that equilibrium was nearly reached after 300 years, which was used as the period for all trials. The resulting long-term (after 300 years) Depletion Level (DL) was chosen as the relevant parameter to characterise the trials instead of the Tuning Level (TL - depletion level after 100 years for the basecase D1 trial), which is sometimes wrongly interpreted as the long-term depletion.

(2) The *Maximum Sustainable Yield Rate* (*MSYR*) should refer to the 1+ component of the population instead of the mature component. The Committee has used the 1+ component and specific choices of *MSYR* with $MSYR_{(1+)} = 1\%$ as the minimum in its development of the *SLA* of the AWMP 'because it considered they more closely correspond to biological reality' (IWC, 1998, p.87).

When the 'base case' simulations were run for 300 years for the three TL options of 0.60, 0.66 and 0.72, chosen when the *CLA* was developed in the late 1980s, the final depletion reaches 0.73, 0.74 and 0.76, respectively. Three parameters in the *CLA* can potentially be used for tuning: their details and the consequences of using them are given in Annex D (item 2.2.2).

The Committee did not have time to fully review the results of SC/58/RMP7. Details of the short discussion that ensued are given in Annex D (item 2.2.2). It also considered SC/58/RMP7 that examined the implications of the general (and inter-related in some cases) changes proposed in SC/58/RMP8 i.e. retuning the *CLA*; using a 300 rather than a 100 year time frame; and using a higher population growth rate by changing $MSYR_{(mat)}=1\%$ to $MSYR_{(1+)}=1\%$. These issues are discussed in detail in Annex D.

The Committee briefly discussed the relevance of running simulations over 300 years vs the 100 years used during the development of the RMP. It **agrees** that the acceptability of a proposed amended *CLA* will *inter alia* be judged on performance over 100 years. Further discussion on this point is recorded in Annex D, item 2.2.2.

A primary focus of the discussion was how best to implement the protocol agreed in 1994. The following steps were identified:

(1) agreement on the range of *MSY* rates to be used in the trials;

(2) identification of an appropriate standard set of simulation trials; and

(3) definition of an appropriate set of performance statistics to be used in evaluating alternative procedures.

The Committee **agrees** that the development of proposed amendments to the *CLA* can proceed in parallel with consideration of these points.

With respect to (1), after discussing the work of a small Working Group (Annex D, Appendix 4), the Committee **recommends**:

(a) the interim range of *MSY* rates to be used in further development of amendments to the *CLA*, pending review in 2007, shall be from $MSYR_{(mat)}=1\%$ to $MSYR_{(1+)}=7\%$, corresponding approximately to the range 0.66-7% for $MSYR_{(1+)}$ or 1-10% for $MSYR_{(mat)}$;

(b) a review of *MSY* rates in baleen whales should be conducted at next year's meeting and completed by the 2008 Annual Meeting at the latest;

(c) the review should not simply take published estimates of rates of increase or *MSY* rates but should examine them critically with respect to, *inter alia*, the nature of the data and the analysis methods used (papers considered should be made available as For Information documents);

(d) where relevant data exist but have not been analysed with respect to the question of *MSY* rates, relevant analyses of these data should be actively solicited and the attention of other relevant sub-committees is drawn to this request; and

(e) a list of cases to be considered in the review should be drawn up in advance, by the end of 2006 (the list should include existing estimates and corresponding primary papers, analyses in preparation intended for submission to the review and other relevant datasets of which analyses would be desirable).

With respect to points (2) and (3) above, after discussing the results of a small Working Group (Annex D, Appendix 5), the Committee adopted the set of requirements for simulation trials to be conducted to evaluate proposed amendments to the *CLA* given in Annex D (Appendix 5). The Committee **recommends** that these requirements be integrated into the RMP specification as a footnote. Donovan and Hammond agreed to provide a draft for consideration next year. It was noted that (a) some of the trials used to test the original *CLA* are no longer necessary and (b) additional trials to model possible environmental degradation should be developed in addition or to replace the trials in which K, perhaps together with *MSYR*, varies over time.

The Committee noted the agreement reflected in Annex D, Appendix 5, item 5 that the current *CLA*, which is tuned to 72% final depletion after 100 years, together with the 66% and 60% tunings, provides a set of procedures with which to compare any candidate procedure. Hence it is unnecessary for any new procedure to be tuned to any particular level, as its performance will be compared to the existing (tuned) *CLA* by considering the full set of performance statistics. The Committee **endorses** this agreement.

5.3 Work plan
To facilitate its review of plausible *MSY* rates and the specification of additional trials for testing amendments to the *CLA*, the Committee established two intersessional Working Groups:

(1) to plan the review of *MSY* rates (Annex R8); and
(2) to specify the additional environmental degradation trials for testing amendments to the *CLA* (Annex R6).

The priority items for next year's meeting are considered under Item 19.

6. RMP – PREPARATIONS FOR *IMPLEMENTATION*

6.1 Western North Pacific Bryde's whales
6.1.1 Report from the first intersessional Implementation *Workshop for western North Pacific Bryde's whales (SC/58/Rep1)*
The Workshop took place at the National Research Institute of Far Seas Fisheries, Shizuoka, Japan from 25-29 October 2005. Its objective was to develop an appropriate *Implementation Simulation Trials* structure and to specify the associated conditioning to be carried out before this Annual Meeting. Full details can be found in the 'Requirements and Guidelines for *Implementations*' agreed by the Committee in 2004 (IWC, 2005d, pp. 84-91).

A considerable part of the Workshop was dedicated to addressing issues related to stock structure hypotheses, with emphasis on their role in specifying an appropriate trial structure. It reviewed the evidence for each of the five hypotheses agreed by the *pre-Implementation assessment*. It welcomed the considerable additional data that have become available since 1999 and noted that the assignment of plausibility in a trial context would not take place until the 'First' Annual meeting in 2006. The Workshop considered information from several approaches, both genetic and non-genetic.

After considerable discussion, the Workshop had agreed that four stock hypotheses were sufficient for the trials, as detailed in Annex D (item 3.1.1) and shown in Fig. 1.

Most of the Workshop discussion had focussed on hypothesis 4. It had agreed that at this stage, a hypothesis that included sub-stocks was necessary to implement one of the possible explanations for the differences in the age distributions for JARPN II and for sub-areas 1E and 2, recognising that further work might eliminate that explanation by the 2006 annual meeting (see (4) below). Results from a simple model filter analysis did not provide evidence for or against sub-stocks but suggested that if there is more than one sub-stock in sub-area 1, then there is likely to be considerable mixing.

The Workshop had also considered a number of other issues related to trials structure and had recommended that:

(1) all trials would assume that $g(0)=1$;
(2) there was insufficient information to develop an estimate of the lower bound for *MSYR*;
(3) alternative catch series be developed based on the agreements reached in SC/58/Rep1;
(4) experimental work be undertaken to try to determine whether observed differences in age distributions are (a) related to age reading and/or sampling issues in the commercial data (this has implications for calculation
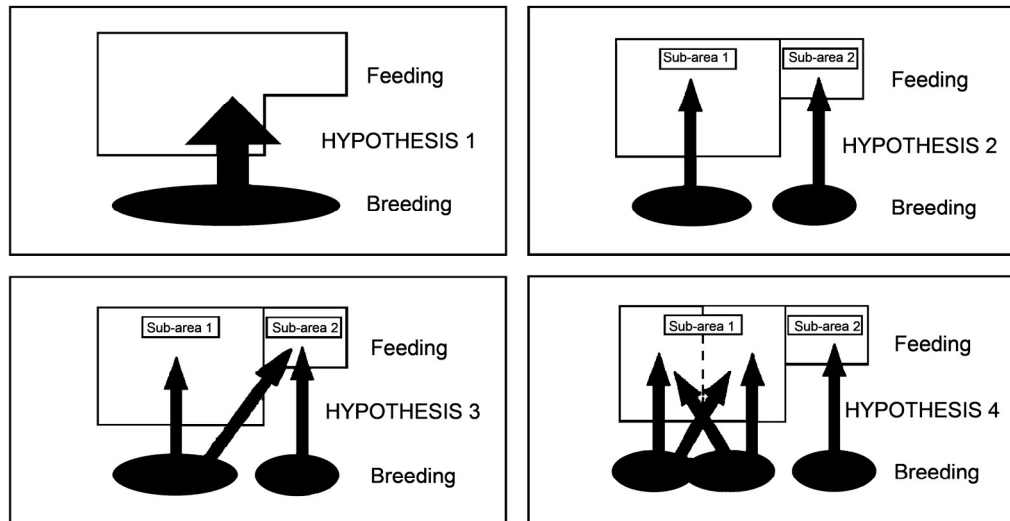
Fig. 1. Stock structure hypotheses selected by the Workshop of the *pre-Implementation assessment* of the western North Pacific Bryde's whales.

of t_m and M); (b) real and reflect age-segregated distribution (this implies that trials should allow for smaller proportions of older animals in 1W than in 1E+2); or (c) differences are real and may indicate some degree of stock structure between sub-area 1W and 1E+2 (this has implications for stock structure hypothesis 4);

(5) the three previously agreed sub-areas be retained (see SC/58/Rep1, fig. 2) but the 1W/1E boundary be moved to 165°E (with sensitivity trials for 155°E);

(6) trials should assume an age at recruitment as applied to past coastal whaling (i.e. assuming no length limits) although it was agreed to investigate the implications of retaining or removing such limits;

(7) the trials structure given in SC/58/Rep1 (Annex G) adequately captures the full range of uncertainty for the western North Pacific Bryde's whales;

(8) a control program that implements these trials be developed and that the trials be conditioned and results reported to the 2006 Annual Meeting using values for abundance, biological parameters, *Small Area* definitions and management variants detailed in the report; and

(9) the results be presented according to the manner described in SC/58/Rep1.

A number of recommendations had been made to try to ensure that this work was completed before the 2006 meeting.

In discussion, the Committee thanked Donovan and the workshop participants for their work. It **endorses** the report and it recommendations. Progress on the recommendations, including a review of the results of conditioning and updates in standard data sets, including abundance and catches and other anthropogenic removals, is discussed in Annex D (items 3.1.2, 3.1.3 and 3.1.4) and summarised below.

6.1.2 Finalise the Implementation Simulation Trials
An important part of this item was the finalisation of the *Implementation Trials* and the weighting of those trials as specified under the 'Requirements and Guidelines for

*Implementation*s' (IWC, 2005d). To do this, it was necessary to consider the plausibility of the important factors considered in the trials.

In that context, the Committee first considered the four stock structure hypotheses developed in SC/58/Rep1. After lengthy discussions and assisted by SC/58/PFI2, a summary of the available information and its inferences for each stock structure hypothesis was agreed and this is provided in Annex D (table 1). It was emphasised that the purpose of the table was not to provide a form of scoring system with 'totals' dictating plausibility verdicts, but rather to provide an aid towards an integrative appraisal of all the potential sources of information. Details of the views developed concerning the four hypotheses are given in Annex D (item 3.1.5.1).

The next factor examined was that concerning *MSYR*. The Committee **agrees** that *MSYR*=4% would be given high plausibility and *MSYR*=1% would be given medium plausibility. Its decisions concerning other factors, i.e. age-dependent mixing, additional process error, stochastic mixing, alternative stock boundaries, and 'low' and 'high' catch series, are also given in Annex D (item 3.1.5.2). It also considered the necessary data and/or research to reduce hypotheses (Annex D, item 3.1.6), and the specification of operational features and management variants (Annex D, item 3.1.7).

The Committee reviewed the *IST*s specified in table 6 of SC/58/Rep1. All 22 trials were retained, and an additional six were specified, as detailed in Annex D (item 3.1.5.2). The full list of specified trials and the assigned weights is given in Annex D (Appendix 6). The Committee **agrees** that these trials shall be used in the *Implementation*.

In conclusion, the Committee **agrees** to all of the modifications to the trial specifications developed since the Workshop (Annex D, Appendix 6). Most of these trials have been conditioned and this conditioning was reviewed and deemed acceptable in nearly all cases. The Committee **agrees** that the intersessional Working Group be mandated to finalise and agree the remaining conditioning. A final catch series and alternatives is given in Annex D (Appendix 7).

6.1.3 Recommended action
In accordance with the 'Requirements and Guidelines for *Implementation*s' (IWC, 2005d) plans were made for the second intersessional Workshop for the western North Pacific Bryde's whale *Implementation*. Japan offered to host the meeting, as for the first intersessional Workshop, to be convened by Kawahara. Donovan agreed to Chair the Workshop which will probably take place 10-14 December 2006. Budgetary implications are discussed under Item 21.

6.2 North Atlantic fin whales
6.2.1 Progress on completing the pre-Implementation assessment
6.2.1.1 REPORT OF THE JOINT NAMMCO/IWC SCIENTIFIC WORKSHOP ON THE CATCH HISTORY, STOCK STRUCTURE AND ABUNDANCE OF NORTH ATLANTIC FIN WHALES (SC/58/REP3)
The joint Workshop was held in Reykjavik, Iceland, 23-26 March 2006. Its main objective was to consider the available information on stock structure, catch history, biological parameters and abundance and trends in North Atlantic fin whales to advance the two organisations' ongoing assessments.

With respect to stock structure, the Workshop reviewed the available genetic and non-genetic data and recommended work to be completed before this Annual Meeting. It also considered hypotheses for feeding areas, using the schematic figures of Daníelsdóttir *et al.* (2005) as a guide and modifying them where appropriate. It noted that in many cases the discriminatory evidence is weak. The results of these discussions are given in SC/58/Rep3 (fig. 1).

The Workshop received a complete review of estimates of fin whale biological parameters but had agreed that there was nothing in the review to necessitate change to the parameter values used previously by both the IWC (IWC, 1992) and NAMMCO (NAMMCO, 2000; North Atlantic Marine Mammal Commission, 2001; North Atlantic Marine Mammal Commission, 2004; North Atlantic Marine Mammal Commission, 2006) Scientific Committees.

Considerable progress had been made with respect to the catch series for the Northeast and Central Atlantic. There was sufficient uncertainty in the catches, in particular in earlier years (when the fin whale catch was estimated from the total catch by species proportion and when the struck and lost rate was thought to be appreciable), to warrant development of alternative catch series. The Workshop agreed to develop a 'high' and a 'low' series, although the work could not be completed at the Workshop. It also considered papers detailing various Catch Per Unit Effort (CPUE) indices for the Icelandic, Norwegian and Faroese fin whaling operations and provided a series of recommendations for their improvement and better documentation, with priority being given to investigating whether appropriate CPUE series could be developed for the 'early' (pre-1915) Icelandic whaling operations and Faroese whaling after the 1st World War.

The Workshop had reviewed several papers detailing abundance estimates from international and Norwegian surveys carried out in the northeast and central North Atlantic since 1987, as well as recent Canadian and Greenlandic surveys. It found the estimates from the NASS and Norwegian surveys for the central and northeast Atlantic were acceptable for use in assessments and agreed on best estimates of current abundance in the central North Atlantic (including the Faroes) and the eastern North Atlantic. The estimates were based on the assumption that $g(0)=1$, which was considered adequate, based on estimates from recent NASS and Norwegian surveys within the range 0.7- 0.9 depending on whether the estimate is for single or combined platforms.

The Workshop had noted that estimated abundance west and southwest of Iceland increased at an annual rate of 10% (95% CI=6%-14%) between 1987 and 2001. This is the area where nearly all Icelandic fin whaling has been conducted since 1915. Estimated abundance in the whole East Greenland-Iceland (EGI) area had increased at 3% (95% CI=-1%-7%) per year, but this rate of increase is not significant at the 5% level. There was no evidence of any trend in abundance in the eastern North Atlantic.

In order to obtain estimates of initial abundance, the Workshop considered a new assessment model for the EGI fin whale population, modelled as four sub-populations with movement between areas. It was unable to draw firm conclusions from the modelling exercise, but noted that the more complex models involving two or more spatial components did fit the historical and modern CPUE and abundance data better than single homogeneous stock models.

A series of recommendations was provided for future work (SC/58/Rep3, item 10). The Workshop agreed that all documents submitted to the respective Scientific Committees pertaining to the assessment of fin whales in the North Atlantic, and their reports, would be exchanged in the future. The first joint meeting between the NAMMCO and IWC Scientific Committees was considered successful, efficient and productive, and it was hoped that this level of cooperation on issues of common importance could be continued.

The Committee thanked Walløe and the participants for their work and **endorses** its conclusions and recommendations.

In the Committee's discussion of the Workshop report, Aguilar noted that most evidence suggested that Mediterranean fin whales were a separate population with little or no exchange with other North Atlantic groups. Records from past whaling as well as more recent studies indicate that fin whale densities in the Strait of Gibraltar area were low historically and are so now. Nevertheless, evidence from satellite tagging and stable isotope ratios (Guinet *et al.*, 2005) indicates that some exchange between the Mediterranean and the Atlantic through the Strait does occur, although movements into the North Atlantic may be limited.

6.2.1.2 REPORT OF THE INTERSESSIONAL WORKING GROUP
Víkingsson presented the report of the intersessional Working Group on North Atlantic fin whales. It had met briefly in St. Kitts, but based its report mainly on a meeting held in connection with the Joint NAMMCO/IWC Workshop (see above). The conclusions of the Working Group are included where relevant below.

6.2.1.3 PROGRESS ON COMPLETION OF THE *PRE-IMPLEMENTATION ASSESSMENT*
PLAUSIBLE STOCK STRUCTURE HYPOTHESES
The Committee noted that plausible stock hypotheses need only to be specified in broad detail at this stage and that they should be consistent with the data and inclusive enough that it is deemed unlikely that new data collected

during the *Implementation* process will suggest a major new hypothesis. Several new analyses conducted subsequent to the joint Workshop were considered by the Committee, as detailed in Annex D (item 3.2.3.1).

In SC/58/PFI6, the genetic structure of North Atlantic fin whales on their feeding grounds was further assessed, using *inter alia* the *BayesAss* program (Wilson and Rannala, 2003). It concluded that the genetic analyses based upon nuclear as well as mitochondrial loci all suggested high levels of gene flow among all North Atlantic sampling areas; although both allele and haplotype frequencies were statistically different among majority of the sampling areas, the actual level of divergence is very low.

In discussion, a number of concerns with respect to the use of *BayesAss* were raised, both in terms of whether the assumptions of the approach were met by the data and whether the approach had been tested on a wide enough range of scenarios, particularly ones where the level of differentiation is as low as that found in North Atlantic fin whales. This is discussed further in Annex D (item 3.2.3.1). Samples from the breeding grounds would be useful in this regard but are not yet available.

In SC/58/PFI7, results were presented of genetic analyses of two fin whale datasets that aimed to study further the temporal and micro- and macrogeographical population structure of North Atlantic fin whales sampled at different feeding grounds. In SC/58/Rep3, the interpretation of P-values when values of FST were very small was discussed and the matter was referred to a Working Group under Skaug (Annex R7), but it has not yet completed its work. In discussion, the Committee noted that the significant heterogeneity between sampling years seen at Iceland and the Faroes suggested either temporal variation in the summer distribution of stocks and/or that different proportional mixtures of stocks were being sampled on the feeding grounds. Such year to year differences may exist in other areas as well but the temporal resolution of the sampling is not sufficient to detect them. The situation at the Faroes was exceptional in that the samples were collected in single events over a short period of time. Therefore it is possible that single 'herds' of related individuals may have been sampled in each event.

There was also some discussion in the Committee over the issue of the use of simple P values vs. bootstrap confidence intervals for pairwise FST comparisons. Although it was generally agreed that providing confidence intervals for FST values is to be encouraged, it was pointed out that the P value from a standard test of heterogeneity provides a more direct test of the null hypothesis that all samples have been drawn from the same population.

In SC/58/PFI8, results of new statistical analyses of three old fin whale allozyme and carbonic anhydrase datasets previously published in Árnason et al. (1992) Daníelsdóttir *et al.* (1991; 1992) were presented. Details are provided in Annex D (item 3.2.3.1).

SC/58/PFI9 detailed the screening of a dataset consisting of 15 microsatellite loci from 226 fin whales from several North Atlantic locations for closely related individuals. The Committee **agrees** that this method shows promise for identifying relatives in genetic samples and can assist in the interpretation of analyses related to stock boundaries and the degree of mixing among areas. It was noted that the number of matches of closely related individuals would increase with sample size, and the certainty of detection with the number of microsatellite loci included in the analysis.

Kitakado presented the results of a preliminary analysis using a new method aimed at simultaneous estimation of mixing proportions and genetic differentiation for stocks for North Atlantic fin whales. The Committee considered this method promising and **recommends** that Kitakado continue simulation testing the model under levels of differentiation observed in whale populations as well as examining its performance by applying it to other species and stocks for which stock structure is better known.

In conclusion, the Committee noted that SC/58/Rep3 provided a range of stock hypotheses and recommendations for further genetic work to refine or suggest new ones. It was gratified to see that much of this work had been accomplished and thanked the authors of SC/58/PFI6-8 and members of the intersessional Working Group for their hard work in fulfilling these recommendations in the short period since the joint Workshop. Considering the new information brought forward, the Committee found no reason to modify any of the existing stock hypotheses, or to suggest new ones.

PRELIMINARY INVESTIGATION OF EXPERIMENTAL WAYS TO DISTINGUISH AMONG COMPETING HYPOTHESES

The Committee noted that recommendations for further analytical work to distinguish among competing stock hypotheses should be provided at this meeting. Further discussion may also take place at the start of the *Implementation* process if it proceeds.

A number of potentially useful avenues of research were suggested. These are summarised briefly below.

(1) **Photo-identification studies**. This is potentially useful, but there are only two North Atlantic catalogues available, for the Gulf of Maine and the Mediterranean Sea. Robbins agreed to compile all relevant information on this issue for the next Annual Meeting.

(2) **Genetic analyses.** Obtaining samples for genetic analysis from the breeding grounds (see (3) below) would be very valuable for identifying fin whale stocks, which might then be distinguishable on the feeding grounds. A number of new methods for genetic analyses have been identified but it is important that their strengths and limitations are tested, ideally under a simulation approach. While the Testing of Spatial Structure Models (TOSSM) project will eventually create an ideal framework for this, the results might not be available for the prospective *Implementation*.

(3) **Telemetry studies.** The location(s) of the breeding grounds are presently unknown. Satellite tags applied late in the season on the feeding grounds might be useful in identifying fin whale breeding areas. They also may provide information on migration routes and movements between feeding areas. However, the rate of success in fin whale tagging, in terms of tag functioning and duration, had been low in previous attempts and these issues must be resolved before tagging can proceed on a large scale.

DISPERSAL RATES

The Committee noted that FST values and other data provided by genetic studies will need to be used to produce realistic ranges of dispersal rates for input into trials.

Dispersal rates refer to permanent movement of individuals between breeding stocks and differ from mixing proportions which refer to situations where more than one breeding stock feeds in a particular area; trials need estimates of both these quantities. This work requires careful consideration and must be completed before the first intersessional Workshop once an *Implementation* has begun. The issue was referred to the intersessional Working Group under Skaug (Annex R7).

ABUNDANCE ESTIMATES (INCLUDING *G*(0) ISSUES AND PLANS FOR FUTURE SURVEYS)

Víkingsson confirmed that all survey data will become available in the IWC database as per the Data Availability Agreement (DAA). It was concluded that these were of sufficient temporal and spatial resolution to calculate abundance estimates both on the scale of the sub-areas that would be likely to be used in conditioning simulation trials and for use in the *CLA*.

At the joint Workshop it was noted that no recent abundance data are available for the American coastline. However, Palka provided information on estimates available for the Gulf of Maine – Bay of Fundy region and noted that these data and analyses can be made available to the Committee. The Committee **agrees** that these data will be valuable in the *Implementation* process.

Abundance estimates from the 1987, 1989, 1995 and 2001 NASS as well as the 1996-2001 Norwegian surveys were reviewed by the joint Workshop and found to be of sufficient quality for use in simulation trials and in the *CLA*. The issue of $g(0)$ for fin whale ship surveys was also examined by the joint Workshop, which concluded that $g(0)$ was close to 1 and the assumption of $g(0)=1$ would be sufficient for trials.

The Committee **concurs** with these conclusions of the joint Workshop.

FUTURE SURVEYS AND SURVEY PLANS

Víkingsson reported that a new survey would be carried out in 2007, and that Iceland planned to continue large-scale surveys at 5-6 year intervals. Plans for the Trans-NASS (TNASS, see item 6.2.3.2), which will cover a large part of the northern North Atlantic and includes the participation of Norway, the Faroe Islands, the Russian Federation, Iceland, Greenland and Canada, were provided in SC/58/O21. The Committee **endorses** the TNASS survey and encourages continuing participation of IWC scientists (notably Hammond and Donovan) in the planning process. A synoptic redfish survey will take place in 2007, coordinated by the ICES Study Group on Redfish Stocks (SGRS), with international participation from several countries including Iceland. The Icelandic vessel will be used as a cetacean survey platform. The Committee **endorses** this collaborative effort and **requests** that the Commission encourage the relevant governments participating in the international redfish survey to include a cetacean component in the survey.

CATCH DATA (INCLUDING ALTERNATIVE SERIES)

Allison confirmed that the catch history for North Atlantic fin whales was sufficiently well known to allow a catch series to be developed for use in trials, and that work on this task was in progress. This compilation will include notations on data quality and available ancillary information. There are sufficient uncertainties in the catch series (allocation of catches between species, catch location,

struck and lost) to anticipate the use of alternative catch series, and the compilation of catch data will be used to develop such alternative series.

SC/58/PFI4 presented CPUE series for fin whales during the early modern whaling operation in Iceland (1883-1915) that have been revised from Sigurjónsson and Gunnlaugsson (2006) based on the recommendations given in SC/58/Rep3. Details are provided in Annex D (item 3.2.5.3). The Committee thanked the authors for their work in responding to the recommendations of the joint Workshop.

FUTURE WHALING OPERATIONS

The Committee recalled that this RMP *Implementation* had been requested by Iceland and the only likely commercial whaling operation in the near future at least, is on the traditional fin whaling grounds off west Iceland. It can be assumed that future whaling will only be conducted from the single existing land station at Hvalfjörður and that the operating area of the whaling vessels will be restricted to largely the same area as during the commercial whaling from 1948-85, except that future catches will probably be within the 200 n.mile limit. Future catches under the RMP would probably be confined to the period June-September.

The Committee noted that there are no plans to initiate commercial whaling for fin whales by other nations that caught fin whales in the North Atlantic prior to the onset of the moratorium, such as Spain, the Faroes, Norway and Canada. The possibility of a very limited catch (5-10 animals) for scientific purposes off Norway and the Faroes in the medium future cannot be precluded and might thus be included as a sensitivity test (Mikkelsen, Walløe pers. comm.).

OTHER ANTHROPOGENIC REMOVALS

The Committee considered information on bycatches and ship strikes from a variety of sources (see Annex D, item 3.2.3.7). It recognised that although it is difficult to evaluate the efficiency of reporting schemes with precision, it can be concluded from the available evidence that non-natural mortality of fin whales in the North Atlantic (outside the Mediterranean) is insignificant compared to abundance. It **agrees** that there is no need to model incidental catches in the *IST*s.

CONDITIONING

SC/58/PFI3 presented some new investigations of life history parameters based on data from biological samples of fin whales caught off Iceland from 1967-85 and scientific catches from 1986-89, originally presented in Lockyer and Sigurjónsson (1991). Details are given in Annex D (item 3.2.3.8)

The Committee thanked the authors for this compilation. It **agrees** that the available biological data, including estimates of relevant biological parameters, were sufficient for the *Implementation* process.

6.2.2 Recommended action

The Committee concluded that the only outstanding item to be completed before proceeding towards an *Implementation* was the development of a list of catches with associated ancillary information to allow the development of a best and alternative catch series for use in simulation trials. Considerable progress towards that had been made at the joint Workshop and it was anticipated that it could be completed in time to begin an *Implementation* this year.

However, the Committee considers that it would be impractical to begin the *Implementation* at this time because of a lack of resources and the Committee's heavy workload, under which the North Pacific Bryde's whale *Implementation* must be completed as a priority. The Committee therefore **recommends** that the *Implementation* for North Atlantic fin whales be initiated in 2007. It was emphasised that this delay in initiation of the *Implementation* was due to the Committee's priorities and workload, rather than a lack of sufficient preparation on the part of the initiating Member State, Iceland.

The Committee **recommends** the following priorities for further research in the interim:

(1) completion of the comprehensive list of catches; and
(2) refinement and extension of genetic and other analyses to discriminate between existing stock hypotheses and to estimate mixing proportions and dispersal rates.

6.2.3 Consideration of surveys under the guidelines and requirements

6.2.3.1 NORWEGIAN SURVEYS
SC/58/RMP4 formed the report of a Norwegian 2005 survey for minke whales in Small Management Area CM around Jan Mayen. The Committee welcomed the report of this new cruise. It also **recommends** that new data on dive time should be collected during future surveys. Such data had been requested in the past, and it had been stated in cruise plans that such data would be collected. Walløe indicated that dive time data would be collected in 2006. Full results, including data analysis of the full set of surveys will be presented in 2008, which is the appropriate time to review and consider approval of those surveys for use in the RMP. Official Scientific Committee oversight for the 2006 Norwegian survey was designated to Øien.

6.2.3.2 OTHER
Víkingsson raised the issue of planning for a joint survey in 2007 in late June. It was noted that any part of a survey planned to provide data for use in the RMP needed to have its cruise plans submitted to the Committee for consideration prior to the survey being carried out. The Committee **agrees** that it will review the cruise plans for this survey in detail at its 2007 meeting. The planners of the survey were reminded that there are specific guidelines to be followed in submitting cruise plans for survey data to be used in an RMP *Implementation* (IWC, 2005e).

The Committee was informed that the next NASS will be conducted in summer 2007. To date, four NASS programmes have been conducted (1987, 1989, 1995 and 2001). It is hoped that by participation of Greenland and Canada in addition to Iceland, Faroes and Norway and coordination with a simultaneous survey planned off the western coast of Europe (CODA), the survey will cover a larger area than any of the earlier surveys (SC/58/O21). The first planning meeting for the 2007 survey (TNASS) was held in Reykjavík in March 2006. The methodology is in accordance with the requirements and guidelines for conducting surveys and analysing data within the RMP (IWC, 2005d) and abundance estimates from NASS for common minke whales and fin whales have been accepted for use in the RMP. Official Scientific Committee oversight for the 2007 survey was designated to Hammond and Donovan.

7. ESTIMATION OF BYCATCH AND OTHER HUMAN-INDUCED MORTALITY (BC)

7.1 Estimation of bycatch based fisheries data and observer programmes

7.1.1 Cooperation with FAO on fishing fleet data and the Fishery Resources Monitoring System (FIRMS) partnership
Intersessional progress on data sharing with FAO has proceeded steadily, with the appropriate memoranda of understanding awaiting 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, the 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, although much work remains. One 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. The new format will help but attempts at retrospective linkages using data from previous years' Progress Reports, will require assistance from relevant members of the Committee.

The Committee **recommends** that this work should be continued intersessionally.

7.1.2 Review progress on standardising reporting in Progress Reports
The Committee welcomed the provision of more detailed information in the national Progress Reports (see Annex Q) of most member states, enabling a clearer understanding of the fisheries involved in whale bycatch events. The Committee **recommends** that the target fish should be identified by scientific name, at whatever is the appropriate taxonomic level, to avoid confusion among common names. The Committee **recommends** use of the revised template which includes an additional code for derelict fishing gear be added to the list of fishing gears.

7.1.3 Information on new European Union (EU) bycatch monitoring schemes
Under European Commission (EC) Regulation 812/2004, EU Member States are required to monitor certain fisheries to ensure that they are able to provide accurate estimates of bycatch. To achieve this, minimum sampling levels of 5% (or in some cases 10%) are stipulated. These levels are intended to enable member states to acquire sufficient information on underlying bycatch rates to design more rigorous sampling protocols in the future.

Progress in implementing this monitoring must be reported to the EC by 1 June 2006, after which it will be possible to assess whether targets have been met. The requirements are restricted to gill/tangle net fisheries and to pelagic trawls. While 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, and there are no requirements to monitor such fisheries. It should also be noted that the regulation does not specify any monitoring for EU distant water fleets which include longliners, pelagic and demersal trawlers and purse seiners.

7.1.4 Methods to determine appropriate observer coverage levels needed in a fishery to estimate bycatch.
There were 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 EU, when implementing the monitoring aspects of regulation 812/2004. It was suggested that members of the Committee involved in such schemes report back to the IWC Scientific Committee next year.

SC/58/BC2 reviewed what is known about the entanglement of large whales in lost or abandoned (ghost) fishing gear, particularly in the USA. Over 20% of rope and net reported on or removed from large whales along the Atlantic coast of Canada and the USA is of undetermined origin. Without better methods to determine the origin and status of the material that entangles whales, the percentage of entanglements attributed to that ghost gear will remain unclear.

SC/58/BC7 synthesised new evidence that baleen whales are highly susceptible to oral entanglement. That evidence indicates that a hydrostatic oral seal is probably a critical locomotor adaptation in all mysticetes as it enables the maintenance of mouth closure by means of suction rather than muscle contraction. The Committee **agrees** that it would be useful to gather data on survival rates of whales with entanglements to the mouth and **recommends** that this be considered next year. The Committee noted that the US National Oceanographic and Atmospheric Administration (NOAA), is planning to hold a workshop in November 2006 to look at the basis for determining serious injuries in whales. The Committee looks forward to reviewing the report of this workshop at next year's meeting.

7.2 Estimation of bycatch based on genetic work
7.2.1 Review progress on intersessional work related to market sampling
In response to a recommendation last year, SC/58/BC3 reports on 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. A series of structured confidential interviews were conducted and interview results were cross-checked with other sources. 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. Details are provided in Annex J (item 6.1.1).

The major distribution routes were described from six primary sources (including traditional whaling, bycatches and the government special permit programmes). Different sources and different species have different pathways into the market. The distribution pathways are not particularly complex and follow those for general seafood distribution.

The distribution of bycaught whale meat suggests that the preferred routes for sale are via the whaling communities or via the wholesale markets near to major whale meat consumption areas. The implication for sampling for bycaught whale meat is that port and city wholesale markets in or near whaling communities and major consumption centres should be included.

Baker *et al.* (2006) presented results from genetic analysis of cetacean meat products purchased in Korean markets between February 2003 and February 2005. The majority of major whale meat outlets in Pohan, Busan and

Ulsan were sampled over the two-year period. Three species of baleen whales (Bryde's, minke and humpback whale) and 12 species of odontocetes were identified. The species distribution was then compared with the expected distribution based on the numbers of each of the species recorded as bycatch in the Korean Progress Reports to the IWC. A number of discrepancies between the official records of cetacean bycatches and what was being sold on the market were found.

Kim queried the possibility, given that there are no records of Bryde's whales occurring in Korean waters, that Bryde's whale bycatches occur there. He will investigate this by checking the reporting system and other sources. He further noted that the Korean reporting system has been initially focused mainly on the recording of minke whales for conducting assessment work by the Committee.

Last year, the Committee recommended the use of simulations to investigate the performance of different sampling designs to estimate bycatch and their sensitivity to the assumptions that have been made regarding market characteristics. A simple simulation model was developed in order to evaluate the bias and precision of mark-recapture methods for estimates of bycatch based on market surveys (SC/58/BC8). Results covering a wide range of simulated market scenarios showed that when the sampling level is sufficient, the estimation method using all 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.

The Committee discussed how this approach might be taken forward. It was 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. 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 indicated a rather simpler market structure than had been assumed at the workshop last year. The Committee **recommends** that further simulation work should be continued intersessionally (see Item 21).

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 reiterated the position of the Government of Japan that the estimation of bycatch from market sampling is of doubtful value and that market related issues are a domestic matter, in view of this, the contribution from Japan to these discussions will be limited.

7.2.2 Planning for a follow-up workshop on the use of market sampling to estimate bycatch
At last year's meeting, the Committee had agreed that the planned follow-up Workshop would be valuable in order to evaluate whether market surveys would provide reliable estimates of bycatch. The Committee had also agreed that such a Workshop would be more successful if progress had been made on: (1) addressing the data requirement needs; (2) developing simulation frameworks for sensitivity analyses; and (3) sampling designs had been tested prior to the Workshop. The following tasks were identified as pre-

requisites to a second Workshop and progress is summarised below.

(1) Improve information on pathways for markets through short contracts to market experts to conduct appropriate studies to address the data needs outlined in IWC (2006a, p.362) - 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 IWC (2006a, p.362) - no new information had been presented but according to SC/58/BC3, statistics on the number of retail and restaurant establishments in Japan could probably 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 (Annex J, fig. 1).

(4) Conduct further concordance analysis between labelling and genetic identification of whale products – some data were presented last year and work continued intersessionally but new information was limited and would not change any of the conclusions reached based on the 2005 data.

(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.

(6) Simulation trials, (ii) based on results of initial simulations and improved data from points (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 and 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 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 will be obtained if the work is undertaken 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 used in a collaborative manner, 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, for example 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 that might focus on further research on markets as detailed in Annex J (item 6.1.3).

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

7.3 Other issues
7.3.1 Information and methods on estimates of cetacean mortality caused by vessel strikes
Panigada introduced the report of a Workshop on large whale ship strikes in the Mediterranean Sea held jointly by ACCOBAMS and the Pelagos Sanctuary[1]. The Workshop report is available from the ACCOBAMS Secretariat. The objectives of the Workshop were to:

(i) synthesise 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) determine data needed for a more comprehensive assessment of the issue;

(iii) discuss whether mitigation and management measures were necessary; and

(iv) discuss what mitigation and management measures might effectively be employed to address the issue.

The Committee **endorses** the recommendations from the Workshop related to estimating the number of ship strikes which included:

(a) testing acoustic propagation models through seasons (to examine whether cetaceans may be more vulnerable at certain times of the year);

(b) undertaking thorough necropsies of carcasses to determine the true cause of death;

(c) undertaking a feasibility study to examine whether information from cases where carcasses are lodged on bulbous bows can be used to model the likelihood that struck whales become lodged and if this can be used to obtain estimates of true strikes;

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

(d) interviewing captains and crews to obtain all information on known ship strikes using an agreed protocol; and

(e) conducting a feasibility study to assess the efficiency of dedicated observers to detect ship strikes.

In addition, some of the recommendations from the Workshop included projects that may benefit from collaboration between the IWC Scientific and Conservation Committees, and the Secretariats of the abovementioned Agreements. Developing an international database of vessel strikes is extremely important and it should be linked to sighting databases. The Workshop also recommended that ACCOBAMS should: (1) liase with the IWC on issues related to ship strikes; and (2) that the ACCOBAMS Secretariat should 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; liason with the IWC would also be valuable in this regard. The Committee **endorses** these recommendations for joint work.

Data on fin whale ship strikes in the Mediterranean Sea up until 2001 were presented in Panigada *et al.* (2006). 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, the whale was discovered only when 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 Committee **recommends** that collection and analysis of data on fin whale collisions due to vessel strikes in the Mediterranean Sea should continue.

The Committee noted that further data on ship strikes of large cetaceans in Italian waters between 2002 and 2005 are available (SC/58/BC4) and **recommends** updating the analyses of the pre-2002 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.

Fernández reported on a study of lesions associated with gas bubbles and fat embolism in stranded beaked whales (Fernández *et al.*, 2005) and suggested that fat embolism in the lungs may be indicative of *ante mortem* trauma, such as collision with a vessel. The Committee **recommends** further work on the histopathology techniques described by Fernández and in particular, investigation of whether these techniques are applicable to baleen whales. The intersessional group under Fernández (Annex R32) should also include ship strikes within its remit. The Committee also **recommends** 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 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 (SC/58/BC5). Data on sperm whale density in the Strait of Gibraltar indicate that new shipping routes to a port due to open in 2007 in the north of Morocco will cross the areas of highest sperm whale density. The Committee **recommends** the undertaking of studies that relate 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 worldwide standardised database of vessel collisions with cetaceans had initially focussed on the Southern Hemisphere and a total of 248 cases of reported vessel collisions had been compiled and reviewed (SC/58/BC6). 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 worldwide.

Van Waerebeek drew attention to the report of the Conservation Committee Ship Strikes Working Group (IWC/58/CC3). 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 Committee **agrees** 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 (Annex R30) 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.

Following a collision incident with a whale in 2004, the Korean 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.

In most of the reported incidents with high speed vessels in Japan, the causes of the collision have not yet been confirmed. The Ministry of Land, Infrastructure and Transport established a Working Group in 2006 (see *www.mlit.go.jp/english/index*) to ensure safe navigation and consider collisions between vessels and both whales and marine debris. Although the work of this group was largely outside the remit of the IWC, the Government of Japan is making efforts to collect and review data on collisions with such vessels.

The Committee also received a report of a database search of Japanese news articles using key words such as 'whale', 'ship' and 'collision'. The search had revealed incidents that had not been previously identified and the Committee **recommends** similar searches in other areas.

Recent data from Hawaii reveal 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 whale population and better reporting by

mariners following education and outreach programmes. In all 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 subsequently indicated severe injuries.

The Committee welcomed these programmes and **recommends** more such work both to encourage better reporting of collisions and to determine the effectiveness of such programmes in improving reporting.

As in previous years, the Committee reviewed the information on ship strikes provided in national Progress Reports (Annex Q). It was noted that some known incidents were lacking and the Committee **encourages** Contracting Governments to include as much data as possible in Progress Reports using the new template. The Committee also noted some sources of confusion in the information requested in National Progress reports and **recommends** some changes be made to the template (see Annex J, Appendix 3). In particular, it will be useful if cases where there are no reports are also indicated, rather than just leaving fields blank.

7.3.2 Information and methods on estimates of cetacean mortality caused by other human activities
Fernández described a study of lesions in a mass stranding of beaked whales in the Canary Islands following naval exercises. 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 7.3.1. The Committee **recommends** that the applicability of these techniques to baleen whales should be investigated.

7.4 Work plan
The Committee's work plan is discussed under Item 19. Further details are given in Annex J (item 9).

8. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE (AWMP)

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995). The report of the SWG on the development of an AWMP is given as Annex E. The Committee's deliberations, as reported below, are largely a summary of that Annex, and the interested reader is referred to it for a more detailed discussion. The primary issues at this year's meeting comprised:

(1) all aspects of the management of Greenlandic fisheries for common minke and fin whales;
(2) preparations for an *Implementation Review* for the bowhead whale; and
(3) management advice for the humpback whale fishery of St. Vincent and The Grenadines.

8.1 Greenlandic fisheries and the Greenland Research Programme
The urgent need for a Greenland Research Programme had been first identified in 1998. This is primarily due to the lack of recent abundance estimates and the poor knowledge of stock structure (IWC, 2004d, p.191). The Committee had informed the Commission that it would be extremely difficult, if not impossible, to develop an *SLA* for the

Greenlandic fisheries that will satisfy all of the Commission's objectives. This is particularly important in the light of the Committee's grave concern at its inability to provide management advice for these fisheries (e.g. IWC, 2006c, pp. 13-15).

8.1.1 Stock structure, range and movement
The main questions for both common minke whales and fin whales off West Greenland revolve around how the abundance estimates derived from sightings made during surveys relate to the true number of animals 'available' to the hunters. It has been generally accepted for both species that the animals found off West Greenland do not comprise the total population (e.g. see review in Donovan, 1991; Born, 1999; IWC, 2000); the evidence is particularly strong for the common minke whale (see below). However, there is no information on the extent of the total population.

This year, the SWG received information on a genetic method (based on linkage disequilibrium) that might be used to provide insights into the abundance of common minke whales available to the fishery off West Greenland (SC/58/AWMP2), especially the lower bound. The Committee **endorses** the recommendation of the SWG (Annex E, item 3.1.1) for an intersessional group to investigate this method further, and in particular attempt a preliminary *Implementation* using the available genetic data off West Greenland (Annex R3).

New genetic information on fin whales was presented in a series of papers (SC/58/PFI6-9) by Bérubé, Danielsdóttir and colleagues, who had undertaken a number of analyses of microsatellite and mtDNA data for regions in the North Atlantic ranging from Greenland to the Mediterranean Sea. With a number of caveats regarding sample size and the limitations of some of the analytical methods used, the microsatellite data showed significant differences between West Greenland and the Gulf of St. Lawrence, Iceland, the Faroe Islands and the Mediterranean Sea. The mtDNA data showed less differentiation than the microsatellite data. Although significant levels of heterogeneity among samples were detected, the overall estimates of nuclear DNA and mtDNA divergence among the North Atlantic samples were low, suggesting high exchange among sampling areas.

8.1.2 Abundance and trends
Last year, the Committee received an analysis of the results of the photographic aerial strip-transect surveys carried out in 2002 and 2004 (and the experimental survey carried out in 2003). It identified a number of problems with the methodology and analyses and had identified a number of issues that must be addressed before it could make a final evaluation of the method (IWC, 2006e). It was particularly concerned about the estimate for minke whales, which, if taken at face value indicated a 90% decline in abundance since the previous estimate. In addition to recommending additional work with respect to the previous photo-surveys, the Committee had strongly recommended that a traditional cue-counting survey be undertaken.

This year, the Committee was extremely pleased to receive the results of two surveys undertaken in 2005, a dedicated aerial survey and shipboard survey that used dedicated cetacean observers on a capelin stock survey.

With respect to the latter, poor weather conditions, particularly in southwest Greenland, resulted in poor and restricted coverage in that region. A detailed discussion of

the results of the survey is given in Annex E (item 3.1.3). After considerable discussion, the SWG **could not agree** to accept the estimates, given the poor realised effort and lack of sightings. Some members believed that after further work it may be possible that these estimates could be considered acceptable for use. The SWG **encouraged** further use of such 'piggy back' surveys. The survey had revealed the potential of this approach if conditions were such that realised coverage could be increased. The potential for integrating multiple surveys using Generalised Linear Model (GLM) approaches was noted. The Committee **concurs** with these views.

SC/58/AWMP7 and SC/58/AWMP9 presented the preliminary analyses of an aerial line transect and cue counting survey of large whales off West Greenland conducted in August and September 2005. Further analyses of this survey will include: (a) sight-resight corrections for perception bias; (b) examination of the effects of measurement errors; and (c) cue counting estimates of fin whale abundance based on small groups only.

The SWG welcomed the paper and the Committee **thanks** the Greenland researchers for following the recommendation of last year and performing an aerial survey (IWC, 2006d, p.96). Although it noted that further analyses were to be undertaken with respect to corrections for perception bias and measurement errors and looked forward to receiving those results, it **agrees** that the preliminary estimates presented are acceptable for use. These are: common minke whales - 3,474, CV=0.42, 95% CI=1,568-7,696; fin whales - 1,722, CV=0.37, 95% CI=841-3,531

It was suggested that for fin whales, a combination of cue counting for small group sizes and a line transect abundance estimate for larger groups might be appropriate. It was noted that the estimate for fin whales, in particular, will be an underestimate, *inter alia* as no $g(0)$ correction has been applied. It was also noted that the abundance estimate for common minke whales is for the area surveyed, and is believed not to represent an abundance estimate for the entire population that may be exploited.

8.1.3 Preliminary consideration of management procedures
SC/58/AWMP4 developed an approach that might be used as a candidate *SLA* for the common minke whale off West Greenland. Unlike traditional *SLA*s, it requires only sex specific catch data. The candidate was simulation tested over trials that cover a *MSYR* between 1% and 7%, a current abundance between 800 and 50,000 females, different degrees of female bias in the sex specific dispersal, a sex specific hunt, a female bias in the sex ratio at birth, increasing trends in the female bias of a sex specific dispersal and a sex specific hunt, and a uniform, increasing and decreasing age-selectivity in the hunt. The authors believed that the results indicated that it would be possible to allocate safe future strike limits for West Greenland common minke whales from sex specific harvest data.

The Committee **appreciates** the substantial effort made to begin to develop an *SLA* for the common minke whale. However, it noted that similar concerns as discussed for Witting and Kingsley (2005; which provides an analysis that is extended further in SC/58/AWMP4), apply here (see Annex E, item 4.2). Some members expressed scepticism that any *SLA* based only on harvest sex ratio data (i.e. not using any periodic abundance estimates) would extract

sufficiently precise information for management. Further technical comments were made that will be taken up in the intersessional Steering Group (Annex R4) established in Annex E (item 4.2) to provide a major review of the use of sex ratio data in the assessment process and the development of candidate *SLA*s.

8.2 Planning for the *Implementation Review* for bowhead whales
8.2.1 Report of the intersessional Workshop
The Workshop (see SC/58/Rep2) was held at the National Marine Mammal Laboratory, Seattle, USA from 24-27 April 2006.

The aims of the Workshop were to:

(1) specify the basic structures and types of simulation trials needed for the *Implementation Review*; this will focus in particular on possible stock structure scenarios and any other new information that has become available since the *Bowhead SLA* was agreed; and
(2) initiate discussions on the range of parameter values to be considered, but not the specific choices.

Stock structure hypotheses serve two different but related purposes, one concerning biology and the other the development of trials. The Workshop carried out a thorough review of the available information and considered both of these issues. Details can be found in SC/58/Rep2. The stock structure discussions and recommendations were referred to a joint session of the SWG on the AWMP and the sub-committee on bowhead right and gray whales; those discussions are reported in Annex F and summarised under Item 9.1.

The Workshop also:

(1) welcomed and reviewed the first estimates of abundance for the Chukotka region (SC/58/BRG15);
(2) agreed on the ranges of values for biological parameters to be used in the trials (SC/58/Rep2, item 4.2) and that these should be the same for both one- and two-stock hypotheses;
(3) began the process of developing suitable mixing matrices for allocating catches (historic and future) in the context of the various stock hypotheses;
(4) had an initial discussion regarding how to condition one- and two-stock trials and developed an initial set of diagnostic statistics for first stage evaluation; and
(5) developed a work plan for the period between the Workshop and the 2007 Annual Meeting.

8.2.2 Stock structure
The joint session with the bowhead, right and gray whales sub-committee referred to above reviewed the available stock structure information including that made available after the intersessional Workshop (Annex F). There was no new information to cause the SWG to alter the broad stock hypotheses considered at the intersessional Workshop. It was noted that new data and analyses may be presented up until the next intersessional Workshop. However, the Committee agrees that the hypotheses currently developed should already cover the likely broad structure of any new hypotheses. It will not be practical to incorporate any major new hypotheses after the next intersessional Workshop at which the final trial structure will be decided. Any major hypotheses developed after the intersessional meeting

would need to be considered following the 2007 *Implementation Review*. If the potential conservation implications of any such hypothesis were deemed sufficiently serious, this could result in an *Unscheduled Implementation Review* under the proposed Aboriginal Subsistence Whaling Scheme (AWS).

8.2.3 Catch history
The intersessional Workshop had highlighted the great importance to the *Implementation Review* process of the historic (pre-1914) catch data. While the total catch information already published is adequate for single stock hypotheses, more detailed information is required with respect to the two stock hypotheses. The Workshop had made a strong recommendation that every effort be made to obtain the data (at least catch position and date for each of the whales) included in the subset of the catches documented in Bockstoce and Botkin (1983) and that they are made available under Procedure A of the DAA. In the light of the discussion under Annex E (item 2.5 and see fig. 5), the SWG restricted the need for the data to three of the blocks (A, G, I) included in Bockstoce and Botkin (1983). The Committee **strongly urges that every effort be made** to obtain these data and that they are made available under Procedure A of the DAA. It re-emphasises the protection for data owners inherent in the DAA; the data can only be used in the context of the *Implementation Review*, the data owners retain publication rights and on completion of the review the data must be returned to the owner and any copies destroyed.

Work to refine the data set for the aboriginal subsistence catches to as fine a level as possible (village and if possible position) is proceeding well and will be completed and included in the master catch series held by Allison.

8.2.4 Abundance
8.2.4.1 CHUKOTKA
SC/58/BRG15 that reported on the first abundance estimates to be obtained from Chukotka (and see SC/58/Rep2 and Annex F). These abundance estimates are suitable for use in conditioning trials, but not necessarily for use by the *SLA*. The Committee **concurs** with the SWG recommendation that a further survey be conducted in this area to address some of the concern over the estimates, particularly with respect to undertaking direct estimation of detection probability.

8.2.4.2 BARROW
As in the previous trials, the estimates of abundance resulting from the Barrow censuses should be used both in conditioning and by the *Bowhead SLA*. The most recent estimates are given in Zeh and Punt (2005).

8.2.5 Modelling framework for the 2007 Implementation Review
8.2.5.1 THE USE OF A SIMPLE MULTI-STOCK MODEL IN THE PROCESS
Consideration of this item formed the major part of the discussions within the SWG on the bowhead whale part of its agenda. As a result of reviewing SC/58/AWMP8 (which reported on explorations using a simple multi-stock population dynamics model and a spatio-temporal catch allocation scheme to model the sorts of trials anticipated to be considered during the *Implementation Review* for the *Bowhead SLA*), the SWG explored the potential of such a simple multi-stock model (hereafter 'AWMP-lite') to assist

the *Implementation* process. Primarily, this involved development of the model used in SC/58/AWMP8 and an exercise to calibrate this with the full age-structured common control program (CCP) and then examine AWMP-lite's performance against that of the fully conditioned CCP's for one- and two-stocks for four trials to independently verify that the calibration appeared to hold adequately over a range of trials. Details are given in Annex E (item 2.5). It is important to understand that AWMP-lite is not intended to give precisely the same dynamics as the CCP. In all four cases examined, it captured the basic dynamics of the stock(s) being simulated, and to the extent there were mismatches, AWMP-lite generally provided overly pessimistic views of stock abundance and future trends.

The two-stock dynamic model used in AWMP-lite is described in detail in Annex E (Appendix 2), together with the associated estimation strategy. Fundamentally, AWMP-lite estimates two-stock trajectories using 'fitting' to estimate the K1 value which (for a pre-specified *MSYR* value) yields a trajectory which best fits the time-series of abundance estimates for Stock 1 (by convention, the stock that is counted in the spring at Barrow). It also uses 'hitting' to solve for the K2 value which (for the same *MSYR* value) yields a trajectory that passes through a pre-specified current abundance for putative Stock 2. Inputs to AWMP-lite are *MSYR*, the catch allocation and whale harvest exposure matrices, and the current putative Stock 2 abundance to be hit. AWMP-lite provides a variety of scenario diagnostics useful for evaluating the simulation and its management implications.

Accordingly, the SWG agreed that AWMP-lite will be a valuable tool for the *Implementation Review* and recommended that the $z=1.08$ tuning be used for simulation of two-stock scenarios necessary for the *Implementation Review*. If the AWMP-lite outcome for a particular scenario does suggest some reason for management concern, then either AWMP-lite might be improved by adding features necessary for a less approximate simulation of the scenario or the problematic trial might be coded in the form of a full age-structured two-stock CCP, with the actual *Bowhead SLA* run to obtain the most accurate assessment of the management implications for that scenario. The Committee **concurs** with these views.

It agrees that AWMP-lite should be initially used for an initial screening[2] of a large number of trials with catch equal to need. These trials would be chosen on the basis of reasonable plausibility[3]; it was noted that AWMP-lite might also be useful to inform plausibility judgments. The initial screening for performance (i.e. conservation risk) will follow the same criteria for acceptability as used for the single stock trials. If the initial screening fails to confirm that management objectives are met, then the scenario should be tested with the *Bowhead SLA* to better understand the nature of the scenario and management implications, and to determine if changes to the *Bowhead SLA* are necessary.

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[2] For the purposes of initial screening of two stock trials, 100 replicate scenario projections with simulated data will be adequate.
[3] Plausibility screening will occur before running any trials and implausible trials will be discarded.

8.2.5.2 MIXING MATRICES
There was considerable discussion concerning the development of the mixing matrices for assigning past harvests by area in the light of the designated stock hypotheses. The Committee **agrees** to use the areas given by Bockstoce and Botkin (1983) with the modifications given in Annex E (item 2.5.1 and fig. 5).

8.3 Aboriginal Whaling Scheme
The Committee again recommends the scientific aspect of an Aboriginal Whaling Management scheme that it had developed in IWC (2003).

9. ABORIGINAL SUBSISTENCE WHALING STOCK ASSESSMENTS

9.1 Bering-Chukchi-Beaufort (B-C-B) Seas bowhead whale stock structure (see also Annex F)
SC/58/Rep2 provides the report of the AWMP intersessional Workshop that was held in Seattle in April 2006. The aims of the workshop were to: (1) specify the basic structure and types of simulation trials needed for the B-C-B bowhead *Implementation Review*; and (2) initiate discussion on the range of parameter values to be considered. There was considerable discussion and a detailed review of the available data on stock structure leading to the development of a number of hypotheses regarding stock structure for use in the *IST*s. Particular attention focused on differences between the newest microsatellite loci and the old loci. The Workshop discussed the advantages and disadvantages of using the old (n=11), new (n=22) or a combined set of the loci, and suggested further work to be completed by the 2006 Annual Meeting. It noted that such discussion would take place in a joint session of the SWG on the AWMP and the sub-committee on bowhead, right and gray whales (see Annex F).

The Committee **endorses** the recommendations from the Workshop regarding priorities for genetic data generation:

(1) scoring the new loci for the 17 whales for the purposes of a unified analysis investigating the 'Oslo bump'[4];
(2) scoring all old and new loci for any whales from St. Lawrence Island (including rescoring to fill in missing data); and
(3) to increase the number of scored samples from spring Barrow whales.

Other priorities include scoring all 33 loci for roughly 50 to 80 whales selected from a genetically homogeneous group of whales in the Canadian Arctic to provide a 'control' group where it is known that the animals are genetically distinct (e.g. Foxe Basin or if these number too few, Hudson Bay whales or a combination of both). If the Canadian data cannot be obtained, then samples from the Sea of Okhotsk

[4] The so-called 'Oslo bump' was put forward by Jorde *et al.* (2004). They found a significant increase in genetic difference between pairs of whales sampled approximately one week apart at the Barrow autumn migration versus those sampled at other time intervals. Considerable time was spent discussing this phenomenon at the 2005 Annual Meeting (IWC, 2006c). The Committee had agreed that the 'Oslo bump' appeared to be a real phenomenon, at least in the available data but had agreed that additional data are necessary to confirm whether this pattern reflects a real characteristic in the bowhead whales of the region; no single explanation has emerged to explain the effect.

could be used. Finally, the Committee **agrees** that the collection and analysis of biopsy samples from Chukotka, especially from the spring and summer, is also important; it **requests** the Commission to urge the Russian Federation to expedite sharing of these samples with interested scientists.

Notwithstanding these priorities, the Committee hopes that the final genetic dataset for bowhead whales will include microsatellite scores for all available B-C-B Seas samples for both the new and old loci, to the extent this is possible by the deadline (6 November 2006) imposed by its Data Availability Agreement.

Partly in response to a request in SC/58/Rep2, SC/58/BRG11 presented information on the development of new microsatellite loci for bowhead whales. Of the 24 new loci initially selected for the development based upon their quality of amplification and their ease of analysis, one has now been withdrawn as it is sex linked while another has been withdrawn because of the potential for null alleles. A total of 170 individuals have been run for the remaining 22 loci and the remaining individuals will be genotyped by 1 September 2006. The Committee **commends** the authors for the development of the new loci.

SC/58/Rep2 had requested information on the advantages/disadvantages of developing new tri- or tetra-nucleotide repeats and the feasibility of developing and using these in time for the 2007 *Implementation Review*. The Committee was informed by Bickham that the primary advantage of these was in ease of scoring rather than information content; accuracy of scoring was not an issue with the 'new' loci or some of the old loci. He also noted that it was not practical to develop such repeats in time for the 2007 *Implementation Review*.

The Committee received two papers (SC/58/BRG18 and 19) presenting analyses of genetic data, some of which had also been considered in SC/58/Rep2. Details of these discussions can be found in Annex F (item 4.1.1.2). It was noted that further analyses using the final datasets will be submitted to the next intersessional AWMP Workshop.

With respect to consideration of 'old' versus 'new' loci, the Committee **agrees**:

(1) the 'old' loci do provide some information and should continue to be scored;
(2) notwithstanding (1) it is important to use only loci that provide consistent scores;
(3) in this light, standardised quality control criteria need to be established for choosing the best loci; and
(4) criteria also need to be established for which animals should be used in the analyses (e.g. successfully scoring 30 of 33 loci).

Details of these discussions can be found in Annex F (item 4.1.1.2).

With respect to point (4), the Committee **agrees** that all researchers analysing the microsatellite data should exchange files about which loci and animals pass specific criteria, so that all researchers can agree the criteria and use the same datasets.

SC/58/BRG13 used a simulation approach to investigate whether a single stock out of genetic equilibrium could result in similar genetic heterogeneity to that reported for recent bowhead whale data (the Generational Gene Shift (GGS) hypothesis). The authors found little evidence for GGS in nuclear markers. The only factor that affected significance of results was the presence of supermales, and

they needed to have high reproductive dominance to see the effect. Although the results were regarded as preliminary until some unexpected results are explained, the effect of GGS was relatively small for mtDNA and even smaller for microsatellites.

In discussion (details are given in Annex F, item 4.1.1.2), it was noted that the simulation results were based on the genotypes of the entire population and so are not a sample. The Committee **agrees** that the results warrant further investigation.

Evidence from other techniques was also discussed (and had also been discussed in SC/58/Rep2), including stable isotope ratios (SC/58/BRG22) and an overview (SC/58/BRG24) of information and hypotheses.

In concluding its examination of stock structure, the Committee **agrees** that there is no evidence to suggest additional stock structure hypotheses in addition to those developed in SC/58/Rep2. This does not preclude the possibility that new hypotheses may be generated as additional data becomes available (see Item 8.2.2).

9.1.1 Other new information
SC/58/BRG15 presented the results of shore-based counts of migrating bowhead whales past the Cape Dezhnev area of Chukotka, Russia, during May and June of 1999-2001. The paper was also discussed in SC/58/Rep2 (and see Item 8.2.4.1). The authors recognised the preliminary nature of the estimates and presented three alternatives (with their 95% confidence intervals) depending on assumptions made: (1) 426 (301, 603); (2) 841 (601, 1,176); and (3) 774 (558, 1,073). The latter two were considered more realistic.

The Committee **commends** Melnikov for successfully conducting these shore-based surveys under very difficult conditions. It **recommends** that additional studies be conducted in Chukotka to refine this preliminary work. It also **recommends** the collection of biopsy samples and, if possible, the undertaking of satellite tagging in the region.

Last year, the Commission requested the Committee to provide guidance on the length of bowhead whale calves. This request came about because a 6.7m whale was landed in 2004 that had milk in its stomach. SC/58/BRG23 presented information on lengths of bowhead whale calves. Calves are typically born in May at a length of about 4 to 5m and grow quickly in the first summer. There is a pause in growth (in body length) shortly after weaning. Therefore, lengths of calves in autumn can overlap with whales that are in their second or even third summers. Baleen length, however, does not appear to overlap. Thus, body length and especially baleen length should be used in combination to assess whether a landed whale is a calf. A landed whale should be considered a calf when its length is 7.5m or shorter and its (longest) baleen is less than 60cm. Calves may inadvertently (and occasionally) be landed in the future because of the length overlap of calves and older animals; calves may stray from mothers for long period of time in the autumn and hunters have difficulty in determining precise body length and baleen length of whales while they are still in the water.

9.2 Annual review of catch data and management advice for the Bering-Chukchi-Beaufort Seas bowhead whale
9.2.1 Catch information
SC/58/BRG21 reported catch information for the 2005 Alaskan subsistence harvest. A total of 68 bowhead whales

were struck, resulting in 55 animals landed (25 males, 28 females, 2 not determined). The efficiency (the ratio of the number landed to the number struck) of the hunt was 81%, similar to the average over the past 10 years (79%). Details of the reproductive status of the females are given in Annex F (item 4.1.3). SC/58/BRG21 also provided an addendum to the 2004 harvest report in which one whale had been inadvertently left out. This 8.8m female whale was landed on 31 December 2004 at Gambell, Alaska.

Two bowhead whales (one male and one female) were landed in 2005 in the Providentsky region of Chukotka. The male was 15.5m and weighed about 59.5 tons; the female was 14m and weighed about 34.3 tons.

9.2.2 Management advice
The Committee **agrees** that the same advice given in 2005 is appropriate. The *Bowhead SLA* remains the most appropriate tool for providing management advice for this harvest (IWC, 2003, p.22), at least in the short term, and the results from the *Bowhead SLA* indicate that no change is needed for the current block quota for 2003-07. Further, an *Implementation Review* is being conducted and should be completed at the 2007 annual meeting, enabling the management advice provided to be based on the best science then available. The *Bowhead SLA* was developed and tested under a single-stock hypothesis. The review will examine the robustness of the *Bowhead SLA* with respect to plausible stock hypotheses via simulation trials (see Item 8.2).

9.3 Annual review of catch data and management advice for the eastern North Pacific gray whale
9.3.1 New scientific information
SC/58/BRG16 presented information on 17 adult gray whales (16 mothers and a single adult) tagged in Laguna Ojo de Liebre, Mexico with Argos satellite-monitored radio tags in March 2005. Details are given in Annex F (item 6.1.1). All six whales tracked for more than 100 days spent most of their time in the Chukchi Sea. Apparent foraging in the Bering Sea was limited to one whale in the Chirikov Basin and another using the Russian coast. The most favoured area during the feeding season was NNW of the Bering Straits in the southern Chukchi Sea, which was used extensively by four whales. In mid-November the last three whales sending data simultaneously headed south through Bering Straits as near-shore ice in the Chukchi Sea developed quickly. The relatively late initiation of their south-bound migration and arrival in southern waters suggests that mothers of the previous year may spend more time on the feeding grounds to restore lost energy reserves from pregnancy, calving and lactation. The use of the Chukchi Sea by gray whales is not new. However, the proportion of the tagged whales using that area and the extent of their use may indicate an increase in foraging there.

9.3.2 Catch information
In 2005, 115 eastern North Pacific gray whales (45 males and 70 females) were landed by native people of the Chukotka Autonomous region. An additional nine whales were struck and lost compared to only one the previous year. Two of the gray whales harvested in 2005 had a strong chemical smell and were inedible. Toxicological studies are being undertaken by Moscow State University. The samples

Have also been sent to the USA for analysis. Further details are given in Annex F (item 6.1.2).

The Makah Indian Tribe was unable to conduct whaling on this stock in 2005 because of domestic litigation. A court ruled in 2004 that the tribe needs a waiver of the US Marine Protection Act. The tribe applied for that waiver in February 2005.

9.3.3 Management advice
At this meeting, the Committee **reaffirms** its advice from last year that the *Gray Whale SLA* remains the most appropriate tool for providing management advice for this harvest. Secretariat calculations reveal that no change is needed to the current block quota for 2003-07. An *Implementation Review* is scheduled for 2009.

9.4 Annual review of catch data and management advice for minke and fin whales off Greenland
9.4.1 Catches
SC/58/ProgRep Denmark reported the following catch information. East Greenland: 4 common minke whales (3 males; 1 female); West Greenland: 173 common minke whales (34 males; 134 females; 5 unidentified sex, 3 struck and lost) and 13 fin whales (1 male; 11 females; 1 unidentified sex and 1 struck and lost but later found dead).

9.4.2 Assessments
9.4.2.1 COMMON MINKE WHALES
Last year, the Committee had agreed that sex ratio data should be attempted to be used in assessments (particularly in attempting to estimate a lower bound for the total population) but noted some of the potential limitations of such an approach. This year, two papers were received on this. The first was a complex and extensive analysis (SC/58/AWMP3) that was a refinement of a paper submitted last year; the author suggested that a current abundance of around 20,000 individuals was a conservative estimate and that a current catch of 175 individuals is probably sustainable. The other was a simpler preliminary analysis developed at the beginning of the meeting (SC/58/AWMP10); those authors stressed the critical role of constant selectivity assumptions for approaches of this type and urged efforts to investigate the spatial and within-season consistency of harvests to examine the extent to which this assumption is justified. There was extensive discussion of these papers, especially the first. Their detailed discussion is given in Annex E (item 4.2.1). Ultimately, it became clear that there was no agreement that the method outlined in SC/58/AWMP3 or the simpler model given in SC/58/AWMP10 could be used to provide management advice at the present meeting.

These discussions and disagreements highlighted the importance of a consolidated cooperative effort to determine whether, and if so how, sex ratio data can be used to conduct a suitable assessment of common minke whales and/or be incorporated into an *SLA*. The Committee **agrees** to establish an intersessional Working Group (that also would meet for a number of days) to examine this issue (Annex R4) and report back to the next Annual Meeting (and see Item 21).

9.4.2.2 FIN WHALES
The SWG received a Bayesian assessment of fin whales (SC/58/AWMP5) that was an update of the paper presented last year. Details are given in Annex E (item 4.2.2). The authors concluded that annual takes of up to 19 fin whales per year have an 88% chance of fulfilling the AWMP objectives. There was considerable discussion of this paper. The SWG **appreciated** the efforts undertaken to develop an assessment for fin whales although some concerns were expressed about particular aspects of the method as presented that might lead to it producing over-optimistic results. The SWG **agreed** that the method was an acceptable assessment method provided certain factors (listed in Annex E, Appendix 3) are addressed. The Committee **concurs** with this view. However, some members felt that the data pertaining to West Greenland fin whales appear too uninformative for the Bayesian assessment method to be able to produce reliable results in the near future. In the context of providing interim *ad hoc* management advice for fin whales, some members believed that the assessment in SC/58/AWMP5 provided a more detailed background for scientific advice and should be considered in addition to the simple calculations developed at the meeting (see Annex E, item 4.3.3). Other members did not believe it was appropriate to use the assessment this year.

9.4.3 Management advice
9.4.3.1 INTRODUCTION
As it has stated on many occasions, the Committee has never been able to provide satisfactory management advice for either the fin or common minke whales off West Greenland. This reflects the lack of information on stock structure and abundance, and the absence of appropriate assessments. This is the reason the Committee first called for the Greenland Research Programme in 1998. It views this matter with great concern. This was particularly the case last year with the new information provided from photographic surveys. While the abundance estimates from those were not considered acceptable, when taken at face value, their implications were extremely severe, particularly for minke whales.

As a result, the Committee made some very strong recommendations with respect to these stocks. For common minke whales, the Committee had urged that considerable caution be exercised in setting catch limits for this fishery because it has no scientific basis for providing advice on safe catch limits. It had noted that if an AWS was in place, this fishery would be at or near the place where the grace period would begin. It agreed that management advice would be re-evaluated next year in the light of the intersessional work recommended. The intersessional work included *inter alia* the carrying out of a traditional aerial survey and further investigation of the value of using the sex ratio data to provide management advice.

With respect to fin whales, it had also urged that considerable caution be exercised in setting catch limits for this fishery and as an interim measure advised that a take of 4-10 animals (approximately 1% of the lower 5th percentile and of the mean of the estimates of abundance) annually was unlikely to harm the stock in the short-term, particularly since this does not take into account the possibility that the fin whale stock extends beyond West Greenland. This advice would be re-evaluated in 2006 in the light of the intersessional work recommended.

This year, the Committee was extremely pleased to note the considerable effort of the Greenlandic scientists to meet these recommendations as discussed earlier in the report. In particular, it recognised the considerable effort and

resources put into carrying out the successful aerial survey in September 2005 (see above).

The present catch limits set by the Commission are up to 175 common minke whales struck in each year for the period 2003-07 with a provision that up to 15 strikes may be carried over from one year to the next and a catch of up to 19 fin whales each year. The SWG noted that at last year's Commission meeting, Denmark voluntarily agreed to limit the catch of fin whales to 10 whales.

9.4.4 Common minke whales

The Committee stresses that it is in a **considerably stronger position** than it was last year. In particular, it has accepted a new abundance estimate from the aerial survey. In addition, progress has been made on incorporating the sex ratio data into an assessment and in examining whether the genetic data can be used to obtain a lower bound for the abundance of the total population. Finally, it noted that further progress will be made on these issues during the intersessional period, although it could not guarantee that this work would necessarily result in an acceptable assessment in 2007.

The new abundance estimate is not significantly different to the 1993 estimate accepted by the Committee although the power to detect trends is low. Its acceptance of course also means that the question of a grace period under the proposed AWS no longer applies. However, the problem of stock structure remains. Although it is agreed that the survey estimate does not apply to the whole population available (*inter alia* given the consistent strong female bias in the catches), it is not presently possible to determine by how much. Thus, despite the great improvement in the situation compared to last year, the Committee is still **concerned** that it is not in a position to give authoritative advice on safe catch limits this year. It noted that the current block catch limit ceases next year. There was considerable discussion as to whether the Committee should provide *ad hoc* interim advice on this stock. A number of possible approaches were suggested. These included:

(a) no *ad hoc* interim advice should be provided this year other than that above, particularly given the intersessional work proposed and the fact that a major review would occur next year given the completion of the present block quota;

(b) a crude *ad hoc* approach could be used to provide a range of possible replacement yields (RYs) under a number of hypothetical scenarios.

It was noted that under assumptions that (a) $MSYR_{(mat)}$ is 3%[5], (b) that the true population has a sex ratio of 1:1 and (c) that the population is underestimated by factors of between 2 and 7[6], the estimated RY ranges from about 80-270 if the lower 5% bound of the 2005 aerial survey estimate is used.

The Committee agrees that **the Commission should exercise caution** when setting catch limits for this stock.

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[5]The Committee has elsewhere suggested that the likely value for common minke whales lies towards the upper end of the range 1-4% (IWC, 2004a, p.10).

[6]Although not accepted as appropriate to use to provide management advice at this meeting, the value of seven is broadly compatible with the results of the methods that attempted to use sex ratio information to obtain a lower bound for the total population abundance (see Annex E, item 4.2.1).

9.4.5 Fin whales

Again, while the Committee is still not in the position of providing satisfactory long-term management advice, it stresses that it is in a **considerably stronger position** than it was last year. In particular, it has accepted a new abundance estimate from the aerial survey, which it recognises is an underestimate. In addition, considerable progress has been made on developing an assessment method although some have some concerns as to whether the data available are sufficiently informative to use it for providing management advice.

The present abundance estimate is not significantly different from that accepted for 1987/88, although the power to detect trends is low. If a similar *ad hoc* interim approach is adopted to that used last year, then using the lower 5% bound and the central estimate from the aerial survey provides a range of RYs of 9-17 for a value of $MSYR_{(mat)}$ of 2% and a range from 17-34 for an $MSYR_{(mat)}$ of 4%. An alternative approach suggested a value of around 23 animals for *MSYR* 2.5% when using the lower bound of the abundance estimate. Although not accepted by the SWG as an agreed assessment at this meeting (Annex E, item 4.2.2), some members believed that the results in SC/58/AWMP5 suggest that an annual catch of 19 whales is safe.

9.4.6 Other research recommendations

In recent years, the Committee has repeated a strong recommendation that samples for genetic analysis be collected from each captured whale as a matter of high priority. It **repeats** its recommendation again this year and was pleased to be informed that 130 common minke whale samples and 7 fin whale samples had been collected last year. It **strongly recommends** that these samples be analysed in accordance with the advice of the intersessional Working Group established under Waples (Annex R3) with, if possible, results being presented to the next meeting.

The Committee also noted SWG's recommendations (see Annex E, item 4.2) towards achieving substantial progress with respect to evaluating and if possible finalising work on incorporating sex ratio data to obtain a lower bound on the total abundance of common minke whales available to the West Greenland fishery (Annex E, item 3.1.1). It **strongly recommends** that appropriate funds be made available to allow the first specialist group to meet intersessionally (see Item 21).

The Committee stressed the need for information that might allow it to find out more about the total range of the stock of common minke whales and **encourages** the further developmental work being undertaken to improve telemetry techniques for this species.

9.5 Annual review of catch data and management advice for humpbacks off St. Vincent and The Grenadines
9.5.1 Catches

Punnett reported that a single female humpback was caught in April, 2006. The whale was not lactating and was not accompanied by a calf.

In recent years, the Committee has agreed that the animals found off St. Vincent and The Grenadines are part of the large West Indies breeding population. The Commission has adopted a total block catch limit of 20 for the period 2003-07. The Committee **agrees** that this catch limit will not harm the stock. It also **repeats** its recommendations of previous years that wherever possible,

photographs and genetic material are collected from the catch. It welcomed the information presented by Punnett of progress in this regard and thanked those involved in St. Vincent and The Grenadines for their cooperation in this matter.

9.6 Catches by non-member nations
One male bowhead whale, 16.4m in length, was harvested at Repulse Bay, Canada on 18 August 2005.

9.7 Work plan
The work plan for the coming year is considered under Item 19.

10. WHALE STOCKS

10.1 Southern Hemisphere minke whales (see Annex G)
10.1.1 Estimate abundance of Antarctic minke whales
10.1.1.1 2004/05 CRUISE
The 2004/05 Southern Ocean Whale and Ecosystem Research (SOWER) cruise took place in the western part of Area III and had three main objectives:

(1) obtain an abundance estimate of Antarctic minke whales using a CPII (Circumpolar survey II) track design;
(2) investigate the relationship between minke whale abundance and sea ice; and
(3) conduct experiments designed to address (a) issues in the analysis of existing IDCR/SOWER data and (b) the feasibility of different protocols on future surveys.

SC/58/IA5 estimated the abundance of Antarctic minke whales from this survey using standard IWC methods as 6,367 (CV=28.9%) in 'Closing' mode and 10,511 (CV=40.8%) in 'Independent Observer' ('IO') mode. The combined estimate was 8,347 (CV=24.5%); including sightings that had been recorded as 'like-minke' made little difference to the abundance estimates.

SC/58/IA11 reported preliminary analyses of Antarctic minke whale abundance within the ice field using sightings data from the icebreaker *Shirase*. The survey area was defined as the area south of the ice edge that was less than 90% ice concentration. In a region where both the icebreaker and the IDCR/SOWER vessels were surveying, estimated whale densities were 0.0324 n.miles^{-2} (CV=37.1%) within the ice field and 0.0230 n.miles^{-2} (CV=40.9%) in open water (a ratio of 1.41); these are not significantly different.

The Committee welcomed the presentation of these results. It was suggested that in the future, only open areas of water within the pack ice be considered as the survey area rather than assuming that density is constant across 0-90% ice cover. The Committee **recommends** that the authors continue these analyses and established an intersessional group to assist in this work (Annex R17). Pending further data collection and analyses, the Committee **agrees** that the study indicates that there are substantial densities of whales within the pack ice for the area covered and demonstrates the importance of accounting for whales within the ice field when estimating the absolute abundance of minke whales.

SC/58/IA21 presented an analysis of minke whale visual dive time data from the *Shonan Maru* on the 2004/05 cruise. Sixteen successful trials were completed on groups ranging in size from 1 to 6 animals. For all group size categories (1, 2, 3-4 and 5-6 whales), cues were not randomly distributed;

rather, there was a clear periodicity in their production with some variation on synchronicity according to group size.

The Committee **recommends** that the *Shonan Maru No. 2* dive data also be analysed and these results be incorporated into simulation studies. It was also suggested that telemetry studies be undertaken to obtain actual surfacing rates from longer periods.

10.1.1.2 CIRCUMPOLAR SERIES
The Committee continued its focus on obtaining estimates of Antarctic minke whale abundance from the IDCR/SOWER surveys. Although some estimates were presented using the new methods that are under development, the developers (Bravington, Cooke and Okamura) agreed that some issues remained to be addressed before confidence could be expressed in the results. The analysis of the standard datasets was, however, completed using the IWC 'standard' methodology, and this was considered, along with the most recent descriptions of the new methods.

In SC/58/IA18, estimates of Antarctic minke whale abundance from the IDCR/SOWER surveys conducted between 1978/79 and 2003/04 were grouped into the three circumpolar sets of surveys, CPI, CPII and CPIII. Abundance was estimated using the IWC 'standard' line transect methodology. Some of the estimation options in this paper were different from those previously adopted in Branch and Butterworth (2001). Circumpolar abundance estimates were: 645,000 (CV=0.143) for CPI; 786,000 (CV=0.094) for CPII and 338,000 (CV=0.079) for CPIII. When adjusted for comparable areas and when 'like-minkes' were included, the ratio of CPI to CPII to CPIII was 0.97:1.00:0.39. The CPIII:CPII ratio for individual IWC Management Areas was also low, ranging between 0.18 and 0.52 except for Area VI where the ratio was 1.59.

In SC/58/IA9, the authors focused on addressing the issue of measurement errors in the context of the hazard probability method. The approach presented was more complex than before (because a distinction between simultaneous and delayed duplicates is required) but the basic structure of the hazard probability method was unchanged from that presented last year. SC/58/IA10 used the method to estimate abundance for the CPII and CPIII surveys conducted from 1985/86 to 2003/04. When measurement errors were taken into account, estimated $g(0)$s increased considerably and the effective strip half-widths increased moderately. The estimated mean school sizes were lower than those obtained using standard line transect methods (SC/58/IA18). The difference between the total abundance estimates in CPII and III was reduced (compared to the standard method) by taking measurement errors into account.

In welcoming this further development, the Committee noted that taking account of measurement errors may be particularly important for those methods that use radial distances. Even so, accounting for large measurement errors retrospectively, as is necessary for the analysis of IDCR/SOWER data, is difficult since such errors are not distributed randomly across the range of conditions encountered, across time periods and between observers. The Committee **recommends** that, in future surveys, consideration should be given to using new equipment that measures distances and angles. This is discussed further under Item 10.6.2.1.

In discussion, it was noted that the preliminary results in SC/58/IA10 did not account for the unsurveyed northern regions south of 60°S in CPII, or the longitudinal slices in CPIII that were surveyed more than once. Thus further work is required before it can be concluded that the difference between CPIII and CPII has been reduced compared to the standard method.

SC/58/IA15 reported progress on non-cue-based spatial models of minke whale abundance for IDCR/SOWER. New methods have been developed and the smoothing procedures in SC/58/IA15 have been completely revised compared to earlier work. Underestimation of school size in IO mode was handled using a prior based on the school size (SSII) experiment carried out during the 1986/87 and 1987/88 cruises, where both IO-equivalent and Closing mode estimates were obtained for each school. The combined-platform $g(0)$ estimates were as low as about 0.5 for school size 1 in poorer sighting conditions increasing under better conditions and substantially higher for schools of size 2 and more.

There was considerable general discussion about the details of each of the three new methods and their respective sensitivities to different assumptions. For all three methods, it is clear that the relationship between true/observed group size and $g(0)$ is quite critical as these quantities are somewhat interdependent. Likewise, in the cue-based models, both cue production rate and cue visibility are related to group size.

Noting that the analyses of SC/58/IA15 had used data from the School Size Estimation II (SSII) experiment, the Committee **recommends** that consideration be given to collecting similar data, perhaps with slightly modified protocols. It was suggested that the only reliable way of ensuring that observers did not modify their estimates of school size during the course of the experiment was to use different observers during the estimation and confirmation of school size. The practical feasibility of this will be discussed at the 2006/07 cruise planning meeting to be held in Tokyo in late September (see Item 10.6.2.1).

It was noted that in Closing mode, even if all estimates of school size were correct, estimated mean school size could still be biased due to selectivity. The bias could operate in either direction: the fact that larger schools may tend to be seen first would lead to positive bias; negative bias would result from undersampling of higher density areas, since larger group sizes tend to occur in higher density areas.

The methods highlighted some aspects of the data collection procedure on IDCR/SOWER surveys that present difficulties in these necessarily complex analyses. Largely these relate to the Upper Bridge's involvement in data recording, and the non-independence of what is recorded by the Barrel observers and those in the IOP. It was suggested that in planning future surveys, data such as species and group size could be recorded independently. There would also be some merit in obtaining some independent effort for the Upper Bridge platform.

The Committee thanked the developers of the three new methods and **welcomes** the progress made. It looked forward to seeing the presentation of minke whale abundance estimates from the IDCR/SOWER surveys next year.

10.1.1.3 SIMULATED DATA

The Committee discussed what, if any, additions should be made to the simulated data sets. It agrees that some additional data sets are required, and that some or all of the following factors should be addressed:

(1) measurement error;
(2) synchronicity and pattern of dive times (see SC/58/IA21);
(3) responsive whale movement or random whale movement;
(4) observer heterogeneity;
(5) extra spatial complexity in terms of boundaries, whale density gradients and the nature of clustering;
(6) sparse data in multiple areas, with low numbers of sightings; and
(7) school size errors and confirmation status dependent on perpendicular distance.

10.1.1.4 ADDITIONAL VARIANCE

The issue of additional variance arises from the fact that the sampling variances of abundance estimates do not account for all of the variability in the estimates due to other factors (e.g. interannual changes in distribution so that different proportions of the population may be present in the survey area). How additional variance is calculated largely depends on whether the objective is to estimate the variability in the trend in estimates, or in the estimates themselves. In either case, the Committee **agrees** that it would be useful to present the 'raw' estimates in their year-by-year form. The Committee also **recommends** further investigation on additional variance.

10.1.1.5 FUTURE WORK

The Committee strongly **encourages** developers of the new methodologies to finalise their methods and apply them to the IWC/SOWER sighting data to estimate the abundance of Antarctic minke whales at next year's meeting. To facilitate the comparison of estimates from different analytical methods and to evaluate the models' goodness-of-fit, abundance estimate descriptions and some provisional diagnostics were suggested. Additional diagnostics need to be specified intersessionally and the Committee **recommends** this be referred to the intersessional email correspondence group on analysis methods under Palka (Annex R16). This group will assist the analysts by (1) developing in what form results should be presented (including diagnostics) and (2) further develop what factors should be simulated, taking account of the high priority to allow sufficient time to analyse the standard dataset.

10.1.2 Catch-at-age analyses of the Antarctic minke whales
Catch-at-age analyses (CAA) are important to examine the consistency of any trends in estimated abundance with biological expectations. Virtual Population Analysis (VPA) uses data prior to the period for which abundance estimates are available, enabling these estimates to be extrapolated back in time. Together with other factors, this may help in providing an explanation to the appreciable decrease in estimates of minke whale abundance from CPII to CPIII, as noted in previous Committee reports.

Substantial work was completed in the intersessional period in relationship to the further development and application of CAA models to data for Antarctic minke whales (SC/58/IA2, SC/58/IA3 and SC/58/IA8).

SC/58/IA2 extends the statistical CAA model developed by Punt and Polacheck (2005) for Southern Hemisphere minke whales to:

(a) deal with multiple areas;
(b) consider alternative selectivity patterns;
(c) model how minke whale growth may have changed over time;
(d) develop an integrated CAA model that includes two stocks that mix across two areas stochastically; and
(e) estimate parameter values by fitting the preliminary abundance estimates from the IDCR and Japanese Special Permit Research in the Antarctic (JARPA) programmes, length frequencies from Japanese and former Soviet Union whaling operations and age-length keys.

Results are similar to those presented last year, suggesting that the recruitment of minke whales in Areas IV and V increased until about the early- to mid-1960s and declined thereafter. The results were robust to assumptions regarding the alternative stock structure hypotheses developed at last year's meeting and to alternative vulnerability assumptions.

SC/58/IA8 presented a refinement of the Adaptive Framework-VPA (ADAPT-VPA) assessments of Antarctic minke whales (Major, 1979; Barnes, 1983). The method was extended to take account of different selectivities for the Russian and Japanese fleets during the period of commercial whaling, but this had little effect on results. There was an indication in the JARPA CAA data of a change in recruitment trends over time, rather than a very high natural mortality as postulated at the time of commercial whaling. ADAPT-VPA assessments were run for the five stock structure hypotheses specified last year, and fitted to various abundance estimate series. Runs generally indicate increasing recruitment of about 4% per annum until the mid-1960s, followed by a decreasing or stable trend in total abundance depending on which abundance estimate series is included. Results for the I-stock (Areas IIIE+IV+VW) are quite sensitive to this selection, but those for the P-stock (Areas VE+VIW) less so. Estimates of natural mortality are generally 0.06–0.09, with a somewhat higher value for the P- compared to the I-stock.

The Committee welcomed the results presented in SC/58/IA2 and SC/58/IA8 and recognised that these preliminary results would probably change when finalised abundance estimates were ready. It is thus premature to focus on the results presented and the Committee **recommends** that further work on these models be continued for next year's meeting, by which time the abundance estimates should be available.

SC/58/IA3 noted that length-at-age data in the commercial and JARPA Antarctic minke whale catches show generally significant and substantial decreases in the estimated mean length when JARPA started in 1987/88. Possible explanatory hypotheses include: a change in growth over time; differences in vulnerability between commercial and JARPA operations; changes in vulnerability over time (within the commercial and/or JARPA operations); earplug extraction problems in the early years of the commercial catches; age reading differences among different age readers; low precision and perhaps bias in the length measurements during the years of the commercial catch; and differences in growth rates by stock/area and differential sampling across stocks/areas.

SC/58/IA22 focussed on the difference in length distributions of Antarctic minke whales between commercial catches and JARPA data. It confirmed that there was strong length-specific catching selectivity under the commercial operations, with larger animals preferentially being caught. It suggested that strong age-specific age readability also exists among commercial catches. Therefore, it was suggested that the age data among younger age classes in the commercial data were biased in that they were more likely to be from longer animals. The author concluded that it was more appropriate to use a growth model, and that the age data for animals from the commercial data that were not aged should be complemented by a growth model based on JARPA data.

There was limited time to discuss SC/58/IA3 and SC/58/IA22. Further discussion is needed by the Committee to decide which set or sets of hypotheses most parsimoniously explain the apparent inconsistency.

The Committee **agrees** that having results from the CAA analyses is valuable when interpreting apparent trends in abundance and estimating trend in recruitment and **recommends** that the further work proposed in Appendix 4 of Annex G be completed. The Committee **agrees** that the data for these analyses be requested via the DAA. An intersessional email group under Polacheck (Annex R15) was re-established. Given the great value of correspondence with Kato and Pastene during the last intersessional period, the Committee **encourages** this dialogue to continue.

10.1.3 Reasons for differences between minke abundance estimates from CPII and CPIII
SC/58/IA12 examined the relationship between Antarctic minke whale abundance and pack ice extent using IDCR/SOWER data and satellite images. For all ten sub-areas except one, IIE (with a large polynya and bay), a negative correlation between sea ice extent and abundance estimates was found, i.e. when the ice extent was great, abundance estimates decreased, and when sea ice extent was small, abundance estimates increased.

SC/58/IA17 investigated the relationship between sea ice extensions and trends in sighting parameters (area size, effort, number of school sightings, effective search half width, and mean school size) from CPII to CPIII. The present analysis focused on Areas IIIW, IVE and VIW. Sighting rate and mean school size decreased in Areas IIIW and IVE, but increased in Area VIW.

The Committee **agrees** that these papers represent an important advance in understanding the impact of changes in sea ice extent on IDCR/SOWER abundance estimates. It was suggested that the same analysis be conducted for JARPA abundance estimates since that would provide a longer time series and potentially be even more informative.

It was pointed out that the decrease in abundance estimates could be as a result of three possible hypotheses (in order of likelihood) related to ice coverage:

(1) whales were missed in the open water IDCR/SOWER surveys because the whales were within the ice;
(2) whale distribution may be affected e.g. when the ice extent is great, whales move to a different area; and
(3) the actual population number of minke whales is related to ice extent.

The latter hypothesis was considered unlikely.

SC/58/IA4 summarised the hypotheses for the appreciable decrease in Antarctic minke whale abundance estimates from CPII to CPIII. The Committee **agrees** that this paper is a useful summary of past work and should be updated and presented again at next year's meeting where the hypotheses can be more carefully examined.

In summary, results calculated using 'standard' methodology continue to indicate an appreciable decline in Antarctic minke whale abundance estimates between CPII (1985/86-1990/91) and CPIII (1991/92-2004/05). However, analyses presented to the meeting have confirmed the potential importance of two factors not taken into account in this previous methodology:

(1) a decrease overall in $g(0)$ from CPII to CPIII related in part to a decrease in mean school size as observed in these surveys; and

(2) an increase overall in the extent of sea-ice coverage from CPII to CPIII which correlates negatively with abundance estimates, and may reflect a greater proportion of minke whales within the pack ice that are not included in the survey estimates.

It was noted that quantification of both these factors should be completed by the time of next year's meeting. The Committee **agrees** that it is thus premature to advise on the extent of any possible appreciable decline in the abundance estimates of minke whales between CPII and CPIII at this stage.

To further the comparison of abundance estimates and sea ice extent changes, the Committee **recommends** an intersessional Working Group under Palka and Shimada (Annex R17) be established with the following terms of reference:

(1) collaborate between the sea ice experts and abundance analysts to obtain abundance estimates by 10° longitudinal 'slices' for the new and standard abundance estimation methods;

(2) provide information about sea ice extent so it could be included as a covariate in abundance estimation; and

(3) examine hypotheses that could explain if, and how, a change in sea ice extent might be related to the abundance estimates.

10.2 In-depth assessment of western North Pacific common minke whales with a focus on J-stock

10.2.1 Report from intersessional Working Group

Last year, a Working Group was formed to draw up a plan for intersessional work in preparation for the in-depth assessment of western North Pacific common minke whales, with a focus on J-stock. SC/58/NPM1 presented a report of progress made. Work that had progressed during the year on distribution and abundance included:

(1) a survey in the northern Sea of Japan in May-June 2005;

(2) a survey east of the Kuril Islands and Kamchatka in August-September 2005;

(3) a survey in the northern part of the Sea of Japan in spring 2006; and

(4) an analysis of data to estimate $g(0)$.

Regarding stock structure, there had been successful collaboration between Japanese and Korean scientists to conduct microsatellite and mtDNA analyses on samples from both Korean and Japanese bycatches. Papers describing the work on distribution and abundance and on stock structure were presented to the meeting and are discussed below. Regarding total catches, work had been initiated on collecting information on Korean bycatch by area, month and year but this is a complex task and requires more time. In summary, substantial progress had been made since last year. Data were available under the DAA, Procedure B. Data had not yet been updated for this year but Pastene will liaise with the relevant scientists to facilitate this.

The Committee expressed appreciation to Pastene and the rest of the intersessional Working Group for their work during the year.

Kim drew attention to Commission Resolution 2005-2, proposed by Korea, Japan, Russia and China, to facilitate closer cooperation between these countries and progress towards obtaining abundance estimates for the whole area. The Resolution called for a workshop, which is planned for September this year.

10.2.2 Progress on assessment

10.2.2.1 STOCK STRUCTURE

SC/58/NPM2 presented the results of an analysis using nine microsatellite loci conducted on samples of minke whales from Japan (sub-area 6) and Korea (sub-area 5 and sub-area 6; see Fig. 2). No evidence of statistically significant temporal heterogeneity was detected in the Japanese samples. However, the Korean sample collected from sub-area 6 in 1999 was different from both the Japanese samples and the rest of the Korean samples, although the possibility that this heterogeneity was due to a chance effect was raised. No evidence of statistically significant heterogeneity was detected within the Korean samples as well as between the Japanese samples and the Korean samples. Although heterogeneity was found in the 1999 sample, no strong evidence for the existence of an additional stock in sub-area 5 and sub-area 6 was indicated.
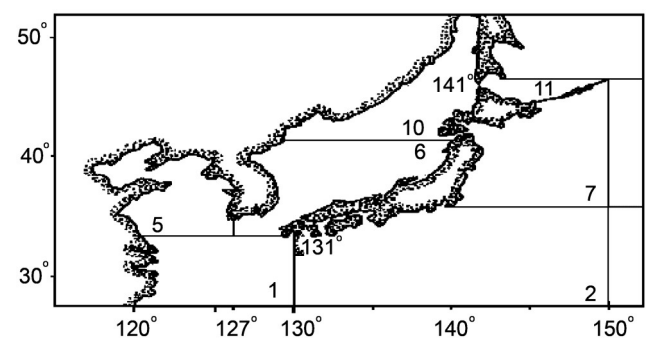

Fig. 2. Map showing some sub-areas of the North Pacific region (adapted from SC/58/NPM2).

However, some noted that results did nevertheless provide some indication of a possible additional stock. Given the significant difference between the 1999 sample from Korea and the others, it is important to investigate these genetic differences further, although the authors noted that they had expressed caution because of the possibility that this single result was due to chance effects.

SC/58/NPM3 presented the results of a similar analyses using mtDNA. No evidence of statistically significant temporal heterogeneity was detected in the Japanese

samples. However, the Korean samples collected from sub-area 6 in 1999 and 2000 were different from both the Japanese samples and the rest of the Korean samples. These results were consistent with those of the microsatellite analyses. Possible reasons for the heterogeneity detected in this analysis are: (1) migration of O-stock animals to sub-area 6; (2) multiple stocks in sub-area 6; and (3) sampling bias resulting from the relatively small size of the Korean samples in sub-area 6 in those years. The authors favoured the latter hypotheses.

However, it was noted that differences found in both types of markers in the 1999 sub-area six Korean samples reduced the likelihood that this significant finding is due to sampling bias. In examination of samples by year and month, the Committee noted that in general, bycatch occurs throughout the year (Annex G1, Appendix 2). There were few Korean samples in summer (June-September) in the earlier years but more in later years. This imbalance of samples and the timing of migration might explain the observed differences seen.

In discussion, a number of additional analyses were proposed:

(1) an overall comparison between Korean and Japanese bycatches in sub-area 6, i.e. unstratified by year;
(2) a sample-by-sample comparison of the 1999 Korean sub-area 6 grouping to investigate whether the difference between this grouping and the other groupings was due to the whole sample or just a small number of different individuals;
(3) an analysis of seasonal variation (pooling over years to increase sample sizes); and
(4) to increase power, the inclusion of samples from the Pacific coast of Japan, including special permit catches and bycatches from sub-areas 2, 10 and 11.

Concerning the seasonal analysis, the Committee recognised that there was a trade-off between stratifying the data to do this and maintaining adequate sample sizes, but nevertheless encouraged the authors to pursue this. The authors reiterated that their presented analyses were preliminary and the Committee looked forward to receiving the results of additional analyses at next year's meeting.

It was also suggested that in future work it would be useful to see the data and analysis structured around the testing of some specific stock structure hypotheses. Development of such hypotheses necessarily depended on the results of exploratory analyses but the Committee **agrees** that sufficient information was now available to begin specifying some plausible hypotheses as shown in Annex G1 (Appendix 3).

The Committee continues to believe that it was very important to obtain information on the proportion of O and J stock animals in the Sea of Okhotsk. The best way to do this is to obtain biopsy samples during sighting surveys but permission had not been given for this during the 2003 survey. The Committee **strongly requests** that the Commission urges the Russian Federation to grant permission as a matter of priority for biopsy samples to be taken on surveys in the Sea of Okhotsk and other waters of their Exclusive Economic Zone (EEZ).

10.2.2.2 DISTRIBUTION AND ABUNDANCE
SC/58/NPM5 reported on the sighting surveys conducted from 29 July to 20 September in the waters east of the Kuril Islands and the Kamchatka Peninsula including the Russian EEZ. Five species of baleen whale (common minke, fin, sei, blue and humpback) and sperm whales were found. Common minke whales were sighted in waters south of 55ºN. There was no survey effort in Russian territorial waters. Whilst it is well known that the common minke whale is distributed in higher densities in coastal waters, no sightings were made close to the Kamchatka peninsula or around some islands. The Committee **agrees** that in future surveys it will be important to survey territorial waters to estimate the total abundance of common minke whales.

The Committee welcomed this report on a successful survey in this important area, part of which had not been surveyed since 1990 and part of it not at all. It looks forward to receiving the results of analyses of the data as part of the in-depth assessment.

SC/58/NPM7 presented a report on the Korean sightings survey conducted from late April to May this year. A total of 24 common minke whales in 21 schools (including 3 mother and calf pairs) were sighted. The sightings were concentrated in the coastal waters of the Korean Strait and in coastal waters in the central part of the survey area.

The Committee welcomed this report on a successful survey and looks forward to receiving the results of analyses of the data as part of the in-depth assessment.

SC/58/NPM4 reported the results of the IO passing mode sighting survey in the northern Sea of Japan from 12 May to 30 June in 2005. A total of 11 schools (12 animals) of common minke whales were sighted on effort and IO data were obtained from 10 schools. They were distributed over a wide area from south to north, especially in the offshore area, which was similar to previous surveys.

The Committee welcomed this report. It noted that the survey had been only partly successful because permission had not been obtained to survey in the EEZ of the Russian Federation.

After a general discussion about recent surveys, the Committee **agrees** that estimation of abundance from these surveys should proceed in parallel with ongoing work on investigating stock structure. It is important to obtain estimates as soon as possible because they will provide valuable information on the biology of the species in the area.

SC/58/NPM4 also presented an estimate of $g(0)$ using data from IO passing mode surveys that have been conducted for common minke whales in the western North Pacific since 1999. Since the sample size on each survey was not large, $g(0)$ was estimated from total sightings. The resulting estimate of $g(0)$ using the simple mark-recapture method of Buckland *et al.* (1993) was 0.779, CV=0.111, 95% CI=0.568-0.904. However, this method does not consider heterogeneity due to covariate effects and more data must be accumulated so that this can be taken into account in future analysis.

The Committee welcomed this new information, which represented an important step forward. It noted that the estimate was probably positively biased because of unmodelled heterogeneity due to the surfacing behaviour of animals. It was suggested that the authors use the program *DISTANCE* version 5 (Thomas *et al.*, 2005) for the analysis, which now allows more advanced methods of analysis for $g(0)$ to be used. In estimating abundance of minke whales as

part of the in-depth assessment, it will be important to consider how available estimates of $g(0)$ are used.

SC/58/NPM8 presented an analysis of data from the sightings survey in Korean coastal waters of the East Sea in April-May 2005. Abundance was estimated as 1,538 (CV=50.4%, 95% CI=581-4,068), where $g(0)$ was assumed to be 1.

The Committee welcomed this paper but **agrees** that much more detail is required in order for the Committee to accept the estimate. At last year's meeting, the Committee had noted that it was important to show the perpendicular distance data and the fitted detection functions, and that functional forms for the detection function other than the hazard rate should be explored (IWC, 2006f). The Committee **reiterates** these comments. It **recommends** that this be done and looks forward to receiving this information for this and previous surveys.

The Committee believed that it would be very useful to consolidate all the estimates made from Japanese and Korean cruises since 1999 and explore GLM methods to attempt to combine these. It **recommends** that such analyses be presented to next year's meeting.

Consideration of future Japanese (2006) and Korean (2007) survey plans for possible use in the RMP is dealt with under Item 6.2.3.2.

SC/58/O23 presented the plans for Japanese surveys in the western North Pacific. Three sighting surveys are planned in the western North Pacific in summer 2006. The survey methodology will follow the guidelines for conducting surveys to provide estimates suitable for use in the RMP.

The Committee **welcomes** these plans and appoints the Cruise Leader, Shimada, to provide Committee oversight of the surveys.

Plans for a survey in coastal Korean waters in 2007 were presented. The survey next year will be conducted with IO passing mode using two-channel radio although the vessel, *Tamgu 3*, has no separate IO platform. The survey will be conducted in the East Sea from mid April to late May 2007. The Committee welcomes these plans and appoints the Cruise Leader, An, to provide Committee oversight of the surveys.

If $g(0)$ is to be estimated from data collected by observers on partially independent platforms, the top barrel and upper bridge, then surfacing rate information will be needed. A proposal for how to estimate $g(0)$ on this survey is given in Annex G1 (Appendix 4).

More generally, the Committee noted that it is important to consider how estimates of $g(0)$ will be used in correcting estimates of abundance in the in-depth assessment and in any future work related to the RMP. In a real application of the RMP, the Committee would require appropriate estimates of $g(0)$. However, even preliminary estimates of $g(0)$ are useful for consideration in *IST*s. The Committee must consider this as part of the long-term planning of sighting surveys in this area.

The Committee recalled that the last survey in the Sea of Okhotsk was in 2003 but some areas had not been surveyed because permission had not been obtained from the Russian Federation to survey in its EEZ, specifically the northern and eastern parts of the area. The Committee **reiterates** its **recommendations** of previous years that the Commission requests the Russian Federation to grant permission for sighting surveys to take place in the waters of its EEZ as a matter of priority.

The Committee discussed priorities for future work to make progress in the in-depth assessment. It noted that since 1999, many surveys had been conducted by Japan and Korea in sub-areas 5, 6 and 10 in April-June but that some areas remained unsurveyed.

Areas in sub-areas 5, 6 and 10 not yet surveyed are:

(1) the northern part of sub-area 5 (China and Republic of Korea);
(2) the western part of sub-area 5 (China);
(3) the northwestern part of sub-area 6 (Republic of Korea); and
(4) continental waters of sub-area 10 (Republic of Korea and Russian territorial waters).

It is evident from the above that to obtain estimates of abundance for these unsurveyed areas requires cooperation from range states in the area other than Japan and Korea. The Committee recalled the planned workshop to facilitate closer cooperation between Korea, Japan, Russia and China (see Annex G1, item 5). It agrees that the following recommendations should be considered by the workshop:

(1) surveys should continue to focus in April-June in sub-areas 5, 6 and 10;
(2) it would be valuable to conduct surveys in the open waters of the Sea of Okhotsk in April-June;
(3) surveys should take place in the East China Sea (sub-area 1) in April-June; and
(4) surveys should take place in parts of sub-area 5 not yet covered (there were post Chinese catches there in spring-autumn). The Committee **recommends** that Chinese scientists be contacted and requested to examine these data. Kim noted that the forthcoming Workshop in Korea would be used as a focus for this.

The Committee noted that some areas of the Sea of Japan have now been surveyed several times and that this will allow trends in abundance to be examined. It welcomed the continuing commitment of Korea to conduct these surveys and **recommends** that surveys continue in these areas in the same period (April-June) with as much consistency as possible.

10.2.2.3 OTHER

The Committee recalled that the level of detail in the available Korean CPUE data was insufficient to progress further than had been discussed at last year's meeting. The Committee **reiterates** its previous view that it is important to obtain more information on past fishing effort, particularly static gear, to attempt to standardise a bycatch CPUE series.

The assignment of bycatches to J or O stock will be necessary for conducting the in-depth assessment. The Committee encouraged the associates be persued and recommended that it be completed, as far as genetic techniques allowed or sooner, by the time of the *Implementation Review* for western North Pacific minke whales, expected to be in 2008. In this context, Pastene noted that work will continue to improve genetic methods for assigning animals to J and O stocks.

10.2.2.4 WORK PLAN

For its work plan for the coming year and beyond, the Committee noted the work on stock structure described

under Annex G1, item 6.3, and the work on distribution and abundance under Annex G1, item 7.5. It **encourages** further work to obtain more detailed information on the Korean CPUE series and levels of past fishing effort. It also **encourages** work on telemetry to provide information on migration.

The Committee especially looks forward to receiving a report from the Workshop in Korea in September to facilitate closer cooperation between Korea, Japan, Russia and China and to facilitate progress towards obtaining abundance estimates for the whole area. The Committee **encourages** range states and other interested parties to cooperate to make the Workshop a success.

10.3 In-depth assessment of Southern Hemisphere humpback whales (SH)

10.3.1 Report of the intersessional Workshop on Southern Hemisphere humpback whales

Last year, the Committee agreed that the completion of the Comprehensive Assessment of Southern Hemisphere humpback whales at the 2006 Annual Meeting was a high priority (IWC, 2006g, p.162) and that to achieve this would require the holding of an intersessional Workshop to:

(1) advance the Comprehensive Assessment of Southern Hemisphere humpback whales to near completion using the best available data; and

(2) review the abundance, population structure and status of Southern Hemisphere humpback whales breeding populations and their relationship to feeding grounds in the Southern Ocean.

The Workshop was held at the Australian Antarctic Division in Hobart, Tasmania, from 4-7 April 2006. Funding was provided by the Government of Australia, the IWC and the United States National Marine Fisheries Service. Details of the discussions and conclusions of the Workshop are found in SC/58/Rep5, which will be published in a forthcoming Special Issue.

Information on genetic and demographic structure, seasonal distribution and migration were examined and the Workshop agreed that the level of confidence associated with stock structure concepts varied considerably across the Southern Hemisphere. In some areas, the connections between breeding and feeding grounds and the structure within these are reasonably well understood, while in others there is considerable unresolved complexity and insufficient data to discriminate among a variety of stock structure hypotheses and hence to reliably allocate feeding area catches to Breeding Stocks. It was agreed that the best available information led to the following immediate conclusions in regards to stock structure of Southern Hemisphere humpback whales.

(1) The most plausible hypothesis for Breeding Stock A (BSA) is that of a single Breeding Stock (eastern South America) connecting with a single feeding ground in Area II.

(2) The situation for both Breeding Stocks B and C (BSB and BSC) (western and eastern Africa) is too complex and unresolved to allow useful attempts to develop stock structure hypotheses of value for assessment modelling.

(3) The available information was sufficient to generate a reasonable hypothesis regarding Breeding Stock D

(BSD) (western Australia) and its general connection to the feeding grounds of Area IV. However, there remains the question of how much mixing exists with Area V to the east and Area III to the west.

(4) The situation for Breeding Stocks E and F (BSE and BSF) (Eastern Australia and the South Pacific Islands) is complex and currently unresolved and therefore that it was not possible to construct stock structure hypotheses for assessment modelling.

(5) For Breeding Stock G (BSG) (western South America), there appears to be a relatively straightforward connection between feeding grounds off the Antarctic Peninsula and the breeding ground in equatorial western South America region. It is still unclear where humpback whales feeding in the Magellan Strait breed, but even if these animals bypass equatorial regions and winter in Central America, this remains in the area currently defined as BSG.

(6) Stock X (BSX) (northern Indian Ocean) corresponds to an isolated population resident in the Arabian Sea year-round.

In light of these conclusions, the Workshop agreed that, with respect to stock structure (and hence allocation of past catches) it would be possible to discuss modelling options to allow completion of the Comprehensive Assessment only for BSA, BSD and BSG at the 2006 meeting. While the structure of BSX is relatively simple, an assessment cannot be conducted because there is no information on abundance and trends for this stock. In view of the above, priority was given to reviewing abundance and trend information for those stocks for which the assessment could be completed; the Workshop also agreed on the appropriate catch allocation hypotheses and estimates to be used in the models (SC/58/Rep 5).

After considering the abundance and other data, (summarised in SC/58/Rep5), the Workshop agreed that completion of the Comprehensive Assessment remained possible for BSA, BSG and BSD and that this should be the primary focus of further intersessional work and of the Committee at the 2006 meeting. In its review of biological parameters, the Workshop concluded that the available information suggested that the intrinsic growth rate parameter (r) currently used in modelling exercises (a maximum rate of increase of 12.6%) seemed biologically implausible and recommended that the existing data should be reviewed in the context of determining a likely bound for the intrinsic growth rate parameter at the 2006 meeting. The Workshop also recognised that the assessment models considered at present are relatively simple in the way they incorporate demographic parameters and suggested that the incorporation of factors such as depensation was desirable and probably practical. In addition, it was noted that genetic analysis (current mitochondrial DNA [mtDNA] haplotype diversity) should be used to try to determine minimum numbers below which populations could not have been reduced.

From the perspective of completing the assessment for the other areas, it was agreed that the highest priority research is for studies of stock structure and movements for BSB, BSC, BSE and BSF, particularly those that will allow appropriate allocation of catches from the feeding grounds to breeding stocks. Information from a variety of sources

was recognised as important in this regard, especially genetic, photographic, telemetric and acoustic studies.

The Workshop also provided general and stock-specific recommendations to improve knowledge of all breeding stocks in the Southern Hemisphere, with emphasis on the completion of the Comprehensive Assessment. These recommendations are presented in item 10 and Annex H of the Workshop report (SC/58/Rep5).

The Committee **endorses** the report of the Workshop and its recommendations, noting that substantial progress had been made towards completing the Comprehensive Assessment for at least BSA, BSD and BSG.

10.3.2 Comprehensive Assessment of Southern Hemisphere humpback whales

In the light of the report of the Workshop, effort was focused on completing the assessment of BSA, BSD and BSG during the 2006 annual meeting. Details of the discussions in the sub-committee are found in Annex H.

10.3.2.1 BIOLOGICAL PARAMETERS

SC/57/SH4 and SH24 considered the likelihood that humpback whales could increase at high rates (>10-12% year^{-1}). Current assessment models use a Pella-Tomlinson model which constrains the maximum possible annual rate of increase (MPR) to be bounded at 12.6%. Based upon discussions of SC/58/SH4, the Committee **agrees** that, on the basis of the best information currently available, 10.6% is a reasonable value to adopt as an upper bound for this annual rate in assessments. However, the Committee **recommends** further research to obtain data on parameters from Southern Hemisphere populations rather than relying on values drawn from humpback whales in the North Pacific or the North Atlantic. In addition, it was suggested that the implications of dynamics different from the Pella-Tomlinson form should be explored. The Committee noted that MPR levels in that model apply to population sizes at very low levels and would not be expected in a population approaching the carrying capacity, K.

With respect to interpretation of observed rates of increase that exceed the demographic maximum, the Committee **agrees** that this does not necessarily imply that the information from such abundance estimates should be disregarded; the effect of sampling variability on abundance estimates from surveys about true population abundances leads to similar variation in associated estimates of trend, which consequently can exceed the demographic maximum. Information from such surveys can legitimately be included in assessments provided that these assessments also take due account of the bounds implied by demographics (ideally from the population in question). However, if an appropriate confidence interval for any estimated rate of increase from the series of abundance estimates entirely exceeds the bound implied by demographics, this constitutes compelling evidence to not incorporate such information in assessments, pending evaluation of the possibilities of biases in the abundance estimates or their being influenced by immigration.

SC/58/SH3 introduced the 'Social Aggregation Hypothesis' (SAH), which suggested immigration as a possible explanation for relatively high rates of increase observed for some Southern Hemisphere humpback whale populations (e.g. eastern Australia). Details on the discussion of this hypothesis are found in Annex H (item 2.2.1) but the extent to which immigration contributed was

unclear. The utility of the genetic data in SC/58/SH25 to test the SAH (SC/58/SH3) was discussed; while microsatellites might be used to detect individual movements, testing of the SAH probably requires a broader temporal data set than currently available.

SC/58/SH22 investigated the use of mtDNA diversity in a present-day population to provide a lower bound on historical estimates of minimum population size (N_{min}) for that population. The authors recommended that for the purposes of establishing N_{min} in modelling, two values should be used: (1) two times the number of haplotypes seen in the population (the doubling accounts for males), and (2) four times the number of observed haplotypes. The ultimate goal of this work was to establish a reasonable prior for N_{min} in modelling, but this was contingent upon determining the frequency distribution of alleles at N_{min}.

The Committee welcomed the information presented and the innovative techniques applied. However, it was also noted that these (especially (1) above) were absolute lower bounds because the probability of detecting the haplotypes of all individuals in a population was very low. The Committee agrees that use of twice the number of observed haplotypes was too extreme and that four times was more appropriate in terms of placing a minimum bound.

10.3.2.2 SOUTHERN HEMISPHERE HUMPBACK WHALE ASSESSMENTS

The Committee endorses the following abundance and trend estimates for use in the assessments.

Breeding stock	Point estimate	CV	Location*	Ref.	Trend	CV	Area	Ref.
A	6,251 (in 2005)	0.16	BG	(A)	0.074	0.48	BG	(E)
G	2,920[7] (in 2003/4)	0.19	BG	(B)	None	-	-	-
	3,337 (in 1996)	0.21	FG	(C)	-	-	-	-
D	10,032 (in 1999)	0.11	BG	(D)	0.106	0.43	BG	(F)

*Location refers to the region where estimates were obtained: BG = breeding grounds and FG = feeding grounds. (A) = SC/A06/HW2 revised in SC/58/SH15; (B) = SC/A06/HW13; (C) = SC/A06/HW6; (D) = SC/A06/HW3; (E) = SC/58/SH14; (F) = IWC (1996).

BREEDING STOCK A

SC/58/SH2 reported an update of previous Bayesian assessments of BSA (Zerbini, 2004; Zerbini, 2005). Details of the approach, which incorporated a deterministic sex- and age-aggregated population dynamics model, modern whaling catch data, absolute estimates of abundance and indices of relative abundance, can be found in Annex H. In addition, sensitivity analyses to the prior for r, catch allocation hypotheses, the number of abundance indices included, a boundary on N_{min} and depensation were investigated (SC/58/SH2 and Annex H, item 2.2.3.2.3). While there was some variation in model outputs across these sensitivities, changes were slight in almost all cases. The choice of the catch series had the highest impact on the estimate of K and this indicated that misallocation of catches or underreporting could cause appreciable bias in the estimate of stock status.

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[7] The Committee modified the selection of the IDCR/SOWER estimate from SC/A06/HW56 suggested at the Hobart workshop for reasons elaborated below.

New model runs were undertaken at the meeting using the best available information and the revised constraints on parameters (Annex H, item 2.2.3.2.3). Sensitivity to an alternative 'higher' abundance estimate and a different catch allocation hypothesis was also investigated (Annex H, table 2). The point estimates of population status of BSA ranged from 27-34% of the pre-exploitation level. The new runs confirmed that model parameters are more sensitive to the catch allocation hypothesis. The Committee **agrees** that there has been an observed increase in population size in recent decades, but that the stock remains well below initial population levels.

BREEDING STOCK G[8]

SC/58/SH23 presented a Bayesian assessment of BSG using a sex- and age-aggregated production model incorporating updated historic catch series (and alternative 'Core' and 'Fringe' series) and the current abundance estimates (the two given in the table above). In the absence of trend data for this breeding stock, the prior distribution for r was obtained from a model fit to both BSD and BSE (Johnston and Butterworth, 2005), allowing for mixing on the feeding grounds. Populations were projected into the future under a continuation of a zero harvesting strategy. Sensitivity analyses were performed on catch history values, the prior specified for r and the possibility of depensation.

The Committee considered the CV of the SC/A06/HW56 estimate (0.02) to be unrealistically low and noticed that some associated methodological questions remained unresolved since the Hobart meeting. It **agrees** that a conservative approach would be to focus the present assessment modelling on the SC/A06/HW13 estimate with the IDCR/SOWER estimate (similar to the SC/A06/HW56 estimate, but with a more realistic CV) used as an alternative. However, it recognised that the methods used to obtain the SC/A06/HW56 estimate appear to be a useful extension of mark-recapture analysis and **recommends** that a more detailed description of these methods be presented and reviewed in greater detail next year. It was agreed that new model runs should also incorporate the 'Core' or the 'Overlap' catch allocation hypotheses, a uniform prior on r or a prior given by the posterior distribution of this parameter obtained for BSA, and an N_{min} bound.

Selected results of the new runs are provided in Annex H (table 3). The point estimate of current status ranged from 30 to 70% of K. The choice of the absolute abundance estimate (SC/A06/HW13 versus IDCR) and the prior (uniform versus the posterior distribution for BSA) had important effects in the estimates of model parameters. The Committee **agrees** that no firm conclusions can be drawn about the status of BSG, given the substantial variation in the point estimates of current status.

BREEDING STOCK D

SC/58/SH23 presented a Bayesian assessment of BSD using the same model and sensitivity analyses as described for

BSG. The model was fitted to absolute abundance estimates from the breeding (SC/A06/HW13) and the feeding grounds (JARPA and IDCR/SOWER), and to all available trends in abundance (Annex H, item 2.2.3.4.1). Use of the breeding ground trend data led to an estimate of present status that was high, whereas feeding ground trend series produced even higher results. The model was unable to match the high rates of increase indicated by JARPA and IDCR/SOWER data. However, there was relatively good agreement between the estimated and observed CPUE trends for the model variant using the SC/A06/HW13 estimate of recent abundance in combination with the breeding ground trend data.

Selected new model runs (Annex H, table 4) included the SC/A06/HW13 estimate, the 'Core' or the 'Fringe' catch allocations, trend data from the breeding grounds (IWC, 1996), and an upper bound on r of 0.106. Results indicated that the model outputs were sensitive to catch allocation. The 'Core' hypothesis resulted in a somewhat more optimistic current abundance estimate relative to K than the 'Fringe' hypothesis (Annex H, table 4).

The Committee **agrees** that assessment results for BSD should be considered preliminary due to the potential for exchange with BSE on the feeding grounds. The Committee noted that previous models that incorporated mixed stocks on the feeding grounds but used the similar data led to much lower estimates of the status of the population (Johnston and Butterworth, 2005). The status of BSD should therefore be re-evaluated in the future, but this will first require analyses to clarify the structure of the E breeding substocks and the extent of mixing at high latitudes. In this context, the Committee **endorses** the Hobart Workshop recommendation that every effort be made for scientists to share data and carry out such analyses under the DAA. Nevertheless, the Committee **agrees** that this stock has shown a substantial increase since protection.

CONCLUSION

The Committee **agrees** that of the three stocks assessed, the most reliable results are those for BSA. This is because there was trend information from surveys on the breeding grounds and less uncertainty about catch allocation from the feeding grounds. For BSG, the only trend information available was for the feeding grounds and there was also uncertainty about possible stock structure within this stock. For BSD, although there is breeding ground trend information and an absolute estimate of abundance, catch allocation is less certain and perhaps influenced by mixing with BSE.

10.3.2.3 OTHER INFORMATION
10.3.2.3.1 FEEDING GROUNDS
SC/58/SH10 and SH17 reported on aerial and vessel surveys, together with photo-identification and biopsy sampling work, carried out in a recently discovered humpback whale feeding ground off the northern Patagonia region, Chile. An increasing number of whales have been recorded in the summer and autumn in coastal waters near Chiloé Island, Corcovado Gulf and Moraleda Channel. This, the northernmost feeding ground for humpback whales in South America, extends the Magellan Strait feeding area to at least 41°S.

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[8] Editor's note: An error was made in choosing the appropriate abundance trend to use for the SOWER cruise data for Breeding Stock G from the options given in SC/A06/HW6. Reanalysis using the correct trend data reveal a somewhat more pessimistic model output at the upper end. The corrected results will be presented to the 2007 Annual Meeting for discussion by the Committee.

The Committee **endorses** sub-committee recommendations that:

(1) photo-identification and biopsy sampling efforts continue in this area to facilitate comparison to other areas; and

(2) surveys be extended further north than 41°S along the coast of Chile to determine the northern range of this population.

The existence of a feeding population at this latitude in summer emphasises the importance of evaluating relationships to Antarctic abundance estimates. The Committee recalled that the Hobart workshop had concluded that a single stock was likely for BSG. This assumption was questioned in light of new evidence for feeding grounds at mid-latitudes in southern Chile.

SC/58/SH6, SC/58/SH13 and SC/58/SH21 provided information in response to specific requests made during the Workshop in Hobart (SC/58/Rep5) with respect to JARPA and Baseline Research on Oceanography, Krill and the Environment (BROKE) survey methodology and results. The Committee expressed its appreciation for the authors prompt response to these requests. Further discussion is reported in Annex G, item 4.

SC/A06/HW6 summarised estimates of abundance for humpback whales in the austral summer based on the three IDCR/SOWER circumpolar sighting surveys. These have encircled Antarctica three times: 1978/79-1983/84 (CPI); 1985/86-1990/91 (CPII); and 1992/93-2003/04 (CPIII). Circumpolar estimates with approximate midpoints of 1980/81, 1987/88 and 1997/98 were 7,100 (CV=0.36), 10,200 (CV=0.30) and 41,800 (CV=0.11). When extrapolated to unsurveyed areas[9] so that all refer to the full area south of 60°S, these estimates became 9,700 (CV=0.36), 12,500 (CV=0.3) and 41,600 (CV=0.11), respectively. Estimates were negatively biased because they assumed that all whales on the trackline were sighted and because some humpback whales likely remained north of 60°S. The Committee has identified a number of potential concerns when comparing minke whale estimates from different IDCR/SOWER circumpolar survey sets. The Committee **agrees** that there needs to be a thorough review to evaluate to what extent these concerns also apply to humpback whales when making quantitative comparisons.

10.3.2.3.2 BREEDING GROUNDS
There were a number of papers with information from the breeding grounds, including documents from the Hobart Workshop (SC/A06/HW9, 10, 12, 16, 17, 23, 27, 32, 34, 35, 36 and 51) but they were not discussed at the meeting due to insufficient time. The Committee acknowledged the receipt of these papers, thanked the authors for their efforts and **agrees** that the papers should be considered at next year's meeting.

SC/58/O6 and SC/58/O13 provided new information on humpback whales from BSC2. Of particular interest was the new work from the Comoros Archipelago (SC/58/O6), which included the creation of a photo-identification catalogue of 153 individuals. The Committee welcomed the submission of this work which addresses data gaps identified SC/58/Rep5 and **recommends** the continuation of this work in the future.

SC/58/SH5 described photo-identification and biopsy sampling at American Samoa (which lies between BSE and BSF) conducted in September/October 2003-05. The detection rate was low and observed behaviour was consistent with other low-density breeding grounds. Although there were some within-season sightings, none of 50 individuals were re-sighted there between years. However, 11% (*n*=4) of those photo-identified prior to 2005 were matched to other breeding sites in Oceania: three with BSF and one to BSE. There have been no successful high latitude matches.

SC/58/SH25 investigated the genetic diversity of eastern Australian humpback whales, comparing mtDNA sequence data with those from breeding grounds across the South Pacific (New Caledonia, Tonga, the Cook Islands, French Polynesia and Colombia), as well as from western Australia. The results supported the proposed subdivision of BSE into three substocks, E1 (eastern Australia), E2 (New Caledonia) and E3 (Tonga). The Committee **agrees** that the work related to the recommendations for further genetic analyses agreed in SC/58/Rep5 was required before the latter conclusion could be accepted. It was also noted that if separation of BSE into three substocks proved to be appropriate, this would require information on the relationship between these areas and the feeding grounds, in order that catches could be appropriately allocated. A variety of genetic analytical tools were available to assess mixing and allocate proportions of animals from Breeding Stocks (or substocks) onto feeding grounds.

10.3.2.4 ANTARCTIC HUMPBACK WHALE CATALOGUE (AHWC)
SC/58/SH19 summarised the findings and advances in the AHWC over the past year. Details are given in Annex H. There are now a total of 4,449 photographs of 2,594 individual whales. Of these, 183 individuals were identified in more than one year, and 41 individuals were sighted three or more times in different areas or years. The remaining IDCR/SOWER data including the most recent cruise will be analysed this year and made available, in the public access catalogue by next year, in accordance with IWC policy. Efforts continued to stimulate submission of opportunistic data from ecotourism cruise ships in the Southern Ocean, as well as from research organisations and expeditions working throughout this region and the Southern Hemisphere. The AHWC provides a unique clearing-house for such data, making the photographs and analysis available to other researchers.

The Committee welcomed this report, stressed the important contributions the AHWC makes to its work and **recommends** that this work be continued (see Item 21).

10.4 In-depth assessment of Southern Hemisphere blue whales (SH)
For the past two years, the Committee has agreed that the Comprehensive Assessment of blue whales should be

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[9] These unsurveyed areas are almost entirely between the northernmost extent of the surveys and 60°S. The extrapolation assumes equal density in such areas to those in the northern strata of the corresponding survey. Trends from IDCR/SOWER referred to elsewhere in this report are derived from these extrapolated estimates, so that they are based on comparable areas.

initiated (IWC, 2005f, p.244; IWC, 2006g, p.162). At this meeting, substantial new information on ongoing blue whale research was presented (Annex H, item 3.1).

10.4.1 Distribution
SC/58/SH1 and SC/58/SH7 provided information on blue whale distribution in the Antarctic as indicated by catch and sightings data. SC/58/SH1 presented a new analysis of blue whale distribution in the Southern Ocean, in relation to sea surface temperature, extent of seasonal ice zone (SIZ), and krill distribution. Results suggested that:

(1) 99% of the catches were located within the SIZ;
(2) blue whale abundance was heterogeneous around the Antarctic continent with a greater abundance in the Atlantic, West Indian Sector, and to the north of the Ross Sea;
(3) blue whales were found exclusively in waters cooler than 2°C, closer to the ice edge; and
(4) except in the Antarctic Peninsula area, where the SIZ is low but where the krill population is essentially driven by advection, the circumpolar abundances of the blue whale are highly related to the extent of the SIZ.

Surprisingly, the correlation of whale abundance with krill densities was much lower, at the limit of the significance threshold.

SC/58/SH7 described blue whale distribution in the Antarctic Areas III-E, IV, V and VI-W in the waters south of 60°S, based on JARPA sighting data. Whales were encountered throughout the surveys and were widely distributed in the research area. No gaps in distribution were observed.

SC/58/SH16 presented positional data for blue whales in the Southern Hemisphere and northern Indian Ocean, an area which encompasses the known range of Antarctic (true) and pygmy blue whales. Results indicate that blue whales avoid the nutrient-poor central portions of the Indian, Pacific, and Atlantic Oceans, and are more likely to be seen around the oceanic margins, especially in deep-water regions characterised by high chlorophyll-a levels. They are exceedingly rare in the Antarctic compared to historical catches, are no longer seen far from the pack ice in summer and have almost vanished from the waters around South Georgia and southwest Africa, but are more concentrated south of Madagascar, around Sri Lanka, off western and southern Australia and off the west coast of South America. Monthly data suggest that blue whales (generally pygmy blue whales) from the more concentrated areas do not participate in the classical summer migration to feeding grounds in the Antarctic and may therefore have avoided the worst effects of Antarctic whaling. It was also shown that whales track the krill in relation to the sea ice habitat, and not exclusively in relation to the krill abundance.

The large scope and broad study of this paper was acknowledged (details are given in Annex H, item 3.1.1) and the Committee **endorses** the recommendation that the work be completed.

SC/58/SH9, SH17 and SH18 described research undertaken along the southern coast of Chile, a complex system of inner seas, archipelagos, channels and fjords, that has been suggested to behave as a massive estuarine system.

The area is thought to act as a generation and dispersion centre for phytoplankton blooms, as well as a retention area with abundant zooplankton. Research has included aerial and boat surveys, photo-identification, biopsy sampling and telemetry. Telemetry results (Mate, pers. comm.) suggest reproductive behaviour takes place in the vicinities of Nazca Ridge (25°S and 800km offshore). Preliminary photo-identification results indicate that some level of site fidelity exist in northwestern Chiloé Island. Chile could be one of the few areas where needed research about status, critical habitat, feeding preferences and sub-specific identity of blue whales might become available due to the logistic advantage of working close to the coast. It was noted that data presented in SC/58/SH16 suggested that Chilean blue whales had larger total lengths than pygmy blue whales from the Indian Ocean, but had smaller total lengths than Antarctic blue whales. The relationship of the blue whale population in the northern Indian Ocean to southern pygmy blue whale populations was questioned and remains uncertain.

The Committee expressed appreciation for and **recommends** the continuation of the work conducted off Chile. It also **recommends** that abundance estimates be generated using sighting and photo-identification data from these and other regions in the eastern South Pacific. Finally, it **recommends** that further work be carried out to investigate the population structure of blue whales from the within this area and comparisons with populations from other regions be made.

SC/58/O2 and SC/58/O16 presented analysis of acoustic studies conducted in the Indian and Southern Ocean. In the southern Indian Ocean, preliminary results of one year of data indicate that the presence of blue whales, pygmy blue whales and fin whales has been detected year round (SC/58/O2). SC/58/O16 described a sonobuoy survey in the Southern Ocean during the large-scale BROKE West survey of Southern Ocean waters between 30 and 80°E. An initial analysis indicates blue whales were the most commonly recorded species. The Committee welcomed these studies and **recommends** their continuation.

10.4.2 Stock structure
SC/58/SH8 estimates the proportion of pygmy blue whales in the Antarctic from ovarian corpora data. The estimated proportion (0.4%, 95% CI=0.0-1.1%) was not significantly greater than zero, and thus the possibility that no pygmy blue whales enter Antarctic waters cannot be excluded. There was no evidence for an increase in this proportion from the 1930s to about 1950, a period when the Antarctic blue whale population decreased threefold. The Committee welcomed this novel approach and **recommends** that this project be completed. The results provide a useful addition to the Committee's previous conclusion that 'a small proportion, not more than 7%' of blue whales in the Antarctic would be pygmy blue whales (IWC, 2001a).

10.4.3 Abundance and trends in abundance
SC/58/SH7 provided estimates of abundance of blue whales in the Antarctic Areas IIIE, IV, V and VIW in waters south of 60°S from JARPA surveys. Abundance of blue whales was estimated to be 1,300 (95% CI=690-2,440) for the 2003/04 and 2004/05 seasons.

10.4.4 Biological parameters
SC/58/SH17 reported on 'skinny' blue whales observed in 2006 at northwestern Chiloé Island for a second year. There are at least three possible explanations for the skinny blue whales:

(1) natural or human produced changes in prey availability or habitat quality;
(2) physiological changes; or
(3) disease.

It was suggested that the most likely cause of this condition is nutritional stress due to the lack of prey resources but the underlying reason(s) for this remain unknown.

10.4.5 Other information
SC/58/O17 described long-term recordings that were used to examine the seasonal presence of blue and fin whales in the waters off East Antarctica. Preliminary results of these analyses show a higher acoustic presence of both these species from April through June, with the strongest peak occurring in April-May. In addition, previously identified pygmy blue whale calls were detected on both of the instruments. This is the furthest south these sounds have been recorded.

10.3.2.3 and 10.4.6 Work plan
Last year, the sub-committee recognised that the completion of the assessment of Southern Hemisphere humpback whales had become a priority and that the assessment of blue whales should be initiated (IWC, 2006h). Recommendations for future work to be conducted in regards to the Comprehensive Assessment of humpback whales are provided in the report of the intersessional Workshop in Hobart (SC/58/Rep5) and in Annex H, item 2.2.4.7.

Priorities for next year are discussed under Item 19. Budgetary implications are discussed under Item 22.

10.5 Other small stocks of bowhead, right and gray whales
10.5.1 Small stocks of bowhead whales
SC/58/BRG4 presented information on the genetic relationships among bowhead whales based on samples collected in the waters of the Eastern Canadian Arctic and Western Greenland, as well as samples from the B-C-B bowhead whales. Details are given in Annex F (item 4.2.1). The analysis consistently revealed a lack of identifiable structure for these samples. The small sample of whales from the Beaufort Sea was not clearly distinguished from the other samples in the analysis.

The Committee **commends** the Canadian and Greenland researchers for the recent efforts to collect and analyse the new samples. There were considerable discussions about whether the putative Davis Strait-Baffin Bay and Hudson Bay-Foxe Basin stocks should be combined or remain separated. The new genetics data will be important in assessing stock structure. The results from the Bayesian clustering procedure (*STRUCTURE*) provided no evidence for more than one stock. However, several members again commented on the low statistical power of *STRUCTURE*, especially for populations that are weakly differentiated. Therefore, while the results were consistent with one population, the presence of multiple stocks cannot be ruled out. The Committee **acknowledges** the need for additional

genetics data, but also **recognised** that other data were important for evaluating stock structure.

No spatially stratified comparisons of allele frequencies were included in SC/58/BRG4 as requested last year, since recent satellite tagging information (SC/58/BRG5) provided no clear guidance on how to pool the data. Despite this, the Committee **recommends** that a pairwise comparison, not including first-order relatives, be made of adult females sampled during the summer in Foxe Basin and Disko Bay, presumed locations for each stock. Sample sizes were sufficient from both of these areas.

SC/58/BRG5 presented results from a satellite tracking project that occurred between 2002 and 2005. A total of 28 bowhead whales was tagged in northern Foxe Basin (*n*=16) and Cumberland Sound (*n*=12). Of these, 17 tags transmitted for periods from a couple of weeks to about seven months. Combined with tracking results of Greenland whales, the findings indicate that bowhead whales are wide ranging, exhibit varying travel routes and clearly have the capacity for making quick shifts of residence areas over long distances. The tracks also clearly demonstrate that bowhead whales move well beyond the stock boundaries formerly presumed for the two putative stocks. Whales from both Foxe Basin and Baffin Bay regions share common ranges in summer as well as winter. Common use of wintering ranges suggests that there is potential for significant genetic exchange between the various components of the eastern Arctic population. Information on dive times was reported in SC/58/BRG6.

Discussions focussed on the usefulness of the tagging data for assessing stock structure. Heide-Jørgensen commented that in addition to the satellite tracking, two other lines of evidence support the one stock hypothesis. One is the considerable age and sex segregation between Hudson Bay-Foxe Basin and Davis Strait-Baffin Bay. The other is the history of exploitation that shows that the Hudson Bay-Foxe Basin and Davis Strait-Baffin Bay populations were depleted simultaneously, indicating a link between the two areas.

The Committee **agrees** that several lines of evidence point towards one stock, but that the genetic data could still be interpreted to indicate two stocks. A synthesis of data and analyses would be welcomed for the 2007 meeting in order to provide a more reliable determination of the relative plausibility of one and two stock hypotheses.

SC/58/BRG7 presented results of aerial surveys carried out in 2002, 2003 and 2004 in the eastern Canadian Arctic, conducted to estimate numbers in both the putative Davis Strait-Baffin Bay and Hudson Bay-Foxe Basin stocks and to develop a better understanding of the summering distribution of these whales. Surface counts of bowheads were analysed using *DISTANCE* software and adjusted for diving whales. An estimated 7,309 (95% CI=3,161-16,900) bowheads occupied Eclipse Sound, Prince Regent Inlet and Gulf of Boothia in 2002. In 2003, 1,828 (95% CI=940-3,554) bowhead whales were estimated in Admiralty Inlet and along the east coast of Baffin Island and an estimated 981 (95% CI = 319-3,018) whales occupied the southern Gulf of Boothia, Foxe Basin and northwestern Hudson Bay. Due to the wide-ranging movements of bowhead whales demonstrated by tagging studies, survey estimates between years cannot be reliably combined. The best partial estimate from the combined bowhead population is 7,309 (95%

CI=3,161-16,900). This is considered a partial estimate because it covered the Prince Regent Inlet-Gulf of Boothia-Eclipse Sound survey area, which is only part of the known summer range.

The Committee **commends** the Canadian and Greenland researchers for collecting much needed information on these bowhead whales. Even though the Committee was pleased to receive these analyses, concern was expressed concerning some aspects of the abundance estimates including the estimation of surface time, survey design and uneven coverage probability and the low number (17) of sightings in 2002. Further discussion is given in Annex F (item 4.2.2).

Information was also provided about recent observations of bowhead whales near Svalbard in late April 2006 at 80°N and 0°W. There were 20 sightings of bowheads and seven biopsies were collected from these animals.

10.5.2 North Atlantic right whales
Gaines *et al.* (2006) analysed mtDNA from bone samples from eastern North Atlantic right whales to better understand the effects of whaling. Novel haplotypes were discovered in the samples. Further, the diversity of haplotypes was greater in bone samples than the diversity in the entire western North Atlantic population. The analysis demonstrated that historical whaling markedly reduced the genetic variation in mtDNA.

10.5.3 Southern Hemisphere right whales
The long-term programme of aerial surveys had continued in 2005; the annual series began off southern Western Australia in 1976 and expanded along the coast into South Australia from 1993. The total of 600 right whales including 176 cow/calf pairs, was the highest so far in the series. For cow/calf pairs over the period 1993-2005, the increase rate was 7.53% (95% CI 4.03, 11.04%).

A total of 684 right whales including 260 cow/calf pairs were recorded on an aerial survey off South Africa in October 2005. This is the highest field count of calves in 27 years of surveys.

The Committee **repeats** its previous recommendation that these long-term monitoring programmes continue.

SC/58/O7 reported southern right whale sightings during the 2005/6 JARPA II survey in Area IV. A total of 82 individuals were sighted in 61 groups. Fifteen biopsy samples were obtained.

SC/58/IA1 reported two southern right whale sightings during the 2005/6 IWC-SOWER cruise in the western part of Area III. Three individuals were sighted in two groups. All three whales were photographed and two biopsies were obtained.

10.5.4 Other small stocks of right whales
SC/58/O8 reported right whale sightings during the 2005 JARPN II survey in the sub-areas 7, 8 and 9 of the western North Pacific. Two individuals were sighted in one group. Two biopsy samples were collected and photo-identification was obtained for both individuals.

10.5.5 Western North Pacific stock of gray whales
The Committee (and the Commission) has noted in the past that this remains one of the most endangered populations of baleen whales (e.g. IWC, 2005b, p.31; IWC, 2005a).

SC/58/BRG2 presented information on a freely-available CD-based photo-identification catalogue containing images of 150 western gray whales collected between 1994 and 2005 off Sakhalin Island, Russia, by the joint Russia-US research programme. The primary objectives of making this catalogue available are to: (1) facilitate international cooperation and collaboration between current and future research groups collecting data on the western gray whale population; and (2) provide an individual numbering scheme and standardised images of western gray whales that can be used for comparison by other research groups and organisations. The images and the data in the catalogue are provided on the understanding that they will only be used with permission of the authors.

The Committee **welcomes** the provision of this catalogue. It **reiterates** its agreement last year (IWC, 2006c, p.30) that scientists working as part of the oil companies' research work should compare their photographs with those in the [Russia-US] catalogue and that potential new whales should be reviewed by a group of experts (including scientists from both programmes) before being added to the catalogue. This is particularly important given the different opinions expressed over the possibility of errors occurring in the Russian catalogue referred to in SC/58/BRG28 (see the discussion in Annex F, item 6.2.1).

The Committee received two papers (SC/58/BRG17 and 28) that referred to studies of the impact on gray whales of construction and other activities related to the oil and gas industry off Sakhalin Island in 2005. The conclusions as to whether there had been an impact were conflicting. In the former case, the authors were not present to answer questions while in the other, only a summary of the conclusions of the work was available. The Committee was concerned at these conflicting conclusions given the importance of this issue to the conservation of western gray whales and **strongly requests** further information be presented at next year's meeting. Sufficient detail should be included to allow an evaluation of the analyses leading to the conclusion.

In addition, while the Committee **welcomes** the summary of several studies on a variety of subjects conducted in 2005 under the Russian programme on the western gray whale research and monitoring off northeastern Sakhalin Island presented in SC/58/BRG28, it **requests** that full papers on these and new studies be presented next year where possible, rather than simply a summary of conclusions. SC/58/BRG29 had presented information on shore-based, aerial and vessel-based surveys undertaken as part of the Russian programme that indicated that the overall distribution of gray whales in the northeastern Sakhalin waters was similar to that in 2004. Further details are given in Annex F (item 6.2.1).

SC/58/BRG3 summarised the 2005 results of the on-going Russia-US research programme off Sakhalin Island. Genetic samples have now been collected from 124 individuals. The total of known reproductively active females remains at only 23 individuals. Fourteen (15.2%) of the 92 whales identified in 2005 were recorded as 'skinny', considerably more than the 3 and 5 recorded in 2003 and 2004, respectively.

SC/58/BRG30 provided an updated population assessment of the western gray whale using the photo-identification data collected off Sakhalin Island under the joint Russia-US programme from 1994 to 2005. New median estimates of key population parameters (with 90% Bayesian confidence intervals) were provided as detailed in

Annex F (item 6.2.1); the present abundance is estimated at 122 (CI=113-131) and the annual rate of increase is 3% (CI=2.1%-4.2%) over the 1994-2005 period. The updated assessment is more optimistic than last year, mainly due to reduced calving intervals observed in recent years, implying a higher reproductive rate. However, if whales continue to be entangled in nets at the 2005 level (three females), then the population is predicted to decline with high probability; there is a substantial risk of extirpation by 2030. The 2005 level of bycatch is therefore unsustainable and it is important to avoid further human caused deaths in this depleted population.

In this regard, SC/58/O14 reported on the status of conservation and research of western gray whales in Japan, following recommendations in IWC Resolutions in 2001-3, 2004-1 and 2005-3. A lactating female (12.79m) with a calf (7.75m) was entangled by a large set net located off Enoshima Island in the morning of 15 July 2005. The whales were not seen before the entanglement. Extensive biological data were collected from the animals. The Fisheries Agency of MAFF, Japan (FAJ) collaborated with local governments to initiate actions to eliminate anthropogenic mortality.

Given the three fatal entanglements in 2005, and the finding that this level of mortality is unsustainable, the Committee **stresses** the urgency of reducing anthropogenic mortality in this population to zero. The Committee welcomes the administrative measures taken by the Japanese authorities and **recommends** that means to avoid such mortalities be actively explored, and **requests** that information on the steps taken be provided next year. The Committee **repeats its recommendation** of last year (IWC, 2006c, p.30) that: (1) every effort be made to ascertain whether the three western gray whales that died last year in Japanese waters were previously identified animals from the Sakhalin feeding ground; and (2) that arrangements be made for samples and photographs from these whales be sent to the archives of the joint Russia-US programme (i.e. the SWFSC) in La Jolla, California.

Given these anthropogenic risks and the lack of information on the migratory routes and breeding destinations of these animals, the Committee **recommends** that a satellite tagging programme be initiated on the feeding grounds near Sakhalin, noting the success of such work on eastern gray whales. Given the concerns over the status of this population, the Committee also **strongly recommends** that:

(1) the work is only carried out using experienced investigators (e.g. Mate) using proven technologies; and

(2) tags are only applied to known males (these can be identified in the field by experienced scientists based on their appearance and the results from the joint Russia-US programme).

The Committee **agrees** that the general issue of the use of telemetry and potential effects on whales should be considered at next year's meeting, when *inter alia* the report of the Society of Marine Mammalogy workshop will be available. The need for an IWC Workshop on this topic will be assessed at that time.

Furthermore, the Committee **recommends** that the Commission requests China to submit any information it may hold on the past or present occurrence of gray whales in its waters, where the breeding grounds are suspected to occur.

10.5.6 Work plan
This is discussed under Item 19.

10.6 SOWER cruises
10.6.1 2005/06 cruise
Initial planning of the 2005/06 cruise was undertaken at the 2005 annual Scientific Committee meeting where four items had been identified as being high priority for the cruise. The original priorities had to be re-examined at the planning meeting in Tokyo during September 2005 (SC/58/Rep4) as unfortunately, Japan was able only to provide one research vessel for the cruise (see Item 10.6.2.2). For minke whales, it was agreed that the primary aim was to evaluate the Buckland and Turnock (BT) survey mode which would provide data for estimation of $g(0)$. For fin whales, it was agreed that the primary aim of the feasibility study was to investigate methods to try to estimate abundance (which is primarily north of 60ºS) and especially to examine the use of an adaptive sampling techniques to try to maximise the efficiency of sighting effort.

SC/58/IA1 presented the report of the 2005/06 SOWER cruise. The research area was in the western part of Area III (000°-020°E longitude) and the planned duration was 65 days. Research was conducted from the Japanese Research Vessel *Shonan Maru* No. 2 which departed Cape Town on 22 December 2005 and returned on 22 February 2006.

The main aim of the feasibility study for fin whale research, carried out for 21 days was to trial Adaptive Line Transect Sampling (ALTS) as a method for estimating the abundance of fin whales. Sightings of fin whales totalled 31 groups (274 individuals), and included two large (one of 40 and one of 100) aggregations; 30 biopsy samples were obtained and many animals photographed. Fin whales were never heard before they were seen.

Minke whale research, primarily to evaluate BT mode was conducted between 18 January and 13 February in the vicinity of the ice edge between 000°-020°E. Minke whales were the most frequently sighted species during this part of the research, totalling 361 groups (940 animals).

Blue whale research was conducted concurrently and included the collection of biopsy samples, photo-identification, acoustics recordings and behavioural observations. Thirty-three groups of 63 blue whales were sighted including one calf. A total of 36 biopsy samples were collected and photo-identification images were collected from 52 whales including all the biopsied whales. Sounds attributed to blue whales were recorded in the vicinity of 29 sightings.

Biopsy samples were collected from 71 humpback whales and 115 individuals were photographed, including all the biopsied animals. Many of these were seen north of 60ºS. A pair of southern right whales and three groups of killer whales classified as Types A, B and C were also photographed and biopsied.

Ensor (Cruise Leader on the *Shonan Maru* No. 2) expressed thanks to the captain, crew and fellow researchers for their hard work. The Committee expresses its **gratitude** to the Government of Japan for providing the vessel to conduct the research. It also thanks the officers and crew, the Cruise Leader and the researchers for their efforts to ensure a successful cruise.

There was considerable interest in the large aggregations of fin whales that had been encountered and how best to handle this both in the field and analytically. This is discussed in Annex G (item 2.2).

The Committee noted that both the ALTS and BT mode trials had been successful. In the discussion of the BT mode trials there was concern that the separation of search regions between the different observers was not sufficient and it was unclear whether animals had responded to the vessel before initial sightings. To assist future planning, the Committee **recommends**, if possible, that the results from the ALTS and BT mode survey are made available at the Tokyo planning meeting at the end of September. Further analyses of responsive movement, e.g. using swim directions or the methods of Palka and Hammond (2001), would be valuable.

The Committee noted blue whale research has been conducted for a number of years now, it **recommends** these data be analysed, in particular, the photo-identification and other data collected to facilitate sub-species recognition (and see Item 21). The Committee also **recommends** that development of a direct data acquisition system should wait until further methodology has been agreed.

10.6.2 Short- and long-term recommendations for future SOWER cruises
10.6.2.1 RECOMMENDATIONS FOR THE 2006/07 CRUISE
At the 2004 meeting the Scientific Committee agreed that the objective of any future SOWER programme should be:

> 'to provide information to allow determination of the status of populations of large whales that feed in the Antarctic waters. The programme will primarily contribute information on abundance and trends in abundance (including Antarctic minke whales) learning from both the successes of past IDCR-SOWER cruises and the difficulties in interpreting previous results (IWC, 2005b, p.29)'.

Sub-objectives were to consider methodological developments and improvements in abundance estimation and its interpretation; stock structure; abundance estimates and trends in abundance.

The Committee was informed that the Government of Japan intended to offer the research vessel *Shonan Maru No. 2* for 65 days, of which approximately 48 days were available for research. The Committee **welcomes** this generous offer. However, the Committee **reiterates** the concern expressed in SC/58/Rep4 that the likelihood of meeting the objectives with only one vessel could be very low. Nevertheless, until analysis of results from the 2005/06 cruise have been completed and the likely precision of any abundance estimates achievable with single-vessel surveys estimated, it is unclear how much could be achieved with one vessel in addressing the above objectives of the programme. To assist in the planning for the 2006/07 SOWER cruise, the Committee **reiterates** that these analyses be completed by the Tokyo planning meeting, which is scheduled to be held 27-29 September 2006.

The Committee **agrees** to a number of priorities to be considered for research for the 2006/07 cruise. High priority projects include:

(1) further trials of BT mode;
(2) school size estimation experiments;
(3) further feasibility work on fin whale abundance;
(4) biopsy sampling/photo-identification;
(5) satellite-tagging; and
(6) reducing errors in distance/angle estimation.

Depending on the species, acoustic studies are of High to Medium priority. A Low to Medium priority project for this year is Adaptive Line Transect Sampling. Details are described in Annex G (Appendix 2). The target species and general order of priorities were unchanged from previous years. Area III was proposed as the research area because of the good opportunities for research on the four target species; minke, blue, fin and humpback whales. Discussions on the detailed method to be employed are referred to the Tokyo planning meeting. The Committee **recommends** the SOWER Steering Group complete the planning of the 2006/07 SOWER cruise. Members appointed were: Kato (Convenor), Bannister, Best, Bravington, Brownell, Childerhouse, Clark, Donovan, Ensor, Hedley and Palka.

10.6.2.2 RECOMMENDATIONS FOR THE LONG TERM
In SC/58/Rep4 it was recommended that the Japanese Government be strongly requested to reconsider whether in the future it might be able to provide a second vessel and also recommended that other IWC member nations be asked to contribute vessels, or equivalent ship time to the SOWER programme. It was also agreed that it was necessary to devise ways of maximising observer efficiency and research time. Finally, the importance of seeking ways in which to cooperate with other organisations that are already planning or undertaking research in relevant regions, such as CCAMLR and the Australian Antarctic Division, was stressed.

The Committee **concurs** with these recommendations.

The Committee noted that the CCAMLR IPY multivessel survey was planned for the Scotia Sea region of the Antarctic in the 2007/08 season and there was an offer from CCAMLR for the IWC to participate. Although it was not possible for any commitment about potential involvement of a SOWER vessel to be made at this time, the Committee recognised that coordination of a SOWER vessel with the activities of several potential whale observation platforms in this area might assist in obtaining adequate coverage of this area to obtain more precise abundance estimates of a variety of whale species, such as minke, humpback and fin whales. It **recommends** that possible collaborations be investigated further (see Item 21).

10.7 Abundance and trends using JARPA data
Discussion was limited to the survey design and analysis of the JARPA data used to estimate abundance and trends of minke and humpback whales; estimates were not discussed. SC/58/SH21 reported information on the JARPA sighting survey design and clarified previous presentations of line transect analyses, as was requested in SC/58/Rep5.

The Committee **welcomes** this paper and notes the considerable amount of work that had been undertaken in a short space of time to provide extra details on the survey tracklines, strata and timing. Although it was recognised that the location of these surveys, with a highly variable and to some extent unpredictable ice edge location, presents difficulties in determining trackline locations, the Committee **recommends** that consideration be given to other treatments of apparently unsurveyed areas within strata when converting density estimates to abundance. Some concerns were raised about the cruise-track design for the southern strata. Given that minke whale abundance tends to decrease away from the ice edge, transects perpendicular to this edge are certainly appropriate for

abundance estimation, but the lengthy intermediate transects which run more nearly parallel to the ice edge might introduce bias, particularly for design-based estimation approaches. The Committee therefore **recommends** that as a sensitivity analysis, calculations be repeated including only the perpendicular transects, or at least exclude segments that appeared to track the contours of the ice edge, to investigate implications for bias and precision. Furthermore, concerns were raised about uneven coverage particularly within some southern strata, and the Committee **recommends** that this also be investigated by the use of sensitivity tests involving post-stratification.

Details of survey protocols for JARPA can be found on the Institute of Cetacean Research website (*www.icrwhale.org*). The Committee **recommends** that a single document be prepared for the forthcoming JARPA review meeting that details the JARPA survey design and protocols, how they have changed over time, any differences between the implementation and design and the following specific questions, even if the information may be found in other documents elsewhere. Questions about the survey design of relevance to this Committee are:

(1) How are tracklines adjusted in 'real-time' on the vessels, including when the ice edge is encountered unexpectedly?
(2) How do the vessels interact at the end of the survey day and is the amount of night steaming by each vessel independently decided?
(3) Which vessels were used in the surveys and were they used any differently in different years?
(4) How does the location of the ice edge change during the course of the survey?

Regarding (4), it was noted that only limited information is available from direct observations on the surveys (i.e. only the southern boundary of the southern strata is mapped by the vessels), but it was suggested that satellite data might be used. It was recognised that there would be differences between satellite images of ice edge location and its location mapped real-time by the vessels, and that there could be little *post hoc* ground-truthing of the satellite data. Nevertheless, at a broad level satellite images could be useful in interpreting results from the surveys. The other details requested would help determine the appropriate method to estimate sampling variance, which may be underestimated at present. This is a separate issue from additional variance.

The Committee noted that with respect to humpback whales, the detection functions used showed more variation than might be expected. It was suggested that this be investigated further, possibly looking at pooling options and also whether searching behaviours for humpback whales were different in areas of higher minke whale density.

Two further papers examining the JARPA methods and possible effects on abundance were considered. Details are given in Annex G (item 4). SC/58/SH6 examined whether abundance estimates for Southern Hemisphere humpback whales were biased due to the survey modes in JARPA: sighting and sampling mode (SSV); passing and closing mode from the sighting vessel (SV_P and SV_C). The authors concluded that these results suggested that the method is appropriate and that the correlation between the distribution of humpback whales and that of minke whales is so weak

that the humpback abundance was not biased due to survey mode.

SC/58/IA6 investigated whether abundance estimates could be underestimated due to gaps in planned trackline coverage ('skip')[10]. The relationship between encounter rate of Antarctic minke whales and three kinds of 'skip' were examined. The authors conclude that two of the three skip types cause a negative bias (A and C).

SC/58/SH6 and SC/58/IA6 were discussed together. The Committee **recommends** that since skip type (A) occurred only during the first four years of JARPA, the resulting potential negative bias in estimates for these years should be accounted for before including these estimates when examining trends in abundance. It was suggested that in addition to the approach discussed in SC/58/IA6, the authors consider a GLM approach with survey mode (SSV, SVC and SVP) as a factor. This approach could more readily facilitate trend estimation. It would also be worthwhile investigating the possible extent of failing to find a significant difference between modes when in reality such a difference exists (Type II errors). With respect to skip type (D) that was not examined, it was pointed out that gaps in effort due to weather might be correlated with density in the case of Antarctic surveys, where there is some suggestion of better weather in higher density areas (e.g. close to the ice edge). In principle, associated potential biases could be at least partially corrected by stratification, however, the degree of success would depend on the spatial scale of the strata and the actual pattern of coverage within each stratum, which are different for JARPA and IDCR/SOWER. It was suggested that any future investigations of skip include such analyses to address these points regarding skip type (D).

SC/58/IA7 estimated trends in abundance of Antarctic minke whales in Areas IV and V (1989/90-2003/04 in Area IV and 1990/91-2004/05 in Area V) based on JARPA abundance estimates. A linear regression of logarithm of abundance on year weighted by the inverse of the squared CV was applied in order to estimate the instantaneous increase rate. Increase rates were estimated to be 1.2% and -1.3% in Areas IV and V, respectively. As their 95% confidence intervals are (-2.8%, 3.9%) and (-4.3%, 1.1%) in Areas IV and V respectively, the authors concluded that there is no significant trend in Areas IV and V in the JARPA abundance estimates. However, they noted that the change in Area V may be negatively biased because of a possible underestimation of abundance in 2004/05.

Comments were made that $g(0)=1$ had been assumed, but that the other work implied that incorporating estimates of $g(0)$ would also affect trend estimation. Noting the difficulties in estimating and applying a single correction factor across all surveys and years, it was suggested that, as a sensitivity analysis to possible biases, the presentation of estimates using SV_P mode data alone would be informative. To examine similarities or differences in trends in abundance between modes, the Committee **recommends**

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[10] Skip type (A) is when the vessel steams at night, while not surveying, to a start point for the next day. Skip type (B) is when the vessel steams, while not surveying, to a point to catch up to the schedule within a stratum. Skip type (C) is when the vessel steams, while not surveying, due to closing on a detected sighting and/or chasing a targeted minke whale. Skip type (D) is when the vessel steams, while not surveying, under bad weather conditions.

that a GLM approach be investigated, standardising on SV_P, and also allowing for interactions. The question of the use of a single correction factor was also raised in the context of variance estimation, and in particular whether estimates of the variance would be negatively biased. One suggestion was that the correction be estimated by treating it as a random effect in a mixed model framework.

SC/58/IA20 presented results having combined six JARPA surveys and compared this to fitting separate models to each survey. A two-stage procedure was used to fit the data. First a GLM was fitted to the presence/absence of schools in the segments of effort, and then a Generalised Additive Model (GAM) was fitted to the estimated number of schools in the segment, given that a school was present. The product of predictions from these two models then gave the estimated density of schools. However, the variances, obtained using resampling techniques, were so large that no inferences about the model fitting could be made.

In discussion of this paper, a number of issues were raised for further consideration:

(1) the appropriateness of modelling localised skip type (A) bias with a broad level of smoothing;
(2) using a single-stage model with longer segments; and
(3) further investigation of knot placement issues and use of other types of smoothers that were designed specifically for complex topographical regions.

Because skip type (A) occurred during the first four years of JARPA only, the Committee **agrees** that the relative priority of using spatial models to try to correct for bias was somewhat lower than previously envisaged, but that model-based approaches would still provide a satisfactory way of analysing JARPA data.

10.8 Other abundance estimation methodological issues
SC/58/IA16 outlined a robust method for generating design-unbiased surveys for geographically complex study areas. In the highly convex inshore stratum, a systematic cluster sampling algorithm was developed and within selected clusters a systematic parallel line was used to ensure equal coverage probability in long, narrow fjords.

The Committee **agrees** in principle that the approach to trackline design described in this paper is a valuable tool for planning surveys. It was noted that sometimes the uneven probability of coverage may mean only a model-based method is appropriate. Work to investigate what the probability of coverage might have been under different sampling strategies on IDCR/SOWER was considered valuable.

SC/58/IA13 compared abundance estimates for bottlenose dolphins off southern Spain using mark-recapture and model-based line transect methods. In general, mark-recapture is likely to be more useful for relatively closed populations of species with good natural markings in small areas, while line transect sampling is likely to be more suitable for larger areas containing open or closed populations. An important distinction is that mark-recapture methods generate estimates of the total number of different individuals using the area, while model-based line transect methods give estimates of the average number of animals in the area, within the time frame of the study.

The Committee welcomed this paper, was informed of ongoing work to integrate the two methods and **encourages** this development.

SC/58/O12 summarised the planning for a major synoptic survey for cetaceans in the Mediterranean and Black Seas and contiguous Atlantic waters; the waters covered by the ACCOBAMS agreement and for which there is little reliable information on abundance, stock structure and even distribution for many areas. There will be two phases to the programme: (1) the large-scale synoptic survey; and (2) the development of a long-term monitoring programme. The priority species include fin and sperm whales as well as five small cetacean species.

The Committee welcomes this report, **endorses** the objectives of the survey (noting that identified complications related to long-diving species need to be addressed) and **recommends** that the members of the Committee continue to assist in the planning phase and provide advice where appropriate.

10.9 Historic abundance estimation – genetic methods
In 2004, (IWC, 2005b, pp.32-4) the Scientific Committee discussed a study by Roman and Palumbi (2003) that used genetic diversity in mtDNA to infer historical levels of abundance of humpback whales, fin whales, and minke whales in the North Atlantic. These figures greatly exceeded previously reported estimates of pre-whaling abundance for at least humpback and fin whales. The Committee agreed that the estimates of abundance provided in Roman and Palumbi (2003) could not be considered reliable estimates of immediate pre-whaling population size. It identified further work needed to assess whether genetically based estimates of initial population could provide useful information for management. There have been no definitive conclusions on this matter, and the discrepancy between genetic estimates and the catch record remains largely unreconciled. The Committee **recommends** it consider this issue at some point in the future when additional publications describing methodological and analytical progress are available. At that time the Committee could consider these advancements and assess whether they are relevant.

10.10 Work plan
This is discussed under Item 19 and funding implications are considered under Item 21.

11. STOCK DEFINITION (SD)

11.1 Review progress on the Testing of Spatial Structure Models (TOSSM) project
In 2003, the Committee instigated the TOSSM project (IWC, 2004a, pp. 27-28; IWC, 2004g, pp.469-85). The main aim is to develop simulation tools that can be used to examine the performance of current and future genetic population structure techniques. The focus is on management implications, in that the genetic techniques are used to suggest management boundaries, which in turn are used to set or subdivide catch limits according to management rules; the performance of different genetic methods is ultimately to be assessed in terms of how well a simulated management regime performs if the suggested boundaries are used. The Scientific Committee's experience of studying population structure, e.g. in developing *IST*s for common minke whales in the North Pacific, has shown that genetic data do not usually provide unequivocal evidence

for specific boundaries for use in management. Further, few boundary-placement techniques have been subject to any form of simulation testing. Even those that have, cannot be considered to have undergone the level of extensive simulating testing to incorporate uncertainty that has been a feature of, for example, the IWC's work on the RMP and AWMP. This is perhaps not surprising, given the scope and complexity of developing suitable genetically-specified simulation datasets.

The Committee has identified the following six work modules, each of which must be completed before the simulation performance testing can actually begin:

(1) genetic simulation;
(2) biology and population dynamics;
(3) sampling;
(4) catch strategy;
(5) adaptation of population structure methods for automatic boundary selection; and
(6) integrating all the above to allow a complete test to be run.

These tasks, especially (1) and (5), are complex. The entire TOSSM project will have several phases; it is still in the initial phase, namely developing the framework and carrying out explanatory analyses of the relatively simple biological situations shown in Annex I, fig. 1.

In March 2006, an intersessional Workshop was held to review progress on Phase I and ensure that it was possible to complete a 'full run' of steps (1)-(6) for at least some population structure methods (SC/58/Rep6). Several non-IWC population geneticists attended, including the developer of the *RMETASIM* program, which underpins TOSSM and which has required extensive modifications. The primary achievements of the Workshop are summarised below.

(1) Considerable progress was made in the detailed computing work needed to:

   (a) identify and fix problems in the linking of the coalescent (*SIMCOAL*) and individual based model (*RMETASIM*) required for simulating datasets; and

   (b) complete the control program (module vi) that generates genetic samples from the datasets developed by *RMETASIM*, passes the samples to the boundary setting methods, runs the management algorithms, and collates the performance statistics.

(2) The technical specifications for the initial TOSSM trials (demographic structure, genetic structure, initialising the population matrix, harvesting and catch control, sampling and trials) were completed; the resulting 70 scenarios are given in SC/58/Rep5 (annex D).

(3) An initial set of methods to be tested within the framework were identified, along with issues related to automation for boundary-setting, and the people who would 'champion' each method (see list below).

(4) Preliminary results were available from two population structure methods, showing example boundary-setting algorithms in use through a complete run of TOSSM.

At this year's meeting, the Committee thanked the Workshop Chair (Donovan) and participants and **strongly endorses** the Workshop report and its recommendations concerning the future of TOSSM. It welcomes the plans to write a short worked example, which would demonstrate the steps that might be followed in making real-life management decisions similar to those considered by TOSSM, in order to assist geneticists unfamiliar with an IWC management context.

Further developments since the intersessional Workshop have led to some revision of the detailed specifications, as listed in Annex I and SC/58/SD2. Three population-structure methods have now completed a 'full run' (*MIXPROP*, *GENELAND*/*STRUCTURE*, Sequential hypothesis testing; see SC/58/Rep5, annex E and SC/58/SD1); it should be noted that the scenarios tested so far are deliberately very simple, and the boundary-setting rules chosen are highly provisional, so that results cannot yet be extrapolated to real performance.

The seven population structure methods planned for testing are: *MIXPROP*; *BAYESASS*; *GENELAND*/ *STRUCTURE*; Sequential hypothesis testing; Boundary Rank; F_{ST} dispersal; Lamarc; several of these techniques are already being used by the Committee and there has been much discussion over interpretation. Each method has an identified 'champion' who will oversee its implementation in TOSSM, and the overall process will be guided by an intersessional Steering Group (see Annex R10). Simulation results for these methods will be reviewed at the 2007 Annual Meeting.

11.2 Review of statistical and genetic issues relating to population structure

The Committee discussed two papers dealing with genetic correlation induced by mechanisms other than population substructure, such as cohort effects: SC/58/BRG13; SC/58/SD3. The latter describes a model for microsatellite analysis of population substructure and is particularly focused on relating genetic correlation to measurable covariates. The approach is intended for cases when the existence of subpopulations is uncertain and *a priori* assignment of samples to hypothesised subpopulations is problematic. Simulation tests and application to real datasets were used to investigate the power and effectiveness of the approach; of course, in any real application, useful interpretation depends on choosing a covariate that is not linked to population structure. The author plans to release the software as an *R* package later this year.

The Committee noted that the work in SC/58/SD3 completed the first phase of testing recommended last year. It recalled the Committee's DAA (IWC, 2004f), which seeks to ensure that analyses used in helping to formulate important management advice should have had the opportunity for a full scientific review; to ensure this, Procedure A of the DAA establishes distinct 2- and 3-month deadlines for analyses using 'standard' and 'novel' methods respectively. The Committee has reviewed the analysis methods in SC/58/SD3 for two years, agrees it to be an appropriate method for analysis of population structure, especially in situations where a confounding covariate is suspected of contributing to genetic correlation and consequently **recommends** that the Data Availability Group no longer classify the methods of SC/58/SD3 as 'novel'.

11.3 Work plan
The detailed work plan for TOSSM may be found in Annex I. Since several sub-committees and Working Groups are currently trying to evaluate results from the application of *STRUCTURE* and *BayesAss*, it is appropriate to give priority to obtaining results from these methods; this process has already begun, with the adaptation of *GENELAND* (a close relative of *STRUCTURE*).

With respect to genetic data quality issues, a list of review documents was prepared, but there was no opportunity to discuss general issues of data quality this year, and the issue remains on next year's agenda. However, it was noted that the TOSSM datasets could be used to investigate the properties of common allele-checking software such as *MICROCHECKER*; the Committee **requests** papers on this topic next year.

Funding implications are discussed under Item 21.

12. ENVIRONMENTAL CONCERNS (E)

12.1 Seismic surveys and cetaceans
The potential for seismic surveys to impact cetaceans is a cause of concern. A two-day pre-meeting of the SWG on environmental concerns was convened this year to address this issue (IWC, 2005g).

The Terms of Reference (TOR) were:

(1) review and characterise information on seismic sound sources, attenuation, and their effects on cetaceans;
(2) review case studies where on-going seismic surveys overlap with cetacean distribution in critical habitats and wide-ranging areas (i.e. migratory paths);
(3) review and evaluate effectiveness of current mitigation and monitoring programs during planning, operational, and close-out phases of seismic surveys; and
(4) discuss potential impacts for cetaceans [(1), (2)] and recommended/needed changes in mitigation and monitoring during all phases of seismic surveys (3).

Members of the Scientific Committee and Invited Participants (including industry representatives, geophysical contractors, members of national regulatory agencies and individuals representing funding bodies) made valuable contributions in the form of background presentations, contributed papers and participation in discussions.

The issues addressed are complex. Any approach to addressing the potential impacts of seismic surveys on cetaceans needs to be scientifically-based and risk-averse. Overall, the scientific presentations and discussions considerably advanced the Committee's ability to:

(1) evaluate the potential impacts from seismic surveys on cetaceans;
(2) help interpret observed scientific results in the context of effects on critical life functions and on animals at the population level;
(3) provide a current synthesis of studies addressing issues related to seismic surveys and cetaceans;
(4) advance the dialogue, communication and exchange of ideas and information between the Scientific Committee, the wider scientific community and members of industry in order to address this issue effectively;
(5) identify areas where additional research, review and discussion are needed (especially related to measuring

and translating scientific results into assessments of biological significance, as well as to improving existing and developing new mitigation and monitoring approaches);
(6) highlight areas where risk to cetaceans may be reduced by greater consideration to these issues in the planning stages of seismic surveys; and
(7) to serve as a resource for member nations that issue permits authorising seismic surveys within their EEZ.

Detailed discussions are given in Annex K.

12.1.1 Major recommendations
Based on the detailed discussions (Annex K, item 6), the Committee highlights the following major conclusions and recommendations here, while **endorsing** all of the recommendations in Annex K on this issue.

12.1.1.1 OVERVIEW OF THE GLOBAL SEISMIC INDUSTRY: TODAY AND FUTURE TRENDS
The Committee received considerable information on the seismic industry and developments within it. The discussions are detailed in Annex K (item 6.1.3). Recognising proprietary concerns regarding access to seismic data, the Committee **recommends** that relevant governments should characterise future (i.e. a 5-10 year period) industry exploration plans in a regional or national context. This information will allow the Scientific Committee to provide the best scientific guidance on cetacean species of concern within these regions of operation.

With respect to data on operations, the Committee **recommends** that collection of data from seismic surveys should be standardised, transparent and ideally mandatory throughout the industry. The minimum data requirements should be:

(1) a summary of the temporal and spatial coverage of each survey;
(2) the number of vessels involved and the size of the airgun array; and
(3) any mitigation measures that were applied.

It is also highly desirable to include data on the time and location of start and end points for each line and for any test firing. Worldwide datasets should be developed and made available to assess the global extent of both industry and academic seismic surveys.

12.1.1.2 THE EFFECTS OF SCALE AND LOCATION: 'CRITICAL' HABITATS AND WIDER RANGES
Given concerns about ensonification affecting important life history functions for a large portion of a population in areas of special concern[11], arising out of the discussions detailed in Annex K (item 6.2.2) the Committee **recommends** that further research be undertaken to quantify the exposure and potential impact of noise from seismic surveys within these areas and their effect on important life functions. It **strongly recommends** that whenever possible this research be coordinated with projections of imminent and future seismic survey activities within these areas (see Annex K, item 2.4), so that the most informative scientific evidence can be used to minimise any disruption to the animals. It also **recommends** that potential effects on prey species should

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[11] These will be case specific but include restricted migratory routes, feeding grounds, breeding/nursery areas, resting areas and designated protected areas.

be considered in any evaluation of the effects of seismic surveys on cetaceans.

12.1.1.3 METHODS FOR EXTRAPOLATING FROM INDIVIDUAL SHORT-TERM RESPONSES TO LONG-TERM EFFECTS AT THE POPULATION LEVEL AND CONSIDERATION OF A MODEL OF THE PROCESS FROM SOUND TO POPULATION LEVEL EFFECTS

The Committee received a number of papers that examined experimental work to assess short- and long-term effects of vessels on bottlenose dolphins in Shark Bay, Australia, that indicated that short-term behavioural response data may not be sufficient for assessing long-term impacts. As a result of the discussions detailed in Annex K (item 6.2.4), the Committee **strongly recommends** well-planned and properly conducted long-term monitoring studies with appropriate control populations for measuring effects at the population level.

The Committee considered a conceptual model ('PCAD') developed by the US National Academy of Sciences to define the chain from sound exposure to population level effects. As a result of the discussions detailed in Annex K (item 6.2.5), it recognised the value of such a model which can be used to provide a focus for research activities as well as revealing the difficulties in establishing cause-effect relationships and extrapolating results to population level effects. The Committee **recommends** that studies attempting to work through the model should consider this from the perspectives of both proximate behavioural response and population trend. It further **recommends** that whenever possible, population parameters be measured directly as part of long-term monitoring studies. Additionally, behaviour pertinent to biologically relevant activities and vital rates should be quantified and used in models that integrate behavioural responses as a factor in population level observations.

12.1.1.4 CASE STUDIES

WESTERN GRAY WHALES OFF SAKHALIN ISLAND
The Committee reviewed a number of papers relevant to the potential effect of seismic surveys on the endangered western gray whale (e.g. SC/58/E4 and SC/58/E5) which is critically dependent on limited feeding grounds which are subject to oil and gas development. The Committee welcomed these studies and as a result of the discussions (detailed in Annex K, item 6.3.1), **recommends** that:

(1) attempts should be made to separate the degree of change due to natural factors from that due to exposure to sound from seismic surveys; and

(2) information on female condition would be a valuable addition to the analysis because calf production is expected to be related to the condition of females;

Finally, to better determine the sources of mortality to western gray whales, the Committee **strongly recommends** that range states and other interested states increase efforts to determine the distribution of this stock and to detect and report stranded and bycaught animals and where these are found, as well as obtaining photographs and genetic samples for individual identification. In order to identify individual whales, photos and genetic material collected from stranded and bycaught animals should be compared to similar information collected from animals on the Sakahlin feeding grounds (archived in the Russia-US joint database). This is discussed further under Item 10.5.5.

BOWHEAD WHALES IN THE BEAUFORT SEA
The Committee considered a number of papers relevant to the effect of seismic surveys on bowhead whales (e.g. SC/58/E6 and SC/58/E8). As a result of the discussions detailed in Annex K (item 6.3.2) it makes the following **recommendations** regarding bowhead whales:

(1) the cumulative effects on bowhead whales from multiple seismic operations and other industrial activities, especially in light of reductions in sea ice associated with climate change in the Arctic Ocean, should be investigated;

(2) the biological significance of the high sensitivity of bowhead whales to low levels of seismic sound should be determined; and

(3) sensitive areas needed by bowhead whales for breeding, calving or feeding, especially in the Chukchi Sea, should be identified.

In addition the Committee **recommends** that studies should be undertaken to try to determine impacts from seismic surveys on other species in the Beaufort and Chukchi Seas, including gray whales and white whales.

SPERM WHALES IN THE GULF OF MEXICO
The Committee reviewed a number of papers related to the issue of the effects of seismic activity in the Gulf of Mexico, including information on controlled exposure experiments (Mate and Urbán-Ramirez, 2003; Panigada *et al.*, 2006; Frohoff *et al.*, 2005), seismic survey mitigation measures and monitoring (SC/58/E8), visual behavioural observations on sperm whales from platforms of opportunity (SC/58/E45) and telemetry studies (SC/58/E16 and E47). As a result of the discussions detailed in Annex K (item 6.3.3), the Committee **recommends** that research should be continued to measure the effects of exposure to airguns on behaviour, and to assess the short term biological consequences of such effects and how these consequences might affect vital rates and population parameters. It **strongly recommends** that baseline whale population and ecosystem data be collected before any exploration or field development has started.

12.1.1.5 MITIGATION AND MONITORING

As a result of extensive discussions (Annex K, item 6.4), the Committee made a number of recommendations on this issue. In particular it **recommends** that managers: (1) carefully review the goals of specific monitoring and mitigation measures; (2) evaluate whether current data are available to decide whether they meet their goals; and (3) modify procedures or conduct new research to ensure that mitigation measures represent current best practice. In that context, the Committee identified the following critical attributes of effective mitigation and monitoring:

(1) mitigation and monitoring programmes should:

   (a) be evaluated based on pre-established criteria; and
   (b) employ techniques with measurable effectiveness;

(2) mitigation procedures should be practical (i.e. use data that can be readily collected by marine mammal observers during offshore surveys), account for operating conditions and constraints of seismic surveys and, as far as possible, minimise disruption of surveys while maximising environmental protection; and

(3) procedures and protocols should be based on a conservative approach that reflects levels of uncertainty and provides an incentive for good practice.

Both visual observations and acoustic monitoring data can be collected during seismic surveys. These data can be useful for investigating some potential effects and for assessing densities of marine mammals in the area during surveys that could inform assessments of exposure. Marine mammal observers are often able to collect such data in addition to carrying out mitigation surveillance. In this context, the Committee makes the following **recommendations**:

(1) procedures for collecting observational data should be standardised with minimum reporting protocols defined;
(2) all whale observational data associated with seismic surveys should be publicly available either by having central facilities for assembling and disseminating observational data collected during seismic surveys or standardising a mechanism for distributing seismic monitoring data from each contractor;
(3) monitoring data should be integrated with studies carefully designed to investigate changes in distributions of whales with respect to seismic surveys;
(4) standards for training (visual and acoustic separately) should be developed and stipulated;
(5) the use of long-term monitoring programmes in relation to marine development should be encouraged; and
(6) local research groups should be encouraged and/or education programmes to develop local expertise should be initiated.

Several technological changes may mitigate adverse impacts of seismic surveys on marine mammals. The Committee **recommends** that horizontal energy output of airgun arrays be measured and modelled and that there be a reduction of energy in frequencies not useful for geophysical surveys. The Committee also **recommends** additional research into other alternate signal sources or techniques, such as marine vibroseis and horizontal beam patterns.

12.1.1.6 ADVICE FOR MEMBER GOVERNMENTS
In addition to specific recommendations detailed in Annex K (item 6), the Committee **agrees** the following **recommendations** for member governments permitting seismic surveys, i.e. that they should:

(1) implement the appropriate recommended monitoring programmes defined in Annex K;
(2) develop and/or evaluate nationally relevant mitigation procedures; and
(3) identify and facilitate research, monitoring, and mitigation procedures that address the recommendations detailed in the report.

In light of the uncertainty over the potential impacts of seismic surveys, and the fact that seismic surveys may be repeated throughout the life of an oil field, the Committee **recommends** the earliest possible establishment of long-term monitoring programmes for vulnerable species in areas of concern. The design of such long-term monitoring should take into account the likely size of any effect and the probability of detecting it within a reasonable time span. Finally it **recommends** that seismic surveys be designed to use only the amount of acoustic output required for the desired geological objectives.

12.2 Ecosystem modelling
The SWG on Environmental Concerns established a Working Group during this year's Annual Meeting to consider:

(1) an invitation from the CCAMLR Scientific Committee to organise a Workshop to review information required for ecosystem models being developed to provide management advice on krill and krill predators in the Antarctic marine ecosystem;
(2) development of a recommended response to an invitation to nominate experts for consideration by FAO for invitation to an FAO Expert Consultation on modelling ecosystem interactions for informing an ecosystem approach to fisheries; and
(3) the development of ecosystem models.

The findings of this Working Group are reported in Annex K (item 7) and summarised below.

12.2.1 Cooperation with CCAMLR and FAO
The IWC Scientific Committee has been invited to join the CCAMLR Scientific Committee in organising a Workshop to review information required for ecosystem models being developed to provide management advice on krill predators in the Antarctic marine ecosystem. The Committee **agrees** to work cooperatively with CCAMLR and formed a joint Steering Group under DeMaster (Annex R23) for the purpose of convening the Workshop. The Workshop will probably take place between the October annual meeting of CCAMLR and the Committee's Annual Meeting in 2008. The Committee **agrees** to investigate:

(1) the information that the IWC can provide to the joint Workshop;
(2) the steps needed to make this information available for the joint Workshop; and
(3) the information or benefits the Committee hoped to derive from its participation in the Workshop.

The Committee has also been invited to nominate experts for consideration by FAO for invitation to an FAO Expert Consultation on modelling ecosystem interactions for informing an ecosystem approach to fisheries. The primary objective of the Expert Consultation is to 'review the major ecosystem modelling approaches currently being applied on fishery-related topics' and also to 'formulate recommendations/advice for users of existing generic modelling approaches and those considering developing new models'. The Workshop is tentatively scheduled for the second quarter of 2007; the venue has yet to be decided. FAO will develop their list of invitees based *inter alia* on participants having high levels of expertise in the subject under consideration and collectively include expertise on any aspect pertinent to the objectives of the Workshop.

The Committee **agrees** that the following names shall be proposed: Butterworth, Cooke, Hammond, Mori and Punt.

12.2.2 Results from modelling exercises
A number of papers were discussed (SC/58/E3, E14, E21, E32 and E48) related to progress in model development and summaries can be found in Annex K. The Committee **agrees** with the following statements regarding the application of ecosystem models to providing information

that the Committee can use in providing management advice to the Commission:

(1) recent developments in the use of spatial modelling with long-term datasets can be used to investigate the possible effects of anthropogenic stressors on cetacean distribution and abundance;

(2) the incorporation of uncertainty in full ecosystem models and methods for reporting on uncertainty, such as the methods reported in SC/58/E48, are a welcome step forward and authors are encouraged to use them in future documents;

(3) there remains a critical lack of data to evaluate the reliability of models, especially data on lower trophic levels;

(4) multispecies models such as the one described in SC/58/E14 are useful in allowing the Committee to develop hypotheses regarding trophic dynamics (e.g. the importance of top-down forcing or competition in structuring the species composition of a marine ecosystem); and

(5) increased collaboration between scientists involved in designing field surveys and those developing analytical models is needed to more efficiently use the limited resources available to cetacean researchers.

12.3 Other habitat related issues

12.3.1 POLLUTION 2000+: Review final report of Phase I
SC/58/E38 is the final report on POLLUTION 2000+ Phase I and a detailed summary is given in Annex K (item 8.1). The POLLUTION 2000+ programme was initiated to investigate pollutant cause-effect relationships in cetaceans. Phase I comprised two subprojects as discussed below.

Before embarking on the two subprojects, an integrated protocol for sampling, storage and shipping procedures was developed to ensure that tissue samples to be collected were adequate and would reach the designated laboratories in suitable condition for the analyses. Producing this field protocol is one of the important achievements of the programme.

BOTTLENOSE DOLPHIN SUBPROJECT
The bottlenose dolphin subproject was centred around the long-term capture release programme of R. Wells in Sarasota Bay, Florida, utilising surgical biopsies, blood collections, long-term population studies of vital rates (>30yr) and biomarker analyses. Its primary objectives were to: (1) select and examine a number of biomarkers of exposure to and/or effect of polychlorinated biphenyls (PCBs) and determine whether a predictive and quantifiable relationship with PCB levels in certain tissues exists; and (2) examine the relationships between concentrations of variables obtained by biopsy sampling with those of concentrations in other tissues that can only be obtained from fresh carcases.

A major feature of the project was that it highlighted the complex relationships between organochlorine (OC) concentrations and potential biomarkers due to the variation in patterns of accumulation and depuration relative to age, sex, nutritive status and reproductive status. The POLLUTION 2000+ studies confirmed that concentrations in females, originally similar to males of the same age, decrease dramatically after calving and lactation, with a concomitant increase in concentrations in particularly the first calf. The implications of these findings (e.g. with respect to first calf survival rates) are important inputs into modelling exercises to try to examine potential effects at the population level. Finally, a key part of the programme was to develop a modelling framework for examining the possible effects of pollutants at the population level. For the first time, an individual based model was constructed that simulated the accumulation of PCBs in the population and allowed modification of first year calf survival based on maternal blubber PCB levels. It must be noted that there is currently a lot of uncertainty in the dose-response function that was incorporated into the model. The initial and preliminary results from the model suggested that the current estimated PCB accumulation rate observed might be depressing the potential annual growth rate of the population by some 3.6% per annum from a zero accumulation rate (from +1.4% per annum to -2.3% per annum).

The relatively small sample masses obtained from biopsy darting did not permit sufficient testing for the full suit of potential biomarkers and organochlorine variables.

HARBOUR PORPOISE SUBPROJECT
The primary objective of this subproject was to determine changes in concentrations of selected variables with *post mortem* times.

An important result was the finding of the *post mortem* stability of blubber retinoids over the study period of 48hrs. Therefore, blubber can be regarded as an appropriate and reliable tissue for the assessment of the examined OCs and retinoids in specimens preserved in natural conditions up to 48hrs.

An additional major feature of this subproject was the discovery that concentrations of retinoids in liver and in blubber were highly correlated. As opposed to liver, blubber can be easily sampled from live animals using biopsy techniques and is therefore considered an alternative tissue for assessing retinoid status in free-ranging marine mammals. However, species-specific relationships to retinoid concentrations in liver and blubber have yet to be established.

Other results obtained were that luciferase analyses revealed no *post mortem* changes in concentrations of dioxin-like compounds, and therefore also for this biomarker, blubber is a reliable tissue to be used up to 48 hours *post mortem*. A perhaps surprising finding of the sub-project was that harbour porpoises may be relatively insensitive to the enzyme-inducing effect of PCBs.

A further study is being carried out to investigate the effect of long-term freezing on retinoid stability and the effect of PCB exposure on blubber retinoid concentrations.

The Committee **commends** the scientific output of Phase I. Important products are the publication of *JCRM* Special Issue 1, *Chemical Pollutants and Cetaceans*, publications in peer reviewed scientific journals and presentations at international conferences and workshops. In this way, POLLUTION 2000+ has certainly contributed to the Commission's request to 'give priority to research on the effects of environmental changes on cetaceans in order to provide the best scientific advice for the Commission to determine appropriate response strategies to these new challenges'.

The Committee **concurs** with a recommendation from the POLLUTION 2000+ Steering Group that before any

decisions are taken on implementing Phase II, an interdisciplinary workshop should be held to identify the need for a possible Phase II, and if appropriate, design an outline research proposal for the programme's continuation (see Annex K).

12.3.2 Progress report on Southern Ocean Collaboration (SOC) Working Group
CCAMLR advised the Secretariat of its plans for a large-scale, multinational, multi-ship survey across the Atlantic sector of the Antarctic in 2008 as part of International Polar Year (IPY). The IWC is invited to place observers aboard one or more of the ships. The Committee welcomes this opportunity for collaboration and Hedley agreed to act as liaison on this initiative (see Item 21).

The Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics (ICED) in the Southern Ocean (SO) convened a science planning Workshop in May 2005, followed by a joint IWC-SO Global Ocean Ecosystem Dynamics (GLOBEC) Workshop on Cetacean-Environmental Linkages[12]. In addition to the joint Workshop, major items of work conducted by the IWC SOC Working Group during the intersessional period were:

(1) initiation of high priority analyses recommended at the sea ice Symposium (IWC, 2006b);
(2) progress toward completion of the IWC SOC database;
(3) provision of data to multiple researchers working on Antarctic cetacean ecosystem and spatial analyses projects (e.g. SC/58/E32; SC/58/SH16);
(4) analyses and presentations for the July 2006 Scientific Committee on Antarctic Research (SCAR) meeting;
(5) participation in the planning of ICED field programmes (International GLOBEC Newsletter, April 2006);
(6) participation in BROKE-west ecosystem survey (SC/58/E27); and
(7) participation in the final SO-GLOBEC cruise.

The SWG **recommends** that the work of the SOC WG (Annex R22) continue, especially completion of the database and further participation and coordination with ICED science planning, and that both of these projects be coordinated with the upcoming IWC-CCAMLR workshop and IPY cruise planning. Financial aspects are considered under Item 21.

12.3.3 State of the Cetacean Environment Report (SOCER)
The State of the Cetacean Environment Report (SOCER) was designed to provide a 'snapshot' of environmental developments relevant to cetaceans for scientists and non-scientists alike. This year the SOCER contained a literature analysis section, a regional focus on the Indian Ocean and a global section (Annex K; Appendix 4). The review of the Indian Ocean revealed:

(1) a relative lack of information and data for this region in peer-reviewed journals;
(2) many environmentally relevant factors identified in other regions treated by SOCER in the past are also recognised in the Indian Ocean (from marine debris to climate change); and
(3) use and less rigorous control of toxic chemical substances and as a result probably greater release into the environment.

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[12] Available from *http://www.globec.org*.

For SOCER, the analysis of the marine mammal literature from 2005 yielded 545 cetacean publications, of which approximately 56% dealt with basic biology, ecology and evolution, and approximately 44% primarily addressed habitat threats and conservation issues. This underlines that any discussion on cetacean research must actively incorporate environment and conservation related issues.

The editors of SOCER noted that the report remains in draft form upon presentation and therefore is subject to editing and comment before and during the Committee meeting. They urged Committee members to contribute entries, comments and feedback throughout the production of each year's SOCER.

12.3.4 Sea ice: Arctic and Antarctic
SC/58/E7 synthesised information relevant to Arctic issues and sea ice. Among hundreds of International Polar Year (IPY) projects, four Arctic projects have potential relevance to cetacean research:

(1) the Canadian Flaw Lead (CFL);
(2) Global Warming and Arctic Marine Mammals (GWAMM);
(3) Pan-Arctic Tracking of Belugas (PATOB); and
(4) Study of Environmental Arctic Change (SEARCH).

Details and points of contact for these multidisciplinary research plans can be found on the IPY website (*www.ipy.org*). The AMAP, another Working Group of the Arctic Council (*www.amap.no*), focuses on environmental contaminants. Efforts will be focused on evaluating data and writing review articles about emerging contaminants of concern (e.g. brominated flame retardants, perfluorinated chemicals used as stain-resistant coatings) that have been rapidly increasing in Arctic biota, including cetaceans.

SC/58/E13 described the use of chemical tracer profiles to assess the feeding ecology of Antarctic Type C killer whales and made comparisons to profiles of killer whale populations in the Eastern Tropical Pacific and eastern North Pacific. Grebmeier *et al.* (2006) describe the results of a multidisciplinary collaboration that investigated major changes in recent decades from Arctic to sub-Arctic conditions in the northern Bering Sea ecosystem. The authors reported that sea ice has changed from stable pan and pack ice in winter to brash and thin ice, which often retreats very early in spring. One implication is that loss of the tight benthic-pelagic coupling that previously supported high benthic standing stocks is resulting in a decline in the prey base of gray whales and other benthic feeders such as walruses and some sea ducks. Moore also summarised progress on recent initiatives concerning rapid changes in sea ice in the Arctic and the implications for Eastern North Pacific (ENP) gray whales and B-C-B bowhead whales. Integration of the IWC-funded project with results of related studies is anticipated to provide a synergistic way forward for incorporation of sea ice habitats in the population dynamics models for gray whales and B-C-B bowhead whales. A report on the project can be expected at next year's Annual Meeting.

SC/58/SH1 presented a new analysis of the global distributions of blue and fin whales in the Southern Ocean, in relation to sea surface temperature, extent of seasonal ice zone, and krill distribution.

12.3.5 Diseases: developing plans for a future Workshop
The SWG **agrees** to hold a special symposium on infectious and non-infectious diseases of marine mammals and impacts on cetaceans prior to next year's Annual Meeting (Annex K, Appendix 5). The Symposium will include a diverse exchange of information including oral presentations by invited experts, solicited papers and topic-specific discussion groups to develop recommendations. The format may also include hands-on demonstrations of diagnostic biosampling techniques. This Symposium will be held in Anchorage, Alaska (or nearby) and a report will be presented next year. The estimated budget is US$18,000 but no IWC funds are requested.

12.3.6 Potential value to the Committee from information on handling and release of cetaceans
Last year, the Commission suggested that information from handling and release of entangled cetaceans in fishing nets and marine debris could be of relevance for the Committee's work. The Chair of the Scientific Committee provided the SWG with background on the request from the Commission and suggested a four-step approach in response, including:

(1) develop a draft TOR at this meeting;
(2) insertion as a special topic on next years Agenda;
(3) solicit appropriate documents for discussion; and
(4) develop a final TOR and budget for a Workshop to be held probably in 2008.

The Committee **agrees** to hold a session next year whose aims will be to help inform the TOR for a possible future Workshop. The focus for a Workshop could be two-fold: (1) consideration of what happens to animals after they are released alive; and (2) useful research possibilities that could be incorporated prior to release of the animals, such as collection of tissues and attachment of satellite transmitters. Additional potential aims could include: collation of information on the global scale; potential models to estimate survival rates following disen-tanglement; and recommendations for biological data collection from entangled/entrapped whales.

The Committee **agrees** that the focus of solicited papers should be on the following topics:

(1) the use of data gathered by release programmes in improving estimates of the magnitude, rate and geographic extent of entanglements;
(2) the impact of entanglements on whales, focusing on the potential, through available case studies and/or modelling, to estimate mortality rates and other non-lethal impacts, including both individual and population level affects;
(3) methods of safely collecting appropriate data while releasing different species, practical experiences of disentanglement techniques and relative success rates;
(4) types of data which can be collected from entangled/ entrapped whales (e.g. DNA samples from retrieved ropes/nets and/or biopsy samples, placement of radio and/or satellite tags on whales or fishing gear, collection of behavioural data and respiratory gases);
(5) uses of similar or related data that can complement data collected from entangled/released whales (e.g. stranding and scarring data).

12.3.7 Other issues
Fernández (Annex K; item 8.5.1) summarised his work on the pathology of stranded beaked whales associated 'temporally and spatially' with naval exercises. The results of his investigations on beaked whales that stranded in association with naval exercises are presented in Table 2.

Except for those of 16 April 2005, the complete evaluation of tissues from the stranded animals provided evidence of gas and fat embolic pathologies and in two of these three cases, sonar use was confirmed. No specific information on the military activities has been provided for the most recent case. Fernández provided a list of actions to be performed in cases where full necropsy is infeasible and involvement of naval exercises is suspected. He noted that a number of confounding factors render it impossible to provide a single factor to estimate total numbers affected from numbers found stranded or floating dead. During discussion by the Committee, it was noted that the same types of necropsies need to be conducted for any beaked whale mass stranding event, whether or not there have been known naval exercises in the region. The reasons for this are two-fold: (1) data are needed from beaked whales not associated with mid-frequency sonar or other anthropogenic sound sources for comparisons; and (2) more often than not, information about anthropogenic sound sources such as military sonar is not available for some time after the event and the initial response (e.g. Almeria, Spain). An intersessional Steering Group (see Annex R32) was established to improve response to unusual mortality events, particularly those associated with (but not limited to) anthropogenic noise. It will address *inter alia* issues concerning the standardisation of protocols, obtaining experts and advice to appropriate locations and to obtaining advance notice of potentially relevant acoustic events. Naval exercises using mid-frequency sonar occur worldwide. For example, there is a North Atlantic Treaties Organisation (NATO) exercise ongoing now (June 2006) off the Cape Verde Islands and a US naval exercise is scheduled off the Hawaiian Islands in July 2006.

The Committee was notified of a mass stranding of beaked whales in Taiwan during its meeting and local researchers contacted Committee members for expert assistance with the stranding analysis. This further illustrates the importance and relevance of the proposed Steering Group.

SC/58/E22 provided a short update that noted increasing evidence including the results of investigations into several atypical mass strandings of the impacts of anthropogenic noise on cetaceans.

Fernández also presented information on sperm whales, ship collisions and histopathology. Mortality from ship collisions has been demonstrated as an important threat to whales in areas with large volumes of maritime traffic. The principal objective of the study reported was to develop histological techniques for obtaining additional indirect scientific evidence of *ante mortem* severe trauma (with especial attention to ship collisions) versus *post mortem* changes. The hypothesis is that severe trauma affecting bones or soft tissues induces 'fat emboli'. Details are given in Annex K.

A number of other papers on a variety of issues were considered: SC/58/E29 reported on developing techniques

Table 2
Summary of investigations on beaked whales and potential naval exercises.

Date	Location	Naval exercise/acoustic source	Species stranded	Comment
24 September 2002*	Canary Islands	Neo-Tapon/mid frequency sonar used	14 beaked whales	Gas and Fat Emboli Syndrome (G&F ES)
11-17 June 2004	Canary Islands	Majestic Eagle/mid frequency sonar used	4 beaked whales	G&F ES-like pathology
16 April 2005	Canary Islands	Novel Javelin/no sonar used	1 beaked whale	Virus infection; no indication of acoustic trauma
26 January 2006	Almeria, Spain	Unknown/not yet verified	4 beaked whales	G&F ES-like pathology

*Fernández *et al.* (2005).

as a non-invasive means of examining whale diet; and SC/58/E23 presented some new tools for investigating toxicological hazards from endocrine disruptors in Mediterranean Sea cetaceans. SC/58/E10 reviewed some of the key international papers and reports on ocean acidification to date, and drew inferences on possible implications for cetaceans. SC/58/E10 highlighted the recommendations of the recent Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) which recognised the need for 'additional research measures'. The Committee's attention was drawn to the conclusions of the Royal Society's (London) 2005 report on ocean acidification that 'The increased fragility and sensitivity of marine ecosystems [due to changes in ocean chemistry] needs to be taken into consideration during the development of any policies that relate to their conservation, sustainable use and exploitation, or the communities that depend on them.'

12.4 Work plan
This is discussed under Item 19.

12.4.1 Suggestions for 2008 and 2009
Since the original IWC climate change Workshop ten years ago, significant new information and new research tools on this theme have been developed. The SWG agreed that is was timely to revisit this issue and a small Working Group was formed to consider the arrangements (Annex R18). If possible, this Workshop should be held intersessionally in 2008, prior to the Annual Meeting.

13. SMALL CETACEANS (SM)

13.1 Review of the status of small cetaceans in the Caribbean (excluding the Gulf of Mexico) and the western tropical Atlantic
The Caribbean Sea and western tropical Atlantic are characterised by complex oceanographic and topographic features. Small cetaceans occurring in this area occupy different and diverse habitats varying from coastal lagoon, mangrove and reef systems to open oceanic waters. For this review, the Committee focused its discussions on the Caribbean Sea (excluding the Gulf of Mexico) and the contiguous tropical waters of South America, south to the Subtropical Convergence (Annex L). A minimum of 26 small cetacean species have been recorded from this area with information being derived from strandings programmes, opportunistic sightings and a small number of dedicated surveys. However, the review should be considered partial since several member states did not participate in the work (e.g. see Annex S), although the received information covered a wide geographical area and 26 species (15 Delphinidae, 2 Kogiidae and 9 Ziphiidae).

13.1.1 Distribution
Papers were provided on the occurrence and distribution of small cetaceans over a wide geographical area. Detailed information on distribution was obtained from dedicated and opportunistic sightings surveys and strandings in Brazil (SC/58/SM21), Venezuela (SC/58/SM9), Dutch Antilles (SC/58/SM14), Costa Rica (SC/58/SM4), Dominican Republic (SC/58/SM12), Guadeloupe (SC/58/SM17), Dominica (SC/58/SM1), Martinique (SC/58/SM23) and the wider Eastern Caribbean area including Grenada, Tobago and Trinidad (SC/58/SM24). Most of the survey effort was restricted to coastal waters. The most commonly sighted species in the Caribbean Sea include bottlenose dolphin, pan-tropical spotted dolphin, false killer whale, pygmy sperm whale, Fraser's dolphin and short-finned pilot whale. Beaked whale species are also regularly seen, especially in the waters around Guadeloupe (SC/58/SM17); Cuvier's beaked whale and Gervais' beaked whale are the most frequently stranded species of small cetacean in Leeward Dutch Antilles (SC/58/SM14). In the tropical western Atlantic, the most commonly recorded dolphins include common dolphin, Atlantic spotted dolphin, bottlenose dolphin, spinner dolphin, false killer whale and rough-toothed dolphin. The marine form of tuxuci is restricted to the shallow coastal waters of central (SC/58/SM4) and South America (SC/58/SM9, SM21).

Systematic survey effort in some areas in the Caribbean and tropical Atlantic has been limited and quantitative information is sparse. Nevertheless, the various opportunistic sighting programmes show that the region has a diverse cetacean fauna, although quality control in species identification is a major challenge as it is in many places. Rambally stated that in the case of the Eastern Caribbean region, systematic surveys have been conducted since 2000 as well as during the FAO Lesser Antilles Pelagic Ecosystem (CAPE) project, as noted in the 2004 report of the Scientific Committee (IWC, 2005h). The Committee **recommends** that biopsy sampling, in addition to photographs and careful field notes on observed characteristics, should be attempted as a way of confirming *inter alia* species identifications. It also **recommends** that training programmes be conducted to increase capacity in cetacean field identification and biopsy sampling techniques. The potential value of a centralised, long-term, publicly accessible database on cetacean occurrences in the region, with appropriate validation and quality control, was noted.

The Committee **recommends** and **encourages** wider participation in systematic small cetacean research programmes and coordination among such programmes. A particular critical need is the collection of at-sea effort to allow analysis of encounter rates. The Committee therefore **recommends** that:

(1) more training programmes be carried out on survey design;
(2) more international collaborations be established to strengthen the analytical capacity of researchers within the region;
(3) collection of effort data be incorporated routinely into surveys; and
(4) approaches to data collection and analysis be standardised to the greatest extent possible.

13.1.2 Abundance
Few abundance estimates exist for any species in the region outside Brazil, and the Committee **urges** scientists to collaborate in developing programmes to estimate cetacean abundance throughout the region. On a local scale, abundance estimates have been made using photo-identification mark-recapture analysis for bottlenose dolphins in Costa Rica and the Dominican Republic (SC/58/SM4, SM12), Atlantic spotted dolphins in the Dominican Republic (SC/58/SM12), tuxuci in Costa Rica (SC/58/SM4) and Brazil (SC/58/SM21) and spinner dolphins in Brazil (SC/58/SM21). Density estimates for tuxuci for four different bays and estuaries in southern Brazil ranged from 0.04 to 23.16 individuals per km^2 (SC/58/SM21). The available estimates are summarised in Annex L (table 2).

13.1.3 Stock structure
No genetic analysis on population or stock structure was presented. While the (short-beaked) common dolphin is not known from the Caribbean, many historical records have been found to be misidentified. In Brazil, there is a pattern for long-beaked-like dolphins to be in coastal areas and short-beaked-like dolphins in offshore waters, particularly in the more temperate south near the Subtropical Convergence. Therefore, the Committee **recommends** that a complete review of *Delphinus*, including genetic analysis, in the tropical and subtropical Atlantic be carried out as soon as possible.

The IWC species list recognises only one species of tuxuci but recent publications based on morphometric and genetic analyses suggest that the two forms, riverine and coastal, represent separate species (Monteiro-Filho *et al.*, 2002; Cunha *et al.*, 2005). An international Workshop is planned for June 2006 in Rio de Janeiro will include a review of taxonomy and systematics and its conclusions could be used by IWC to amend its species list, if appropriate.

Various techniques have been used to look at stock discreetness in a few species. Ongoing morphometric and genetic studies suggest that both inshore and pelagic forms of bottlenose dolphins are present in Brazilian waters (Baretto, 2004; SC/58/SM21); they are found along the whole coast, although two discrete populations are known. An apparently discontinuous distribution of bottlenose dolphins has been recorded off eastern Central America (SC/58/SM4), with photo-identification studies suggesting no mixing and thus two 'resident' groups (one in Costa Rica and the second smaller group in Panama). A resident group of bottlenose dolphins has been found in the southeastern Dominican Republic (SC/58/SM12).

The Atlantic spotted dolphin occurs in two different regions off Brazil; to the north of 6ºS and between 21ºS and 33ºS, indicating a discontinuous distribution (SC/58/SM21).

The northern animals appear morphologically more similar to those in the Caribbean (SC/58/SM21) and as this species exhibits considerable morphometric geographical variation from Central America to the western North Atlantic, some population structure likely exists. However, the limited available data preclude a rigorous analysis.

Photo-identification studies of tucuxi in Brazil and Costa Rica suggest that there are resident populations in a number of areas (SC/58/SM21, SM4). In addition, SC/58/SM4 suggested that hybridisation may occur between bottlenose dolphins and tucuxi of Costa Rica; this needs further investigation. The Committee **recommends** genetic analysis to examine the structure of tucuxi and **encourages** the coordination and collaboration of research in the area, e.g. comparison of photo-identification catalogues and increased geographical coverage of studies. The Committee **recommends** increased effort to obtain tissue samples from stranded and bycaught tucuxis throughout the region and that these samples be analysed collaboratively for evidence of population structure at various scales.

13.1.4 Life history, ecology and habitat use
Some information exists (from single and mass strandings) on age and growth, group size and presence of calves, and diet for a few species, although often based on small sample sizes, while information is sparse or absent for the majority of other small cetacean species in the area.

For bottlenose dolphins, group sizes varied over the area, with some evidence of larger groups offshore (SC/58/SM9, SM12). The maximum recorded age was 26 yrs in Brazil (SC/58/SM9) and Brazilian bottlenose dolphins appear to have a greater body length than elsewhere. Bottlenose dolphins and tucuxi are sympatric in a number of areas (e.g. Brazil, Costa Rica) and bottlenose dolphins have been observed interacting with humpback whales in the Dominican Republic (SC/58/SM12). They are sometimes seen in mixed schools with Atlantic spotted dolphins (SC/58/SM9, SM12) and agonistic behaviour has been observed between bottlenose dolphins and long-beaked common dolphins in Venezuela (SC/58/SM9).

Information on melon-headed whales comes from mass strandings in the area: at least 148 animals live-stranded in Costa Rica, in 1976 (SC/58/SM8); 240 individuals in Brazil in 1987 (Lodi *et al.*, 1990; SC/58/SM21) and three individuals occurred off Venezuela in 1998 (SC/58/SM8, 9). Mass strandings of up to 100 individuals have also been recorded for Fraser's dolphin in Brazil (Moreno *et al.*, 2003; SC/58/SM21) and Uruguay.

For Atlantic spotted dolphins, the oldest recorded animal was 23yr and the maximum length 223cm (SC/58/SM5). Calves have been observed throughout the year in Dominican Republic waters (SC/58/SM12) and Venezuela (SC/58/SM9). A large mass stranding of about 200 individuals occurred off northeastern Venezuela in 1998 (Bolaños-Jiménez and Boher, 2001). In southern Brazil, these dolphins consume a wide variety of prey including benthic and pelagic fish and cephalopods (SC/58/SM21). They are occasionally seen in mixed groups with bottlenose dolphins (SC/58/SM12, SM9) and interacting with humpback whales (SC/58/SM12).

The maximum length recorded of rough toothed dolphins was 283cm, and the oldest individual was 24yr. A 6 year old female 250cm in length was pregnant (SC/58/SM5).

A very limited amount of life history information was available for false killer whales in Brazil (SC/58/SM5) from where two mass strandings (5-10 individuals) have been reported (SC/58/SM21). Reference was made to two instances of agonistic interactions between false killer whales and humpback whales off Guadeloupe. One involved a mother-calf pair and the second a male humpback whale (SC/58/SM17).

Biological aspects of the marine tucuxi are relatively well studied due to the availability of large samples from bycatches in coastal fisheries in Brazil. Some details of life history were summarised in SC/58/SM21. Both sexes reach sexual maturity at 5-8 years of age and maximum length is slightly more than 2m. Estimated length at birth ranges between about 92 and 106cm and the lactation period is about 9 months. Weaning may begin at about 120cm at an age of 7 months. The prey comprises primarily of estuarine species such as Sciaenidae and Loliginidae (SC/58/SM21).

Given the lack of knowledge about life history, the Committee **encourages** scientists to continue to develop existing strandings schemes that incorporate standardised protocols and **recommends** further collaboration in the establishment of new stranding schemes in this region. It further **recommends** the collection of tissue samples from strandings for life history parameters and feeding studies.

13.1.5 Directed takes and incidental mortality
Directed takes in this area include subsistence removal for food and live capture for dolphinaria both within the region and globally. Directed hunts for a number of species have previously been reported, including bottlenose dolphins, tucuxi, Fraser's dolphin, short-finned pilot whales, spinner dolphins, Atlantic spotted dolphin, pygmy killer whales, false killer whales and melon-headed whale. There has been a long-standing fishery for small cetaceans in St. Lucia and St. Vincent and The Grenadines. There is no recent information on species or catch levels in this fishery, but annual takes of bottlenose dolphins in St. Lucia had previously been given as two in 1999 (IWC, 2001b, p.289) and 20 per year in the early 1980s (Price, 1985). Melon-headed whales were reported from catches in the St Lucia fishery in 1999 (IWC, 2001b), but the number (presumably low) was not given. Pilot whales ('blackfish') have been exploited for centuries in the Caribbean and western tropical Atlantic, first by international ship-based whalers and more recently by shore based whaling operations in at least St. Vincent and The Grenadines (Caldwell and Caldwell, 1975; Price, 1985) and St. Lucia (Reeves, 1988). A total of 2,912 pilot whales were reported between 1962 and 1974 (Caldwell and Caldwell, 1975), and 2,220 between 1978 and 1983 (Price, 1985) in St. Vincent and The Grenadines. Catches in recent years have not been reported to the IWC. Rambally noted that caution should be taken when using these catch statistics for pilot whales as the term 'blackfish' is used in St. Lucia and St. Vincent and The Grenadines to refer to all species of small cetaceans and not specifically pilot whales. Therefore they may not reflect the true catches for this species. Information on takes in this region is summarised in table 2 of Annex L. The range and extent of current directed hunts is unclear.

A number of reports were received of recent live captures of bottlenose dolphins in the Dominican Republic (SC/58/SM11), Honduras, Venezuela, Haiti, Guyana and Cuba (SC/58/SM26). Some 238 dolphins were exported

from Cuba to other parts of Latin America, Europe, Canada and Israel between 1986 and 2004. The annual rate of reported capture and export has increased from <10 in the 1990s to around 24 in the past three years. The animals may be taken from a coastal stock and there are no data to assess the sustainability of these takes.

Vail (2005) summarises the facilities for holding small cetaceans in captivity in the region and it was noted that a new dolphinarium is currently being constructed in St. Kitts. Concerns exist over movements of dolphins between some of these facilities (which may spread disease), as well as illegal supply and import. The Committee **agrees** that more information on the specific details of animal holdings and transfers would be useful and suggested that United Nations Environment Programme (UNEP) Caribbean Regional Marine Mammal Action Plan, as it develops, could play a role in this regard. The Committee was concerned at the complete lack of abundance data against which to measure the sustainability of live capture removals.

In this context, the Committee welcomed the work of Cuban scientists (SC/58/SM26), and **encourages** further research on sustainable removals, international exchange of information, and collaborative studies through existing frameworks in order to improve understanding of the status of bottlenose and other dolphins in Cuban waters.

The Committee recognises the potential threat to small coastal populations of bottlenose dolphins from unregulated and undocumented live capture fisheries and **recommends** that a central database of animals held in captivity in the area should be established, together with a mechanism for recording live captures and their subsequent dispersal to dolphinaria.

The Committee further **recommends** collaboration within the region to assess the impact of such removals and document the status of affected populations.

All records of incidental take (summarised by Bolaños-Jiménez and Rojas-Bracho, 2005) from this region are anecdotal in nature. There are no dedicated observer schemes or any systematic schemes for *post mortem* examination of stranded animals. Here, as elsewhere, a number of species and gear types are involved. Information on the species involved are summarised in Annex L (table 1). For example, bottlenose dolphins have been recorded in both gillnet and trawl fisheries in Honduras, Colombia, French Guiana and Venezuela and gillnet fisheries in Brazil and longlines in Costa Rica. An increase in bottlenose dolphin strandings associated with elevated levels of entanglement is believed to be affecting the prospects of long-term survival of the Patos Lagoon resident population, according to model predictions (Fruet *et al.*, 2005 cited in SC/58/SM21).

Tucuxi are frequently entangled in fishing gear, especially coastal gillnets in Brazil, where they are used as bait in shark fisheries and in the Gulf of Venezuela (SC/58/SM9) Dozens of stranded animals with net marks have been recorded every year by Rio de Janeiro State, the Gulf of Venezuela (SC/58/SM9) and French Guyana (SC/58/ProgRep France).

The Committee **recommends** that work be undertaken to assess the bycatch of bottlenose dolphins, especially in areas where resident populations may be under pressure. Much work has been carried out in Brazilian waters and is commencing in Venezuela. The Committee encourages this

work, and **recommends** it be promoted further north and west, especially along the continental coast of South America; particular attention should be given to tucuxi and other small vulnerable populations of coastally distributed dolphins.

13.1.6 Other
Habitat degradation is recognised in both coastal and offshore waters of the region and includes habitat loss from coastal development, pollution, acoustic disturbances and vessel strikes (SC/58/SM12); it is increasing. For example, some of the inshore coastal and estuarine habitat of the tuxuci is heavily polluted and subject to major anthropogenic disturbances, including those from urban and industrial development, mangrove destruction and land reclamation (SC/58/SM15). In Costa Rica, contaminant run off from the Sixaola River where the small Costa Rican population of tucuxi resides is of concern (SC/58/SM4). The Caribbean, in particular, receives considerable boat traffic. It is potentially one of the largest oil producing areas in the world with a steady stream of tanker traffic and the Caribbean cruise ship industry represents some 58% of the world's cruise ship passengers, with its volume roughly quadrupling in the last 20 years. The Committee **agrees** that the potential impacts of chemical pollution and vessel strikes to small cetaceans in the Caribbean deserve greater attention, including a careful analysis of floating and beached carcasses and consistent effort in assessing their exposure to contaminants. It **recommends** that whenever possible, data be collected to allow causes of morbidity and mortality to be determined; such baseline data is critical when unusual mortality events occur. Given the limited available resources, the Committee **recommends** that collaborative research projects with ongoing or planned regional programmes consider the inclusion of marine mammals as appropriate. Proper assessment of the threats highlighted above requires data on abundance, mortality and impact on reproductive rates. Recognising the potentially high levels of pollutants, including agrichemical contaminants and sewage discharges, in many coastal areas within the region, the Committee **recommends** that pollutant levels should be examined in bottlenose dolphins and tucuxis especially and that cetaceans are included in any widescale environmental contaminant studies in the region.

13.1.7 Consideration of status
Within the partial review, the lack of information on abundance estimates, directed or incidental takes or life history data for any species prevented the assessment of the status of any species in the Caribbean and western tropical Atlantic.

Recognising the limited resources and capacity within the region, and noting the recent promulgation of a regional marine mammal action plan under UNEP's Caribbean Regional Seas Programme and the establishment in Guadeloupe of a Regional Activity Centre for implementation of the protocol on Specially Protected Areas and Wildlife, the Committee **urges** scientists and the UNEP's Specially Protected Areas and Wildlife Regional Activity Centre (SPAW/RAC) officials to develop regional networks, collaborative studies and training activities to promote scientific understanding of the small cetacean

fauna of the region and to develop the scientific and technical capacity of the region.

13.2 Progress on previous recommendations
IWC Resolution 2001-13 (IWC, 2002, p.60) directs the Scientific Committee to review progress on previous recommendations relating to critically endangered stocks of small cetaceans on a regular basis.

13.2.1 Baiji
The baiji or Yangtze River dolphin is the world's most endangered cetacean. The Commission has requested that the Government of China report progress on the conservation of the species to the Scientific Committee on an annual basis, but no new information was received this year. Last year's report referred to plans on the part of the Chinese authorities to capture some baijis from the Yangtze River and place them in either a dolphinarium or the Shishou oxbow 'semi-natural' reserve (IWC, 2006c, p.41). The Committee had expressed the view that any dolphins captured should be placed in the reserve rather than the dolphinarium and also endorsed a recommendation made at a 2004 Workshop in Wuhan, China, that a range-wide baiji survey should be implemented as a matter of urgency prior to capture operations.

This year, the Committee received information on an Emergency Implementation Meeting on the baiji that was held in California, in December 2005. The main purpose of the meeting was to address how a series of capture-translocation operations could be successfully implemented and financed, following the range-wide survey scheduled for the second half of 2006. However, a research application arising from the meeting and addressing these issues was unsuccessful in receiving funding.

Arrangements were made for individuals involved in Chinese baiji and finless porpoise capture operations to attend a training session in Florida, in 2006. Two experienced scientists from the US Southwest Fisheries Science Centre agreed to join scientists from China for a pilot survey on the Yangtze River in March 2006, to inform the design and planning of the range-wide survey tentatively planned for November 2006. A number of finless porpoises but no baiji were seen (see *www.baiji.org* for a report), although the pilot survey was in a segment of river where baiji likely would have been encountered in the past.

The Committee **welcomes** this international collaboration. Should baijis be found and captures be attempted, it **recommends** that scientists with relevant expertise are able to contribute directly to the process. It looks forward to receiving the results of the large-scale survey and any follow-up activities at next year's meeting.

13.2.2 Vaquita
The committee has followed with great interest the progress on the conservation of the critically endangered vaquita. It received an update on current research and conservation activity in SC/58/SM10. Recent conservation actions include:

(1) a newly decreed special protection zone;
(2) financial support from the Ministry of the Environment to assist fishermen; and
(3) the voluntary agreement of fishermen to phase out nets with meshes of more than 6 inches (144mm).

However, concern was expressed that some Mexican federal and state government officials were reluctant to accept 1990s population and bycatch estimates as evidence of any conservation problem with respect to the vaquita. The use of pingers in fisheries has again been suggested to enable fishing to continue while protecting vaquita; but the Committee **re-emphasises** its previous strongly held view that this is not an appropriate safeguard in the present situation.

Given the reluctance of some to accept the severity of the conservation status of the vaquita, work is now focused on synthesising existing information to estimate the current vaquita population size and trajectory, on assessing habitat requirements and on ecological studies of the northern Gulf of California. The Committee **welcomes** these new initiatives, and expressed its support for the ongoing buyout of the larger meshed nets. The Committee **agrees** that a new survey to estimate abundance is not a priority because of the low power to detect trends. Highest priority must be the urgent investment of more resources for bycatch mitigation.

13.2.3 Harbour porpoise
The Committee reviewed the status of harbour porpoises in the North Atlantic in 1995 and agreed that reported bycatch levels justified concern about sustainability. This year, two new estimates of abundance and a method to determine appropriate limits for small cetacean bycatch in the European Atlantic and North Sea were presented.

SC/58/SM19 presented results from aerial surveys of harbour porpoises in the German EEZ of the North and Baltic Seas based on line transect surveys in 2004 and 2005. Abundance in the German North Sea was estimated to be 34,309 (95% CI=17,463-69,866) in July 2004 and 64,506 (CI=36,776-127,036) in May 2005. Abundance estimates in the Baltic were 2,031 (CI=921-4,243) in July 2004 and 4,793 (CI=2,440-9,752) in May 2005.

The SCANS project in 1994 provided the first estimates of abundance of small cetaceans in the North Sea and adjacent waters (Hammond *et al.*, 2002). In July 2005, the Small Cetaceans in the European Atlantic and North Sea (SCANS II) project conducted a similar survey. The study area was surveyed by seven ships and three aircraft using similar, but improved, methods to those from 1994. A preliminary estimate of 380,000 (CV~0.2) harbour porpoises was presented and was found to be lower but not significantly lower than the 1994 estimate in an approximately equivalent area to that surveyed in 1994. Preliminary estimates of 25,000 (CV~0.4) white-beaked dolphins, 13,000 (CV~0.25) bottlenose dolphins and 76,000 (CV~0.4) common dolphins were also presented. If animals missed on the trackline and responsive movement are not taken into account in the shipboard estimates for common dolphins, the estimate is much higher, demonstrating the importance of taking account of responsive attraction to the ships. Final abundance estimates will be available next year. The Committee **welcomes** these new results and looks forward to receiving the final abundance from SCANS II next year.

NAMMCO reports suggested a likely substantial level of bycatch of harbour porpoises in Icelandic and Norwegian fisheries and noted that the directed catch of harbour porpoises in Greenland exceeds 2,000 animals in some years. The Committee **endorses** the view of the NAMMCO Scientific Committee that better estimates are needed to assess the sustainability of the ongoing bycatches and catches in those regions. It also noted that a large-scale sightings survey (TNASS) was being planned by NAMMCO to cover waters from Canada to western Europe (SC/58/O21) and **endorses** this survey which should produce new information on a number of species of small cetaceans, including harbour porpoises, as well as large whales.

SC/58/SM16 described a component of the SCANS II study aimed at developing a procedure for setting bycatch limits for small cetaceans in the North Sea and European Atlantic. The objective(s) of this study relate to the conservation of a number of species, including harbour porpoises. Two candidate management procedures were considered: the Potential Biological Removal (PBR) and a *Bycatch Limit Algorithm* (*BLA*) which was developed based on the IWCs *CLA*. Details are given in Annex L. The Committee **agrees** that this study represents a valuable approach to this issue, encourages its continuation and looks forwards to further reports.

13.2.4 Franciscana
In 2004 the Committee recommended, *inter alia*, continued survey effort for franciscana. This year it was pleased to receive information on an aerial survey of part of the southern coast of Brazil (SC/58/SM6) conducted in February 2004. Conventional distance sampling methods were used to estimate abundance. The resultant estimate was lower, although not significantly lower than a previous estimate but a number of factors made direct comparison problematic. The Committee **agrees** that this study represents a valuable approach to the issue, **encourages** its continuation and looks forward to further reports.

SC/58/SM7 indicated that franciscanas are homogeneously distributed along the southern coast of Brazil according to depth and all appear to utilise most depths surveyed. The study indicates that area closures will not be an effective way to minimise the bycatch of a particular age, sex or reproductive component of the population.

13.2.5 Hump-backed dolphins
The Committee has previously expressed its concern regarding the impacts of habitat degradation on coastal delphinids, especially hump-backed dolphins (IWC, 1999, pp.213-214; IWC, 2003, p. 57).

SC/58/SM18 documented a small (approx. 100) resident population of Indo-Pacific hump-backed dolphins in Sanniang Bay, southern China, which is remarkable in that it occurs in a habitat that is not degraded. However, the Committee **expresses serious concern** that scheduled industrial development will have a detrimental effect on the dolphins. SC/58/O15 summarised the scant knowledge on the status of the Atlantic hump-backed dolphin in Guinea. Recent interviews with fishermen suggest that the species is seen and occasionally captured. The Committee **recommends** that both small-boat and shore-based surveys be implemented to locate hump-backed dolphin communities along the Guinean coastline, obtain a measure of abundance, collect specimens and evaluate threats, especially bycatch.

13.2.6 Other recommendations
In 2004, the Committee considered new information and made recommendations on the status of West Greenland

white whales and on the status of narwhals in West Greenland and the Canadian Arctic (IWC, 2005h, p.314). Regarding white whales, it had recommended that the West Greenland stock be considered 'of highest conservation concern' and that efforts should be made to improve its status. Regarding narwhals, the Committee had expressed concern and recommended that the stocks that are either depleted, small in size or declining in numbers or range should be considered 'of highest conservation concern', and that special emphasis should be given to those for which all three of those characteristics apply.

In October 2005, the NAMMCO Scientific Working Group on the Population Status of Narwhal and Beluga [white whale] in the North Atlantic, and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga Scientific Working Group, conducted new assessments of the monodontid stocks in all Greenland waters (East and West) and in the Canadian Eastern Arctic (JCNB/NAMMCO, 2005). Results suggest that for West Greenland the take is probably not sustainable. Concern was also express about the sustainability of takes at the Admiralty Inlet, Canada and East Greenland. The Committee **expresses** its appreciation for this assessment work and encourages its continuation and expansion. It **reiterates** its earlier recommendations that West Greenland stocks of narwhals and white whales remain the focus of major conservation concern, noting particularly the inconsistencies between the catch limits recommended by the scientific advisory body and the actual quotas implemented by the Greenland management authorities. The Committee also **expresses concern** for the narwhal stocks in Canada (Admiralty Inlet) and East Greenland that the JWG had indicated may be overexploited.

In 2003 (IWC, 2004e, pp.315-20) the Committee noted the lack of robust abundance estimates for the small cetacean species of the Black Sea and had also previously expressed concern about the population status of striped dolphins in the Mediterranean. Plans for cetacean surveys in the Mediterranean and Black Seas (the ACCOBAMS region) were presented in SC/58/O12. This proposed survey includes both small cetaceans and large cetaceans. The Committee **endorses** this proposal, encourages regional states to support it and **recommends** that it be carried out as soon as possible.

Preliminary abundance estimates for seven cetacean species from a recent systematic line transect survey of western Canadian waters were presented (SC/58/O19). The geographical complexity in this region required the authors to generate an innovative survey design (SC/58/IA16) which is freely available to assist researchers working in similarly complex regions. The Committee noted the importance of providing design-unbiased estimates of cetacean distribution and abundance and **recommends** that such work be continued.

The annual quota for the Dall's porpoise handheld harpoon hunt issued by Japan remained set at 17,700 for the thirteenth consecutive year, apparently based on an abundance estimate for the exploited populations from surveys in 1989/90. The Committee **repeats** previous concerns over the sustainability of the hunt and in light of the large and prolonged nature of the directed takes, the Committee **reiterates** its previous recommendation that

directed takes be reduced to sustainable levels as soon as possible. Moreover, the Committee **emphasises** that current estimates of abundance are essential to assess whether the catch quota is within the limits of sustainability for the affected population(s).

13.3 Takes of small cetaceans
The Committee reviewed a table on incidental capture of small cetaceans (Annex L) and thanked the Secretariat for collating the records. The Committee recognised that several countries had gone to great lengths to supply detailed information on incidental catches, and encouraged others to improve the level of their reporting. The Committee also **recommends** that an additional column should be added to the small cetacean bycatch table to allow the number of animals to be entered when multiple bycatches of the same species are recorded.

Approaches to incorporating sociality into simulated removals of killer whales from a population were presented (Williams and Lusseau, 2006). Killer whales are social animals that rely on relationships within and among family groups for survival. The authors analysed the influence of various individuals' age, sex and matrilineal affiliation on their position in a social network, and found that some matrilines appeared to play more central roles than others in the network. Furthermore, juvenile whales, especially females, appeared to play a central role in maintaining network cohesion. This finding was supported subsequently by simulating removal of different individuals. The network was robust to random removals; however simulations that mimicked historic live-captures from the northeastern Pacific were likely to break the network graph into isolated groups. This finding raises concern regarding targeted takes, such as live-capture or drive fisheries, of matrilineal cetaceans. The Committee **encourages** further attempts to link social behaviour of small cetaceans with their population dynamics.

The Committee noted the report of 354 botos killed for fish bait in Brazil (SC/58/ProgRep Brazil), and that this is considered to be an underestimate. This illegal directed catch began within the past five years and is expanding rapidly in the central Brazilian Amazon. Martin reported that a long-term study of this species in the affected area (Mamirauá Reserve) has recently found direct and indirect evidence of this catch and its consequences on the local boto population. The catch may already be at an unsustainable level, since it appears to be reducing the size of the boto population in the affected area. The Committee **expresses concern** at this information, and **recommends** that the true magnitude and geographical scale of the catch is established and that research continues to determine its impact on the boto population.

13.4 Work plan
The Committee reviewed its work plan and schedule of priority topics and this is discussed under Item 19.

In addition, the Committee **endorses** the proposal to hold a joint workshop on disease and pathology of cetaceans with the SWG on Environmental Concerns and the small cetacean standing sub-committee.

14. WHALEWATCHING (WW)

14.1 Assessing biological impacts of whalewatching on cetaceans

14.1.1 Framework for assessing impacts on population dynamics

The sub-committee considered the application of the US National Academy of Sciences Population Consequences of Acoustic Disturbance (PCAD) model as a framework for assessing the potential for population-level impacts of whalewatching (Annex M, item 5.1). While the model was thought to have certain difficulties in practical application, the Committee **agrees** that it offers a useful framework for considering the potential for population-level consequences on cetaceans from human activities of any kind.

14.1.2 Quantitative methods for assessing impacts

14.1.2.1 METHODS

SC/58/WW7 reported on the development of an individual-based model (IBM) quantifying the links between whalewatching impacts, observable at the individual and school level and the potential dynamics of targeted populations. Using two case studies in which effect sizes were kept conservatively small, results illustrated how whalewatching could influence the dynamics of cetacean populations. These cumulative effects could jeopardise the viability of populations which are already at risk (Annex M, item 5.2.1, figs 2 and 3). Though the work is preliminary, the authors were able to draw some general conclusions that can be useful in identifying how whalewatching can impact population dynamics.

SC/58/WW12 presented a study designed to test experimentally whether killer whales respond differently to approach by few (1-3) versus many (>3) vessels. Results are presented in Item 14.1.2.3. The authors urge caution when designing impact assessments that rely on a simple absence-presence framework, which can mask significant multivariate or non-linear responses.

Bejder *et al.* (2006b) evaluated long-term impacts of vessel activity on the abundance of bottlenose dolphins in Shark Bay, Australia. A nonlinear logistic model demonstrated that when comparing periods with no tourism and periods with one tour operator, there was no change in dolphin abundance within part of the animals' range. As the number of tour operators increased to two, there was a significant average decline in dolphin abundance, approximating a decline of one per seven individuals. Concurrently, within a control site, the average increase in dolphin abundance was not significant. Although this trend may not jeopardise the large, genetically diverse Shark Bay dolphin population, the authors concluded that the decline is unlikely to be sustainable for local dolphin tourism. A similar decline would be devastating for small, closed, resident or endangered cetacean populations.

Bejder *et al.* (2006a) presented results of a multifaceted study designed to investigate immediate, behavioural responses of Indo-Pacific bottlenose dolphins to experimental vessel approaches in two defined sites in Shark Bay, West Australia. Results indicated that experimental vessel approaches elicited significant changes in the behaviour of targeted dolphins when compared with their behaviour before and after approaches (Annex M, item 5.2.1, fig. 4). Results suggest that the documented moderated responses were not because impact-site dolphins

had become habituated to vessels but because individuals that were sensitive to vessel disturbance had left the region before this present study began. This re-interpretation of findings led the authors to question the traditional premise that short-term behavioural responses are sufficient indicators of impacts of anthropogenic disturbance on wildlife.

The Committee **agrees** that this work raises important issues and also **agrees** with the need for strategic planning of long-term and/or population-level studies around the world.

The author noted that while it is important to identify populations where we can undertake such studies, it is important to keep in mind that some populations have already been exposed to whalewatching for a long period and therefore more sensitive individuals already may have died, moved out of the area or been habituated.

The Committee **agrees** that long-term studies in areas where whalewatching activities are taking place, are valuable for assessing whether changes in individual fitness and/or population-level effects are caused by whale-watching. They are also often necessary to detect subtle effects which might otherwise be missed. The Committee further **agrees** that it is essential to obtain baseline data from areas where whalewatching has not occurred and is likely to begin and **recommends** that such data be collected whenever possible.

Williams *et al.* (2006) presented a method to attempt to assess the potential for energetic consequences of short-term avoidance responses of killer whales to vesssel traffic in Johnstone Strait, British Columbia, Canada. Results are discussed under Item 14.1.2.2. The methods used illustrate the value of a study design that uses a suite of methodological and analytical tools, including *inter alia*: complementary data collection of fine-scale observations of focal animals and coarse-scale observations of all animals in the population/study area; statistical methods for addressing serial autocorrelation; combinations of captive and free-ranging studies; and appropriate energetics modelling methods.

14.1.2.2 CASE STUDIES ON POPULATION LEVEL EFFECTS

SC/58/WW6 presented a synthesis of a study carried out in Fiordland, New Zealand to examine the effects of tourism on bottlenose dolphins. At the end of that study (2002), Lusseau and colleagues predicted that if the amount of boat traffic was not capped in Doubtful Sound, some of the resident dolphins could be displaced to other fiords, reproductive success of females could decrease and the decrease in individuals' fitness, through habitat displacement and altered energetic budgets, could also result in lowered survival probabilities. Boat traffic has continued to increase and as predicted, dolphins only observed in Doubtful Sound until 2002 were observed repeatedly in some of the other fiords, female reproductive success lowered and the occurrence of stillbirths increased. These alterations in life history parameters resulted in a dramatic 20% decline in population abundance over a four-year period. Preliminary modelling work shows that such a decline could conceivably be attributed to the impact of boat interactions, even with an effect of small size on survival rate and reproductive success (SC/58/WW7).

Childerhouse acknowledged the importance of this work and outlined progress by the Department of Conservation

(DOC), New Zealand towards addressing the issues identified. Discussions are given in Annex M, item 5.2.1.

The Committee **agrees** that there appears to be a significant impact from whalewatching and vessel traffic on this critically small bottlenose dolphin population. It **recommends** that the Government of New Zealand increases protection for this population and other bottlenose dolphin populations in Fiordland as a matter of urgency.

SC/58/WW8 used long-term records for individual bottlenose dolphins in a West Australian population to evaluate female reproductive success in relation to cumulative vessel exposure targeting dolphins over an 11-year period. All of the females with least cumulative vessel exposure reproduced successfully, while only 47.6% of the females with the highest cumulative vessel exposure reproduced successfully.

The Committee **agrees** that there appears to be a significant impact from whalewatching traffic on the section of the population exposed to vessel-based tourism activities. It **recommends** that the Government of Australia ensures that appropriate action is taken to restore the abundance and breeding success of individuals in the exposed area.

The results of Williams *et al.* (2006) have implications for assessing the implications of short-term responses for the fitness of individual killer whales in Johnstone Strait, British Columbia, Canada. In the presence of boats, whales reduced their time spent feeding and the time spent rubbing their bodies on smooth pebble beaches. Lost feeding opportunities could have resulted in a substantial estimated decrease in energy intake. The sensitivity analysis presented provides preliminary evidence that anthropogenic disturbance could carry higher costs to killer whales in terms of reducing energy acquisition than in terms of increasing energetic demand. While further research is needed, interim measures to establish areas of protection from vessels would confer the greatest conservation benefit to threatened killer whale populations; such protection must be for areas shown to be important for feeding activities.

SC/58/E21 presented a study conducted from 1995 to 2003 on factors affecting the distribution of the Kvarnerić bottlenose dolphin population (Lošinj and Cres archipelago, Croatia), the subject of an ongoing, long-term study started in 1987. Results of GLM analyses showed that bottlenose dolphin presence was negatively affected by two anthropogenic parameters: (1) the distance from the three harbours with marine petrol stations, which can be considered as a proxy for a diffusive negative effect due to the physical presence of boats; and (2) a function of the distance from the main route connecting two of the primary harbours of the archipelago, which corresponded to the presence of fast and erratically moving vessels. It appears that in recent years, bottlenose dolphins were most affected by activities going on along the main speedboat route and around the three main harbours and petrol stations. This may indicate that they have reached their tolerance threshold to the number of boats presently using the archipelago. The Committee welcomes the use of flexible modelling techniques such as GAM and GLM, which will be essential for many studies in which there is no experimental control and manipulation of treatment levels is not possible.

The Committee **agrees** that there is new compelling evidence that the fitness of individual odontocetes repeatedly exposed to whalewatching vessel traffic can be compromised and that this can lead to population level effects. The Committee **recommends** that similar studies looking at individual fitness of cetaceans be carried out where ever possible. However, in the absence of these data it should be assumed that such effects are possible until indicated otherwise. The Committee strongly **encourages** the development of similar studies on large whales, in particular, research to determine sustainable levels of whalewatching.

14.1.2.3 CASE STUDIES ON SHORT-TERM EFFECTS
SC/58/WW9 reported on a study on the behavior of humpback whale mother-calf pairs observed in the Abrolhos Marine National Park, a special breeding and calving ground for this species in Brazil and an area with a high concentration of tourism vessels. Results showed that differences in humpback whale mother and calf behaviour occurred mostly in the presence of vessels within distances of 100-300m. As these changes may be interpreted as negative effects, the authors suggested that Brazilian legislation should include a 300m 'caution' zone, where boats would reduce speed and avoid sudden changes in engine gear and direction.

SC/58/WW11 reported results from a study that monitored movements of vessels and northern resident killer whales during summer daylight hours to determine whether vessels affected killer whales in the Robson Bight (Michael Bigg Ecological Reserve, Johnstone Strait, British Columbia). Killer whales were seen in all parts of the Reserve, but spent significantly more time in the nearshore rubbing beaches. Whales were more likely to move to another area of the Reserve or to leave the Reserve entirely when vessels were present than when they were absent, and were more sensitive to vessels near the rubbing beaches. These findings suggest that boats can displace whales from areas that might be designated as critical habitat. However, the possible long-term consequences of such short-term effects are not known and require further study.

The Committee considered the conclusions of a study on a small and resident population of bottlenose dolphins off Choros Island in Chile (Yazdi, 2005). However, no details on methodology, results, data and how energy requirements were calculated were presented. A full paper was requested for next year's meeting.

SC/58/WW12 reported results to suggest that killer whales did respond differently to approach by few (1-3) versus many (>3) vessels. Swimming paths became less direct when whales were approached by a few boats, but whales increased their path directness when approached by many boats. Consistent with previous studies, inter-breath interval, swimming speed, angle between successive dives and rates of surface-active behaviour did not differ significantly. The authors recommended that whalewatching guidelines be modified to address crowding.

SC/58/WW14 noted a large (17x) increase in whale-watching in Costa Rica since 1998. In 2001, this study was undertaken to evaluate the behavioural responses of four species of cetaceans to various boat behaviours. The most frequently watched species (spotted dolphins) often changed their behavioural state and direction. They reacted most strongly (and significantly) when operators violated approach guidelines. The results were instrumental in the

formulation and successful 2005 passage of legislation in Costa Rica that will govern whalewatching as well as other aspects of marine mammal conservation.

Visser *et al.* (2006) described preliminary results from a land-based study of the behaviour and activities of Risso's dolphins in the presence and absence of boats. The Committee welcomed the information from a taxonomic group and a geographic area from which results are not often received. It was noted that the methods used in SC/58/E21 might be helpful in this case to separate out the potential confounding effects of boat traffic and seasonality.

The Committee **agrees** that appropriate study design and analytical methods are essential for discriminating between natural ecological variability and anthropogenic impacts.

SC/58/WW1 summarised behavioural impact studies over the past year on short-term impacts of whalewatching activities. Richter *et al.* (2006) investigated the behaviour of resident and transient sperm whales in response to boat-based and aerial whalewatching in Kaikoura, New Zealand. Results indicated that time durations at the surface were slightly shortened when whalewatching boats were present and longer when animals were exposed to aerial whalewatching. Time until the production of the animal's first echolocation click when diving was also shorter when whalewatching boats were present. The authors also noted that transient whales reacted more intensely to whalewatching activity and suggested that resident animals may be habituated.

Mattson *et al.* (2005) investigated common bottlenose dolphin behaviour in response to boat traffic in South Carolina, USA. They noted that dolphin groups were significantly larger when animals were surrounded by multiple whalewatching boats. Although changes in behaviour and direction were observed, these were more pronounced in response to other forms of non-whalewatching boat traffic.

14.1.3 Recommendations for strategic long-term research designs
The Committee **agrees** that the careful experimental methods and quantitative analyses presented in Annex M (item 5.2), as applied to bottlenose dolphins in Shark Bay, Australia, Fiordland, New Zealand, and Croatia, and northern resident killer whales in British Columbia, Canada, were extremely valuable contributions to its discussions and **encourages** the continued submission of similar work.

The Committee **agrees** that it is appropriate to develop a holistic approach to whalewatching impact assessment in order to separate impacts attributed to whalewatching, other human-induced effects and ecological effects. Recent approaches reveal encouraging avenues to further our understanding of whalewatching impacts. The Committee **recommends** that a dedicated Workshop to develop a worldwide research design be held. It was **agreed** that the goal of the Workshop should give strong consideration to, *inter alia*:

(1) inclusion in research designs of species of varying taxa and life history strategies and exposed to different environmental factors;

(2) experimental studies with appropriate controls and use of innovative technology and analytical techniques, including modelling; and

(3) availability of specific data (e.g. local history of whalewatching activities, baseline data, longitudinal data on species in question, ecological data, human impacts including exploitation history).

14.2 Identify data sources from platforms of opportunity of potential value to the Scientific Committee
SC/58/WW3 described the creation of a database to track and evaluate opportunistic data collection programmes world-wide (Annex M, item 6). The database includes fields that allow programmes to be categorised by scientist involvement and type of data collected and plans to continue to track scientific publications emanating from specific data sets and to incorporate this information into the database.

The Committee **agrees** that an intersessional Working Group under Robbins (see Annex R25) should be established to: monitor and evaluate opportunistic data collection programmes worldwide, particularly those using whalewatching platforms; encourage scientifically sound and management relevant data collection methods; and facilitate the Scientific Committee's access to opportunistic data sets that may be relevant to its work.

SC/58/WW10 reported on implications of the growing Antarctic tourism industry for cetaceans which has developed from a few hundred people visiting the Antarctic each year in the 1970s, to more than 20,000 annually today. In addition, information on the contribution of the Antarctic tourism industry (since its inception) to the work of the Scientific Committee was presented (Annex M, item 6.).

SC/58/SH19 summarised opportunistic photographs submitted to the AHWC curated at the College of the Atlantic (COA), Bar Harbour, Maine, since 1987. Opportunistic data represent a significant portion of the catalogue and the availability of this data has broadened our understanding of the exchange between areas and in some cases provided information that previously was not available.

SC/58/SM12 contains examples of new information on dolphin distribution in the Dominican Republic (Samana Bay) collected via whalewatching operations. Noting the substantial data gaps in knowledge of small cetaceans as well as a substantial number of whalewatching vessels in the Caribbean, it is possible these data gaps could be addressed via the use of whalewatching operations. It was noted that the web-based Data Recording System (DRS; see *www.wdcs.org/drs*) would be a way of achieving both of these needs. The Committee **agrees** that an intersessional Working Group under Simmonds (see Annex R26) be formed to revisit the DRS and examine data collection from whalewatching operations.

The full cooperation of local tour operators in Shark Bay is essential to document impact and control areas by allowing automatic Global Positioning System (GPS) downloading of tour vessel movement during cruises (Bejder *et al.*, 2006b). The Committee **agrees** that collaboration with tour operators should be strongly encouraged to optimise the effectiveness of experimental designs.

14.3 Other issues

14.3.1 Review reports from intersessional Working Groups

Three intersessional Working Groups were formed at last year's meeting of the sub-committee (Annex M, item 7.1). Rose reported that one of these has made progress in developing a questionnaire for researchers and swim-with-whale operators in an attempt to get more in-depth data on operational procedures when people are placed in the water with large whales. The Committee **agrees** that this group should continue its work (Annex R27) and report to next year's meeting.

14.3.2 Review potential impacts of 'swim-with' programmes on populations of cetaceans

SC/58/WW1 summarised a study by Danil *et al.* (2005) of observations on spinner dolphin behaviour and its relationship to human swimmers at Maku'a Beach, Oahu, Hawaii. The population of spinner dolphins using this area exhibit low activity levels and are presumed to be resting. In the afternoon (3-7pm), the dolphins leave the bay and travel offshore to forage. A significant correlation was reported between the departure time of the dolphins from the bay and the number of swimmers, i.e. with more swimmers, the dolphins spent less time in the bay and therefore had less time to rest.

The Committee considered a summary of a Workshop focused on solitary sociable dolphins held in San Diego in December 2005 (Frohoff *et al.*, 2005). Solitary dolphins often become the focus of intense human attention including unmanaged and concentrated 'swim-with' activities. The Workshop established that there were many examples of such animals worldwide. Many solitaries die as a result of their increasing interactions with human beings and this may have conservation implications, particularly for small populations.

SC/58/WW5 presented case studies on solitary common bottlenose dolphins in the United Kingdom (Annex M, item 7.2.) The cases illustrate that the socialisation of dolphins can significantly affect their survival.

14.3.3 Review of guidelines and regulations

Carlson reported that the compendium of whalewatching guidelines and regulations around the world would be updated and available on the IWC's website this year. It was suggested that the compendium be made available in an electronic format that facilitates review and analysis (e.g. Microsoft Word or Excel). It also was suggested that the guidelines and regulations in the compendium be separated to facilitate its use by managers. The Committee **recommends** continued work on the compendium.

SC/58/WW1 presented information on a 'proposed rulemaking' by the US government involving interactive marine mammal viewing in its waters i.e. a change in regulations in order to reduce marine mammal disturbance and an analysis (Lewandowski, 2005) on public comments (Annex M, item 7.3).

SC/58/WW1 also summarised Hoyt (2005), who discussed sustainability issues related to whalewatching. As a way of monitoring the sustainability of whalewatching in an area, Hoyt suggested the use of a 'sustainability report card' which included indices such as: (1) the growth rate of a watched population; (2) whether recruitment rates exceeded mortality rates; and (3) whether changes in behaviour were exhibited.

SC/58/WW2 summarised encounters with humpback whales in the southern waters of the Dominican Republic and an example of rapid, proactive conservation measures. Protective regulations regarding whalewatching activities do not extend to southern Dominican Republic waters. However, after reporting incidences of disturbance, a Workshop was quickly held and a 'good practice guide' for whalewatching was introduced, followed by a tour operator training programme, both supported by the Dominican Republic government and local tourism bodies. A second, more in-depth Workshop involving additional stakeholders followed. All of this occurred within a period of approximately one year. As a precautionary measure, whalewatching guidelines were promoted throughout the Dominican Republic.

SC/58/WW5 noted that solitary whales and dolphins can present significant and unique management problems and that when such animals appear, there should be a swift development of local management plans that focus on minimising interactions with people and in particular preventing provisioning of the animals and swimming with them.

SC/58/WW13 presented a proposal to improve monitoring of the effects of boat-based whalewatching in the Right Whale Environmental Protection Area, Santa Catarina, Brazil, created on September 14, 2000 to ensure the protection of the main wintering ground for southern right whales off Brazil. An increasing interest in whalewatching activity has been recently observed in the protected area which can put at risk the protection of these whales if not properly managed. The proposal included six areas where closure would apply to boat-based whalewatching and all other recreational craft. Five of the closure areas are regularly monitored from shore during the whale season. In addition, eight other areas where boat-based whalewatching occurs are also monitored in the same way, thus allowing comparisons.

The Committee commends the authors on their work and **recommends** that the proposal outlined in the paper be implemented by the authorities responsible for the Right Whale Environmental Protection Area.

14.3.4 Review of risk to cetaceans from colliding with whale-watching vessels

Mattila reported on six confirmed vessel collisions with humpback whales in Hawaii during the 2006 winter season; four of the six collisions probably involved whalewatching vessels. Although still under investigation, all were apparently in transit and did not see the whale until it surfaced under, or immediately in front of them. It was also noted that the severity of one strike in particular was underestimated until it was more thoroughly investigated (below the surface) by Hawaiian Islands Humpback Whale National Marine Sanctuary staff. Some of the variables that may be affecting the apparent increase in reported ship strikes in Hawaii were noted as well as difficulty in determining the fate of animals struck unless they are reidentified or intact carcasses are found.

14.4 Other

SC/58/WW4 notes that whalewatching is perceived as 'ecotourism' and provides a list of criteria it believes should be met in order for whalewatching to be 'truly responsible and sustainable'. These criteria are similar to those

identified by the sub-committee's definition of 'whale eco-tourism' (see IWC, 2006i, pp.250-51) and include a commitment to situations where research is being conducted such that the targeted cetaceans are being carefully monitored.

In Higham and Lusseau (2006), the authors noted that studies are needed to understand the influence of anthropogenic activities such as whaling on whalewatching when the two activities coexist at a given site. They introduce a framework to highlight these dynamics.

14.5 Work plan
The discussion of the work plan is given in Annex M, item 9. This is taken into account under Item 19.

15. DNA TESTING (DNA)

15.1 Genetic methods for species, stock and individual identification
Last year it was agreed that validation of DNA sequences in GenBank and other such repositories should be carried out routinely (IWC, 2006c). An intersessional Working Group was established to develop and implement a protocol to carry this out. Its report was discussed, and the Committee **agrees** with the following:

(1) the best available vehicle for the validation is *DNA Surveillance* (Ross *et al.*, 2003) (*DNAS* below);
(2) three types of inconsistencies/errors should be targeted in the validation:

   (a) quality of submitted sequences;
   (b) accuracy of species identification; and
   (c) accuracy of geographical location;

(3) validation should be carried out annually;
(4) control-region sequences should be examined in the first round of validation; and
(5) the first priority for validation should be given to the baleen whale species currently under genetic investigation by the Committee: common minke; Antarctic minke, Bryde's, sei, fin, blue, humpback, gray, right and bowhead whales.

It was suggested that additional or alternative methods of validation should be investigated. The Committee **agrees** that this could be done but that *DNAS* offers an immediate and efficient means of validation and should be used in at least the first rounds.

A discussion ensued on how to handle and report errors or anomalies detected in the validations. As a basic strategy, the information must be shared with members of the Committee. The Committee **agrees** that there should also be feedback to GenBank. The present policy of GenBank is that entries cannot be changed but that amendments can be added with the permission of the original submitter. An entry includes information on a voucher specimen and citation of a publication. Thus, by reference to the publication, the validation team can contact the author(s), notify them of the inconsistency and suggest that an amendment be made to the entry (offering to help after GenBank has been notified directly of the permission to amend).

The Committee **agrees** to re-establish the intersessional Working Group under Pastene (Annex R9) to continue with the development of plans for sequence validation,

specifically, determine how many sequences exist in GenBank for these taxa, how many are typically added annually, the expertise and time required to carry out the first round of validation and subsequent annual rounds and the approximate cost if done under contract.

15.2 Collection and archiving of samples from catches and bycatch
A total of 537 and 633 common minke whales were landed in Norway in 2004 and 2005, respectively. Genetic analysis of these samples is in progress. A sample was missing for one of the whales landed in 2004 and for four of the whales landed in 2005.

Regarding collection of samples in Japan, the Committee was informed that a total of 853 genetic samples of the Antarctic minke whale and 10 of the Antarctic fin whales were collected from the 2005/06 austral summer survey of JARPA II. For the western North Pacific (NP) scientific whaling (JARPN II) programme, samples stored in the period 2004-05 were: NP common minke whale, $n=378$; NP Bryde's whale, $n=100$; NP sei whale, $n=200$; and NP sperm whale ($n=8$). The samples from bycatch stored in 2005 were: NP common minke whale, $n=128$; NP humpback whale, $n=4$; and NP gray whale, $n=3$. Genetic samples were stored for the following stranded whales in 2005: NP common minke whale, $n=7$; NP Bryde's whale, $n=1$; NP sperm whale, $n=5$; NP humpback whale, $n=2$; NP right whale, $n=1$; NP fin whale, $n=1$; and unidentified whale, $n=1$.

Regarding collection of samples in Iceland, the Committee was informed that for the scientific whaling, samples stored for the years 2003-05 were: North Atlantic common minke whale, $n=95$.

15.3 Reference databases and standards for a diagnostic register of DNA profiles
Genetic analyses have been completed and data on mtDNA, short-tandem repeats (STRs) and sex entered in the Norwegian register for years through to 2003. For the Japanese register, analyses have been completed for all scientific whaling samples from 2004, for all bycatch samples through to 2005 and for a portion of the stranding samples for 2005. The analyses of the Icelandic samples will begin in the coming year, provided that funding is available.

15.4 Work plan
The TOR for the Working Group for the next year will remain the same as for this year, unless the Commission requests other information in the interim. Members of the Committee are encouraged to submit papers relating to these TOR and to propose additional Agenda items. The Committee **encourages** the group to continue with its development of plans for sequence validation.

16. SCIENTIFIC PERMITS (SP)

16.1 Improving the Committee's procedure for reviewing scientific permit proposals
The Committee noted last year that it has difficulties in reviewing scientific permit proposals (IWC, 2006c, pp. 46-53) and the Committee **agrees** that there is a need to improve on the process currently in use. This was the

primary topic for the scientific permits Working Group (SPWG, Annex O) this year and a suggested way forward for a new process (Annex P) formed the basis of plenary discussions.

The Committee **agrees** with and **recommends** the *pro forma* for proposals given in Annex P.

It was noted that the SPWG had considerable discussion regarding the establishment of a specialist workshop to review special permit proposals and how any report(s) from such a workshop would be incorporated into the advice provided by the Committee to the Commission (Annex O, item 5). The SPWG had concluded that it was not possible for a large Working Group of the Committee (i.e. approximately half of the delegates in attendance at an Annual Meeting) to efficiently review complex documents such as the recent special permit proposals. It had also noted that it was the responsibility of the Committee to review special permit proposals from Contracting Governments; therefore, whatever process was agreed would have to retain this feature. The Committee considered the suggested process described in Annex P, which (in addition to the agreed *pro forma* for proposals noted above) included a review by a small specialist Workshop, the submission of the Workshop report to the Scientific Committee and a final review by the Scientific Committee as a potential way to improve the current system of review. It was recognised that the simplest way to establish the participants to such a Workshop would be for the Convenors of the Committee to identify appropriate individuals (who may or may not be members of the Scientific Committee) based on the proposed area of research, the species involved and the objectives and methods contained in the proposal.

Further, there was **agreement** within the Committee that the review of the specialist group should focus on, but not necessarily be limited to:

(1) comment[13] on the perceived importance of the stated primary objectives from a scientific and management perspective, especially its relevance to the work of the Scientific Committee;

(2) whether the proposed field and analytical methods are likely to achieve the stated quantified objectives within the proposed time-frame, commenting on sample size and time-frame considerations;

(3) the provision of advice and suggestions on components of the programme that might be achieved using non-lethal methods, including, where appropriate power analyses and time-frames;

(4) the provision of advice on the likely effects on the stock or stocks involved under various scenarios of length of the programme. It was noted that this may involve a different analysis to that provided in the original proposal and may include assumptions that permit proposals over a relatively short time period (e.g. 1-5yr) may be projected further into the future; and

(5) a review of the proposed intermediate milestones/ targets and a suggestion for when an intermediate review should take place, noting that when a major review is anticipated, a specialist workshop approach should be followed.

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[13] It was suggested that this should be brief comments in Annex P, but see below.

While this statement was **agreed** by consensus within the Committee, there was disagreement as to the extent to which the specialist Workshop should focus on the degree to which the proposal addresses information relevant to the management needs of the Commission.

The Committee recognised that any new procedure for reviewing proposals for scientific whaling involved a number of logistical steps that would need to be completed prior to convening the first such Workshop. The Committee **agrees** that the approach reported in Annex P will serve as a starting point for next year's Annual Meeting and that the following points will be included as a priority in discussion:

(1) the level to which the suggested process will lead to an improvement to the existing process, if at all; and

(2) if a specialist review group is set up and an intersessional Workshop held:

   (i)   what would the composition of participants be and how would they be selected;
   (ii) what should the TOR be;
   (iii) how would the process be funded; and
   (iv) what is the role of proponents at the Workshop and what is their role at the Annual Meeting of the Committee?

Childerhouse commented that he welcomed the efforts of the authors of Annex P and looked forward to its further review next year.

16.2 Review of results from existing permits

Some members had at previous meetings expressed serious concerns regarding the nature of the JARPA II, JARPN II and Icelandic research programmes, notably with regard to the necessity of lethal sampling and the overall study design. Other members stated that all of the previously expressed concerns had been responded to in detail at previous meetings of the Committee. They reiterated their view that lethal sampling was an important part of comprehensive programmes required to obtain essential data to achieve the stated research objectives and emphasised that the overall study designs for the research programmes addressed data needs relevant to the management of whale stocks and the development of ecosystem models.

A summary of these discussions can be found in last year's Annual Report (IWC, 2006c, pp.46-53) and previous Annual Meeting reports of the Committee.

16.2.1 Japan - Antarctic minke and fin whales

The JARPA II (SC/58/O7) research programme involves both non-lethal and lethal research techniques. This season was dedicated to feasibility studies. For the feasibility surveys, a total of 850±10% Antarctic minke whales and 10 fin whales were planned for sampling. The practicability and appropriateness of sighting methods in the enlarged area and sampling procedures for the increased sample size were examined. Methods for catching, flensing and taking biological measurements of large-sized fin whales were also tested.

The area to be covered by JARPA II is basically the same as JARPA. The first year surveyed Antarctic minke whales in a longitudinal span of 140° on the western side of the research area from 35°E to 175°E. The research period in this cruise was 108 days from 3 December 2005 to 20

March 2006. The searching distances of the sighting vessels (SVs) and the sampling/sighting vessels (SSVs) were about 16,400 n.miles, which consisted of 8,850 n.miles for the two SVs and 7,550 n.miles for the three SSVs.

Fourteen species were identified during the research period. The number of primary sightings was 1,702 schools (3,200 individuals) of humpback whales, 1,658 schools (4,383 individuals) of Antarctic minke whales and 188 schools (748 individuals) of fin whales. These sightings accounted for 76.2% of the total (36.6% for the humpback, 35.6% for the Antarctic minke and 4.0% for the fin whales) in schools.

Out of 821 schools and 1,959 individuals in the primary sightings of Antarctic minke whales by SSVs, 779 schools (1,879 individuals) were targeted for potential lethal sampling. A total of 853 individuals was sampled. Out of 37 schools and 245 individuals in the primary sightings of fin whales by SSVs, 11 schools and 112 individuals were targeted for sampling. A total of 10 individuals were sampled.

The reproductive status of samples by stratum for Antarctic minke whales is given in table 8 of SC/58/O7. Mature females were dominant in Prydz Bay, whereas mature males were dominant in most of the other strata. In the south stratum of Area IVE, both immature males and females were dominant. The pregnancy rate in mature females was 93.8% over the whole research area. The biological data from fin whales is shown in table 9 of SC/58/O7. The largest sampled fin whale was a 20.22m female weighing 61.52 tonnes. A total of 85 targeted individuals were photographed: 13 blue whales, 34 humpback whales and 38 southern right whales. A total of 46 skin biopsy samples were collected from blue whales, fin whales, sei whales, humpback whales, southern right whales, the carcass of a sperm whale, the carcass of a southern bottlenose whale and a long-finned pilot whale.

The authors summarised the main results of the first feasibility survey as follows:

(1) Antarctic minke and humpback whales were the dominant species, observed in similar numbers in the research area. Both species were highly concentrated in the south strata. However, some segregation was observed as high density for one species did not coincide with the high density of the other species in the same stratum. The Antarctic minke whale was dominant in the western part of Area IVW while the humpback whale was dominant in the eastern part of Area IVE. In terms of biomass, the data suggest that the humpback whale is the dominant species in the research area.

(2) Fin whales were widely distributed in the south strata from 80°E to 135°E. In the past it was suggested that fin whales are not distributed in large numbers in the south strata compared with Antarctic minke and humpback whales. However, during this survey, fin whales were observed in the south strata and they had a large mean school size compared to other baleen whale species. The biomass of fin whales appears similar to that of Antarctic minke whales.

(3) Large baleen whales intermingled in the south strata throughout the entire research area. Blue whales were observed throughout the entire research area. Southern right whales were concentrated in the south strata of Area IV. Sightings of both species were few compared with those of Antarctic minke, humpback and fin whales.

Regarding the objectives of the first feasibility survey, the authors summarised the results as follows:

(1) This cruise was planned to cover a longitudinal span of 140° from 35°E to 175°E through early December to late March. It was planned that the search effort in peak feeding season should be distributed mainly in Area IV, the peak feeding season of baleen whales. The only unsurveyed areas were those from 35°E to 55°E and 135°E to 139°E, due to external disturbances. Despite these disturbances, sighting was conducted in the peak season from early January to early March in the main research area from 55°E to 130°E, which included Area IV. The practicability and appropriateness of the planned sighting methods was confirmed.

(2) A total of 779 schools (1,879) individuals of Antarctic minke whales were targeted for sampling. A total of 853 individuals were sampled from 4 December to 20 March. Sampling efficiency was 95.6%. A total of 11 schools (112 individuals) of the fin whales were targeted for sampling. A total of 10 individuals were sampled from 3 February to 13 March. Sampling efficiency was 90.16%. These results showed that the sampling procedure was appropriate for the increased sample size of Antarctic minke whale and additional species.

(3) Although it took more time to catch, transport, measure and dissect fin whales than is the case for the Antarctic minke whales, the process from catch to biological sampling of fin whales was successfully conducted. Therefore the methods for hunting, hauling, flensing and biological sampling of large whales was checked and it was concluded that they are adequate for whales of body length of at least 20.22m.

COMMITTEE DISCUSSION
Discussion regarding this research report focused on the representativeness of samples (e.g. differences in density of whales by vessel type and by distance from the ice edge, upper limit on size of fin whale that could be landed, etc.). In addition, some members proposed working cooperatively in the future regarding the development of new methods for the age determination of large whale species. Cooke questioned whether it was necessary to collect Antarctic minke whales in the second year of the feasibility study, given the success in sampling minke whales in the first year. Hatanaka responded that only half of the study area had been sampled; therefore, sampling of minke whales in the second year was necessary.

16.2.2 Japan - North Pacific common minke, Bryde's, sei and sperm whales
SC/58/O8 outlined the fourth full scale JARPN II survey (offshore component), which was conducted from 16 May to 16 August 2005 in sub-areas 7, 8 and 9 of the western North Pacific. A total of six research vessels were used: 1 SV, 3 SSVs, one research base vessel and one trawl survey vessel equipped with a scientific echo sounder. Almost 12,700 n.miles were surveyed over a period of 91 days. During that period, 114 common minke, 110 Bryde's, 503 sei and 337 sperm whales were sighted by the SSVs. A total

of 100 common minke, 50 Bryde's, 100 sei and 5 sperm whales was sampled. In addition, the cooperative prey and whale surveys were conducted with the participation of the six vessels in parts of sub-areas 7 and 9. All whales sampled were examined on board the research base vessel. Previous surveys in this research area showed that common minke whales fed mainly on Pacific saury (*Cololabis saira*), minimal armhook squid (*Berryteuthis anonychus*) and Japanese anchovy (*Engraulis japonicus*). In this survey, common minke whales were shown to feed mainly on krill (*Euphausia pacifica*), Pacific saury and Japanese anchovy. Krill and Japanese anchovy were also an important prey species for Bryde's whales. In this year, sei whales fed mainly on krill and copepods. Dominant prey in the stomachs of the five sperm whales were various kinds of squids, which inhabit mid- and deep waters.

SC/58/O9 reported the results of the second revised JARPN II surveys (coastal component), conducted 11 April to 21 May 2005, off Sanriku, northeastern Japan (i.e. the middle part of sub-area 7). Based on results from the two-year feasibility study carried out in 2002 and 2003, the coastal component was revised to be conducted twice a year and to sample 60 common minke whales in both spring and autumn; the first revised survey was carried out in the autumn of 2004, off Kushiro. Sampling of common minke whales was conducted in coastal waters within 30 n.miles of Ayukawa port in the Sanriku district. Prey species abundance and dedicated sighting surveys were also carried out. During sampling, almost 5,250 n.miles were surveyed, 202 schools (205 individuals) of common minke whales were detected and 60 animals were caught (23 males and 37 females). Of the males, eight were sexually mature while 14 of the females had attained sexual maturity and all but one was pregnant. The dominant prey species found in whale forestomachs was adult Japanese sand lance (*Ammodytes personatus*). Juvenile sand lance, krill and Japanese anchovies were also observed, but their frequency was much lower. This differs from the 2003 JARPN II coastal survey off Sanriku, in which krill were also dominant. The results indicate that the feeding habits of common minke whales in coastal waters off Sanriku changes yearly. During the survey, coastal fisheries for krill and sand lances operated. The fishing ground for adult sand lance overlapped with the main sighting area for common minke whales. These results indicate that common minke whales and coastal fisheries caught adult sand lances at the same time and in the same area, indicating the existence of interaction between them.

SC/58/O10 outlined results of the third revised JARPN II survey (coastal component), conducted in autumn 2005, off Kushiro, northeast Japan (i.e. the northern part of sub-area 7). The survey was carried out from 7 September to 12 October 2005, using the same type and number of research vessels, with almost the same method as in the spring coastal survey off Sanriku (SC/58/O9). The research area was set within 50 n.miles of Kushiro port. During the whale sampling, the total searching effort was about 6,650 n.miles and 144 schools (145 animals) of common minke whales were sighted; 60 whales were sampled (45 males and 15 females). The dominant prey species found in the forestomachs were Japanese anchovy (43.3%), krill (31.7%) and walleye pollock *Theragra chalcogramma* (18.3%). The concurrent prey survey revealed the distribution of those

prey species in the research area and the dedicated sighting survey sighted 20 schools (21 individuals) of common minke whales while searching about 830 n.miles. The sighting ratio and length frequency of sampled whales were almost the same as in the 2004 survey off Kushiro, but the prey species composition in the forestomachs was different. In the present survey, krill were more dominant and the amount of Pacific saury was much less. These results indicate the existence of yearly changes in feeding habit of common minke whales in the coastal waters off Kushiro.

COMMITTEE DISCUSSION
In discussion, a question arose as to why relatively similar amounts of meat were recovered from sperm and minke whales, given the size discrepancy between these two species. Fujise responded that sperm whales were at the top trophic level and therefore accumulated pollutants more than lower trophic level species through the process of biomagnification. Simmonds asked what levels of contamination are of concern to Government of Japan for human consumption and whether this posed a problem for the utilisation of sperm whale meat. Fujise noted that Japan has investigated the level of mercury in meat from fish and whales and determined that the level of mercury found in sperm whale meat does not pose a threat if consumed by adults and children. However, pregnant women are advised to only eat one serving of sperm whale meat per week. Further, Simmonds asked about the incidence of anomalous testes reported in the JARPN II summary reports. Fujise noted that information regarding this observation is reported in table 14 of SC/58/O8. He added that the cause of this condition appeared to be the result of some unknown infectious disease, possibly a strain of *brucella*. Simmonds commented that a few years ago *brucella* had been found in stranded cetaceans in the UK and that rescue workers had been issued with warning notices.

It was also noted that an apparent shift in the diet of minke whales over the last two years had taken place. This observation led to the question as to whether there were fisheries data available to explain this shift. Fujise responded that the distribution of the dominant prey of minke whales in this part of the North Pacific varies with season (spring, anchovy; summer, saury), as well as varying between years. He added that with high water temperature, saury are found farther north relative to years of lower water temperature. Thus there is a link between the oceanographic regime and prey distribution.

Víkíngsson noted that Iceland has received several requests for brain tissue samples for medical research. This research included neuro-anatomical and histological studies related to Alzheimer's disease and comparative research on brain structure in relation to sleep in mammals. He suggested that requests for samples should be coordinated as possible between Iceland and Japan.

Childerhouse commented that apparently some of the survey effort reported in SC/58/O9 as allocated to the offshore areas (areas 2 and 3) could not be completed due to inclement weather. He questioned whether this would introduce a bias in the sampling regime. Yoshida responded that bad weather did prevent researchers from achieving the sample size planned from offshore areas. However, during the dedicated surveys, all areas were surveyed. Childerhouse noted that while survey data may not be

biased as a result of differing sea states in different portions of the study area, it appeared that there could be a bias in the data derived from harvested whales. Yoshida commented that the high density areas of common minke whale abundance were covered by the sampling survey.

Childerhouse also made a related comment about the lack of coverage of offshore survey areas evident in SC/58/O9 (and SC/58/O20), which highlighted the potential difficulties in using small coastal vessels to achieve representative survey coverage. A response from the authors of SC/58/O20 is provided in the next Agenda Item. Yoshida responded that in regard to the findings reported in SC/58/O9, he did not believe such bias occurred in data from sampled whales off Sanriku district. He further noted that dedicated sighting surveys covering wider areas were conducted concurrently with whale sampling surveys. Results from the sighting surveys indicated that common minke whales were not distributed uniformly off the Sanriku coast; rather sightings were concentrated in limited inshore areas. Since the whale sampling survey included all of the high density areas (i.e. inshore areas), Yoshida believed that the collected samples off the Sanriku coast were representative of whales migrating off the Sanriku coast, although the sampling surveys could not sufficiently cover the offshore waters. Further, Hatanaka responded that sampling with small vessels, while perhaps having less operating capability relative to larger vessels in inclement weather, also had certain advantages. For example, SSVs could not be used for sampling minke whales in certain nearshore areas because of the presence of many small fishing vessels and nets; whereas using small vessels in this situation did not pose a safety risk to fishermen and was less likely to lead to the destruction of fishing gear.

16.2.3 Iceland – North Atlantic common minke whales
The research programme on common minke whales in Icelandic waters that was initiated in 2003 was continued in 2005. The project includes field work and detailed laboratory work for various subprojects:

(1) Feeding:

    (i)   diet composition;
    (ii)   energetics;
    (iii) constituents of prey species;
    (iv) stable isotopes;
    (v)   fatty acid profiles; and
    (vi) seasonal variations in distribution (sighting surveys).

(2) Stock structure:

    (i)   genetics;
    (ii)   telemetry;
    (iii) morphometry; and
    (iv) pollutants and other chemical signals.

(3) Parasites and pathology:

    (i)   haematology and serology;
    (ii)   blood and urine analyses;
    (iii) histology;
    (iv) microbiology;
    (v)   virology; and
    (vi) parasitology.

(4) Biological parameters.

(5) Environmental contaminants.

During 4 July-17 August 2005, 39 common minke whales were taken under a special permit granted by the Government of Iceland. A total of 101 common minke whales have been taken since the beginning of the project in 2003. It is now expected that the sampling of the total of 200 common minke whales according to the original plan will be completed in 2007. The whales were caught from three minke whale catching boats hired by the Marine Research Institute. Searching effort was distributed all around Iceland in proportion to known densities of minke whales. Sampling constraints were imposed by avoidance of whalewatching areas and unfavourable weather conditions in offshore areas. Dissection and sampling of 34 animals took place onboard the vessels. Morphometric measurements were conducted, detection of ectoparasites and skin lesions performed and detailed biological samplings were carried out for various research projects on all collected animals. A special veterinary autopsy was conducted on a subsample of seven animals for parasite and pathological studies in addition to routine investigations and samplings. Detailed weighing of whole animals and individual organs was conducted on nine animals.

The laboratory analyses of most of the samples already collected are finished or at a final stage but interpretation of the results awaits further sampling. Preliminary results give indications of geographical segregation of the sexes. Males have outnumbered females in the areas southwest of Iceland in all the sampling years whereas the sex ratio has been equal or biased towards females in other areas. Preliminary results from analyses of stomach contents from 2003 and 2004 show dominance of sand eel (Ammodytidae), capelin (*Mallotus villosus*) and codfish (Gadidae) in the diet. Increased sampling in offshore areas is planned for the remaining sampling phase and may show different diet composition. Pathological examinations have revealed in general, the good health status of the animals studied.

In addition, field activities directly associated with the minke whale sampling scheme, a series of aerial sightings surveys, initiated in 2003, was continued 11-26 May 2005. The results in 2005 showed considerably lower minke whale densities than observed in mid summer surveys conducted in previous years.

COMMITTEE DISCUSSIONS
In discussion, some members repeated their previously raised comment that SC/58/O20 reported difficulties in sampling due to unfavourable weather conditions in offshore areas. It was also noted that 'Emphasis will be put on increased sampling in offshore areas in the remaining sampling phase that may show different diet composition.' The locations of 95 minke whales taken under special permit in 2003, 2004 and 2005 are given in Víkingsson *et al.* (2005) and SC/58/O20. These are plotted in Fig. 3 which also shows the 100m and 500m depth contours. The 500m contour is a close approximation to the outer boundary of the 9 area divisions described in SC/58/O20.

One member commented that the striking aspect of Fig. 3 was the close distribution to the coast of the sampled animals; approximately 70% of the sampled whales appear to have been in water of less than 100m depth, but water of this depth only covers a small percentage of the total study area. The distribution of sampled whales appears rather

different to the distribution patterns from aerial surveys (e.g. the locations of minke whale sightings from the 2001 NASS aerial survey shown in SC/55/O2, fig. 3) which show minke whales further offshore. He noted that this was particularly evident in stratum 2 (NW Iceland) where 14 out of 15 whales were sampled within fjords. Since the planned sample size for this stratum for the whole programme is 18, there appears to be little scope for further offshore sampling in this case. If estimates of whale diet are to be extrapolated across the study area to total estimates of consumption, he commented that it was critical that samples are representative.

Some members noted that it would be useful to see more details of the sampling design including planned and achieved transects. Given the relatively high struck and lost rate of 5/39 (13%) in 2005 they noted that it would also be useful to know how the decision rules for selecting which whales are sampled are adjusted when animals are struck and lost.
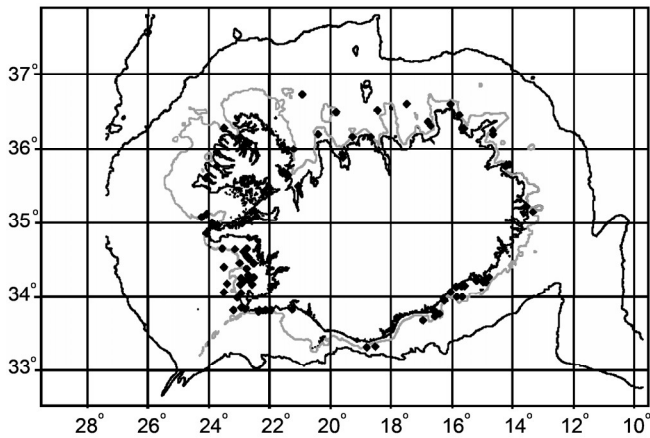

Fig. 3. Locations of special permit catches of minke whales in 2003, 2004 and 2005. Depth contours are 100m and 500m (data from Víkingsson *et al.*, 2005 and SC/58/O20).

In response, the proponents noted that the sampling distribution was originally scheduled as proportional to the relative abundance of common minke whales in Icelandic coastal waters as known from a series of aerial surveys conducted during 1986-2001 (Fig. 4). These surveys were conducted in mid summer so some assumptions had to be made regarding distribution and abundance during spring and autumn. A part of the research programme is aimed at verifying these assumptions.

As stated in SC/58/O20, some sampling problems have been encountered in offshore areas due to bad weather conditions. Search effort is determined by a scientific Cruise Leader onboard every sampling vessel according to pre-determined searching and sampling rules. Considerable search effort has been spent in offshore areas, particularly in areas 2 and 3 north of Iceland but minke whale encounter rates were very low compared to expectations from the mid-summer aerial surveys. Whether this is due to seasonal variation in relative abundance or the rather unusual environmental conditions of the last 3-4 years is unclear. However, despite these difficulties, Fig. 4 shows that the sampling in the first half of the research programme was close to being representative for this area although sufficient sampling has not yet been undertaken in some offshore areas. Increased offshore sampling effort is scheduled in the
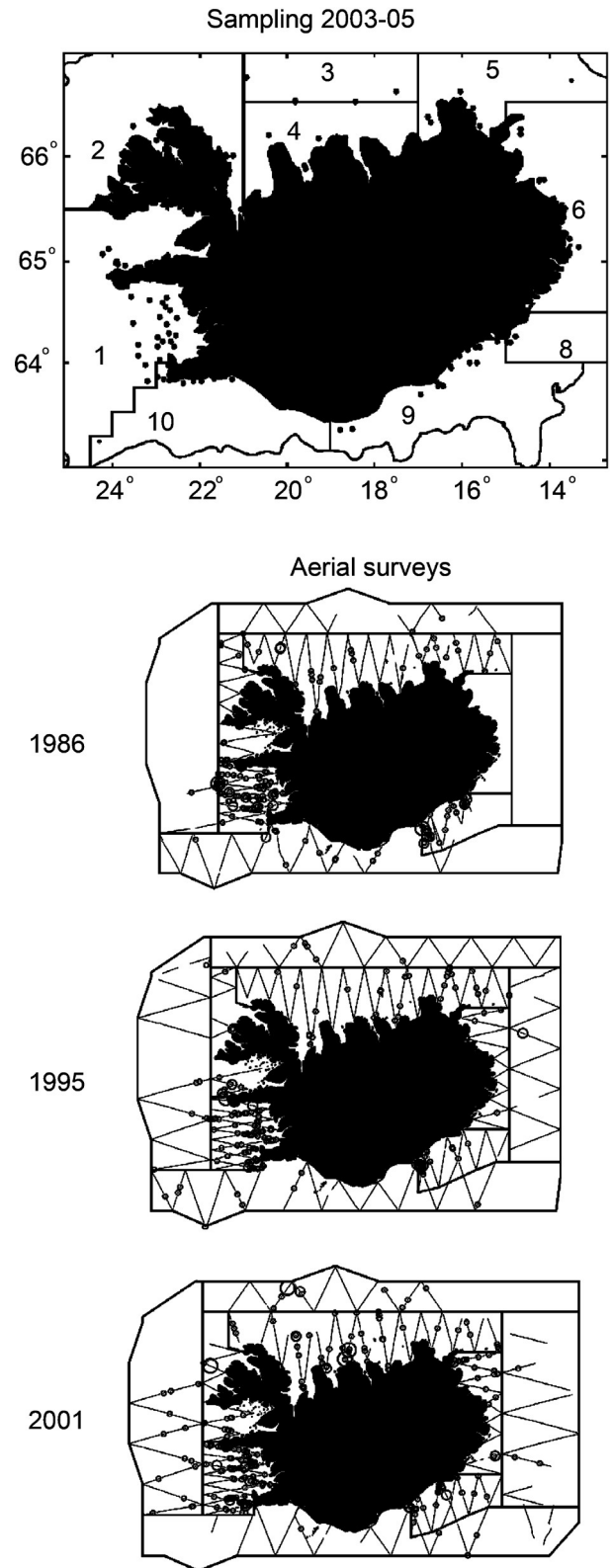

Fig. 4. Distribution of minke whales from aerial surveys 1986-2001 and sampling locations 2003-05.

latter half of the programme to correct for these relatively minor deviations from representative sampling. In addition, the authors of SC/58/O20 noted that restricting effects of weather on the taking of common minke whales was only partly related to vessel size as it was also related to the probability of sighting and chasing the whales. Since the initiation of the programme, a total of five vessels have been used for the sampling varying in size from 30-150

Table 3
Workshops and intersessional meetings planned for 2006/07.

Subject	Item	Venue	Dates	Steering Group
SOWER cruise: planning meeting and future	10.6.2	Tokyo	27-29 September 2006	R14
JARPA review meeting	16.2.4	Tokyo	4-8 December 2006	R13
IWC/CCAMLR meeting on ecosystem modelling	12.2		Summer 2007	R23
Pollution 2000+ Workshop	12.3.1	Europe/USA	Not known	R21
Symposium on diseases	12.3.5	Anchorage	2-day pre-meeting	R29
Planning for bowhead whale *Implementation Review* (two meetings)	8.2	(1) Colorado (2) Seattle	(1) mid-January (2) 19-23 March	R2
Second intersessional Workshop for the western North Pacific Bryde's whale *Implementation*	6.1	Tokyo	10-14 December 2006	R5
Pre-meeting RMP (early start)	6.2	Anchorage	2 day pre-meeting	n/a
Pre-meeting AWMP (early start)	8.1	Anchorage	2 day pre-meeting	R2

tons. The introduction of a 150 ton former research vessel in 2005 did not increase the efficiency of offshore sampling for the reasons given above (weather and distribution patterns).

As regards extrapolations across the study area to estimate total consumption, this will be done by post-stratification at a finer scale than the nine sub-areas. This is part of the newly initiated work on construction of multispecies model based on the GADGET framework and will take into account factors such as bathymetry, oceanography and temporal and spatial distribution of predators and prey.

As originally scheduled, the sampling scheme is being reconsidered based on the experience from the first two years, including ease of sampling and preliminary findings on diet from the first half of the project. The studies so far have indicated considerable differences from the limited data previously available including larger proportions of sand-eel, cod and other gadids and less of krill and capelin.

On the basis of the halfway review of the sampling strategy, slight changes have been made to the original sampling scheme. Apart from increased sampling in offshore areas these changes include transfer of sampling effort from areas with homogenous diet off southwest and south Iceland to areas where there is apparently more diversity in the diet of minke whales.

16.2.4 Preparations for JARPA review
The Working Group reviewed the progress report from the interessional email group preparing for the JARPA review (Annex O, Appendix 2).

16.3 Review of new or continuing proposals
The Working Group did not have time to consider continuing research proposals of Japan (JARPA II and JARPN II) and Iceland. However, it was noted that there were no substantial changes in these proposals since the previous reviews by the Scientific Committee. The Committee therefore refers to its comments made in previous years.

It was noted that it is many years since a number of the stocks taken under scientific whaling permits have been assessed. The Committee **agrees** to assign priority for such in-depth assessments in accordance with the time since the last assessment. After some discussion, the Committee **agrees** that consideration should be given to beginning an assessment for the North Pacific sei whale. According to Committee protocol, such a decision should only be undertaken after: (1) the rationale for the decision has been

presented to the Committee; and (2) a report is prepared that provides a summary of relevant papers, data sources, and desirable data extractions. An intersessional email group was established under Cooke (Annex R31) to prepare such information for next year's meeting. Its TOR is to identify material available or needed for a possible in-depth assessment of the North Pacific sei whale to enable a decision on whether to begin one to be taken at the 2007 Annual Meeting. This material will include relevant papers, data sources and desirable data extractions, as well as identify possible data gaps. In carrying out this task, it will briefly examine the previous assessment (IWC, 1977) and identify the data used for that assessment. The report of the group will be submitted to the sub-committee on in-depth assessments at the 2007 Annual Meeting.

17. WHALE SANCTUARIES
No new proposals for sanctuaries were received. Palazzo briefly stated that Brazil's proposal for the establishment of a South Atlantic Whale Sanctuary was unchanged and discussion of this issue will occur during the Conservation Committee and Commission Plenary meetings.

18. RESEARCH AND WORKSHOP PROPOSALS AND RESULTS
Table 3 lists the proposed intersessional meetings and workshops. Financial implications are dealt with under Item 21.

18.1 Review results from previously funded research proposals
Results from IWC funded projects are dealt with under the relevant agenda items.

18.2 Review proposals for 2006/07
No unsolicited research proposals were received.

19. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2007 MEETING
At this year's Scientific Committee meeting, 14 sub-committees (including SWGs and *ad hoc* Working Groups) were established. The number of sessions for sub-committee deliberations was therefore limited to 90 over a six-day period, based on three concurrent sub-committee meetings for each of five work sessions per day, starting at approximately 08:30 and ending typically at 21:30. At this year's meeting, because of the inability to schedule certain

sub-committees opposite other sub-committees, only 85 could be scheduled.

19.1 Committee priorities for 2007

As in recent years and with the Committee's agreement, the Convenors met after the close of the Committee meeting and drew up the following basis of an initial agenda for the 2007 meeting. The same criteria as previous years were taken into account (e.g. IWC, 2004a, p.51). The Committee recognises that priorities may have to be reviewed in light of decisions made by the Commission.

As last year, with only six days for sub-committee meetings there will be a maximum of 90 sessions available. Items of lower priority on sub-committee agendas will only be discussed if time allows. The Committee **stresses that papers considering anything other than priority topics will probably not be addressed** at next year's meeting. It agrees that this information should be included on the website when the information about document submission is published next year.

There will again be an *ad hoc* Working Group established to consider North Pacific common minke whales and an *ad hoc* Working Group to handle discussions related to ecosystem modelling issues.

In addition, it **agrees** that two pre-meeting meetings will probably be required, depending on intersessional progress; the proposal is that AWMP and RMP will share two days. The Committee **stresses** that these pre-meetings are part of the main sub-committee or SWG agendas; discussion will not be re-opened during the main sub-committee week and the agenda items to be discussed may vary from those expected, depending on progress.

Revised Management Procedure (RMP)
The following issues are all high priority and need to be addressed:

(1) general issues: further evaluate proposed 'threshold' levels for the Guidelines and Requirements for *Implementation*;
(2) general issues: proposed amendments to the RMP, focus on *MSY* rates;
(3) complete western North Pacific Bryde's whale *Implementation* (one intersessional Workshop); and
(4) plan for the start of the North Atlantic fin whale *Implementation*.

Aboriginal Whaling Management Procedure (AWMP)
The following issues are high priority topics and need to be addressed:

(1) complete the bowhead *Implementation Review* (two intersessional Workshops);
(2) review progress on the Greenlandic Research programme and provide management advice;
(3) advice on St. Vincent and The Grenadines fishery;
(4) preparations for the gray whale *Implementation Review*; and
(5) consideration of other large whale species in Greenlandic waters (at request of Commission meeting).

Bowhead, right and gray whales (BRG)
The following work plan was proposed for the coming year. Highest priority will be allocated to:

(1) review of new information on the B-C-B Seas stock of bowhead whales; and
(2) based on advice from AWMP, undertaking of the annual review of catch information and new scientific information for the B-C-B Seas stock of bowhead and ENP gray whales in order to advise the Commission as requested in Schedules 13(b)(1) and (2).

It will also:

(3) review new information on the western North Pacific stock of gray whales; and
(4) review new information on the eastern Arctic bowhead whales.

To the extent that time permits it may also consider:

(5) right whales and other small stocks of bowhead whales.

In-depth assessment (IA)
The following work plan was proposed for the coming year. Highest priority will be allocated to:

(1) producing agreed abundance estimates of Antarctic minke whales;
(2) further examination and agreement on possible reasons for differences between minke abundance estimates from CPII and CPIII;
(3) continued development of the CAA analyses of the Antarctic minke whales; and
(4) develop recommendations for future SOWER cruises, both for the short- and long-term.

It will also:

(5) consider beginning a North Pacific sei whale in-depth assessment.

In-depth assessment of western North Pacific common minke whales with a focus on J-stock (IANP)
High priority will be allocated to work towards completion of assessment and in particular:

(1) continued investigation of stock structure;
(2) continued work on distribution and abundance; and
(3) if documentation is available, development of a standard CPUE series.

Bycatch and other anthropogenic removals (BC)
Highest priority will be allocated to the following.

(1) Further reviewing information and methods to estimate bycatch based on fisheries data and observer programmes, including:

  (a) collaboration with FAO on collation of relevant fisheries data;
  (b) progress on joining the FIRMS partnership;
  (c) review of modelling approaches to determining appropriate levels of observer coverage;
  (d) report back on EU bycatch monitoring schemes;
  (e) review report from NOAA Workshop on the bases for determining serious injuries in whales; and
  (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.

If time and documentation allows, it may also:

(4) consider methods for estimating additional human induced mortalities, e.g from acoustic sources and marine debris.

Southern Hemisphere whales other than Antarctic minke whales (SH)
High priority will be given to the following.

(1) Completion of assessment of humpback whale Breeding Stocks B and C including:

(a) review of abundance estimates;
(b) potential to estimate trends from mark-recapture analysis;
(c) progress on stock structure hypothesis in the breeding grounds;
(d) feeding ground/breeding ground differentiation and connectivity (for catch allocation);
(e) stock structure of feeding grounds;
(f) stock structure hypotheses, catch allocation, abundance estimates and trends in abundance; and
(g) completion of assessment for Breeding Stocks B and C.

(2) Finalisation of the revised 1948/49-1971/72 Southern Hemisphere catch data series.
(3) Progress on blue whale Comprehensive Assessment:

(a) updated catch series;
(b) review progress of the intersessional Working Group;
(c) complete work identified in last year's work plan (IWC, 2006g, p.162);
(d) review genetic, telemetry, photo-identification and acoustics information on migration and distribution; and
(e) review photo-identification data and possibility of mark-recapture approaches.

It will also:

(4) examine historic catch data and the JSV data to improve knowledge of humpback whale distribution at mid-latitudes; and
(5) further examine issues of N_{min} and depensation for population modelling of humpback whales.

If time and documentation allows, it may also:

(6) consider information for other humpback whale breeding stocks.

Environmental concerns (E)
Highest priority will be given to:

(1) review of report of Symposium on infectious and non-infectious diseases of marine mammals and impacts on cetaceans;
(2) review of report of intersessional Workshop on POLLUTION 2000+;
(3) review progress under SOC;

(4) review planning and coordination of IWC's participation in the CCAMLR International Polar Year survey in 2008; and
(5) review progress with respect to the Commission request on entanglement.

It will also:

(6) review progress on a possible climate change Workshop; and
(7) receive the SOCER report (focus: Atlantic Ocean and Mediterranean and Black Seas).

If time and documentation allow it may consider:

(8) progress on acoustics.

Ecosystem modelling (EE)
Priority will be given to:

(1) review progress on joint CCAMLR/IWC Workshop on modelling Antarctic krill predators; and
(2) review collaboration with FAO.

Stock definition (SD)
High priority will be accorded to:

(1) statistical and genetic issues relating to stock definition;
(2) review progress with TOSSM (in particular with respect to *STRUCTURE*); and
(3) consider issues of data quality.

If time and documentation allow it may consider:

(4) unit-to-conserve.

Whalewatching (WW)
High priority will be given to:

(1) assessing the biological impacts of whalewatching on cetaceans; and
(2) identifying data sources from platforms of opportunity of potential value to the Scientific Committee.

It will also consider, as time and documentation allow:

(3) whalewatching in Alaska;
(4) discuss and organise a Workshop on the strategic planning of large-scale whalewatching research;
(5) reports from intersessional Working Groups:

(i) identifying data sources from platforms of opportunity of potential value to the Scientific Committee;
(ii) further development of a questionnaire and improved methodologies to assess the extent and potential impact of swim-with-whale operations
(iii) improvement of data collection from whalewatching operations including further development of the DRS; and
(iv) strategic planning of large-scale whale-watching research;

(6) review of whalewatching guidelines and regulations; and
(7) review of risks to cetaceans from whalewatching vessel collisions.

Small cetaceans (SM)

(1) Population structure, systematics and status of killer whales [highest priority next year];

(2) joint session with E on infectious and non-infectious diseases workshop review;

(3) review of catches; and

(4) progress on previous recommendations.

Scientific permits (SP)

(1) Review the report of the intersessional JARPA review Workshop;

(2) review of results from existing permits;

(3) review new or continuing permits; and

(4) continue to discuss process for reviewing permits.

DNA (DNA)

(1) Review genetic methods for species, stock and individual identification;

(2) continue discussion of plans for sequence validation;

(3) collection and archiving of tissue samples from catches and bycatches; and

(4) reference databases and standards for diagnostic DNA registries.

20. DATA PROCESSING AND COMPUTING NEEDS FOR 2006/2007

The Committee **agrees** the programme for intersessional work by the Secretariat (see Table 4). Progress on these tasks will be reviewed by Donovan, Butterworth, Punt, Cooke, Bjørge and Palka.

A Minority Statement is presented in Annex S.

21. FUNDING REQUIREMENTS FOR 2006/2007

Table 5 summarises the complete list of recommendations for funding made by the Committee. The total required to meet its preferred budget is £315,600. The Committee **recommends** all of these proposed expenditures to the Commission[14].

However, it understands that the projected amount available for funding is £279,000. It therefore carefully reviewed the full list, taking into account its work plan, priorities and the possibility that some of the work requiring funding could be postponed to a future year or years. Such considerations are difficult and the Committee **stresses** that projects for which it has had to suggest reduced or no funding are still considered important and valuable. Should the Commission be unable to fund the full list of items in Table 5, the Committee **agrees** that the final column given in the table represents a budget that will allow progress to be made by its sub-committees and Working Groups in its priority topics. Progress will not be possible in some important areas, as outlined below and the Committee **requests** that the Commission or individual member governments provide additional funding in these areas. The Committee **strongly recommends** that at a minimum, the Commission accepts its reduced budget of £279,000.

A summary of each of the items is given below, by sub-committee or SWG. Full details can be found under the relevant agenda items and annexes as given in the table.

[14] Editor's note. During the discussion of the Finance and Administration Committee's Report in the Commission meeting, the Commission agreed to remove references to Item 26 in the Committee's Budget Request (see Table 5) as discussed in IWC (2007).

Revised Management Procedure
(1) North Pacific Bryde's whale - intersessional Workshop
The Commission has endorsed the process recommended two years ago by the Committee with respect to the time schedule if an *Implementation* begins (IWC, 2005d, pp.84-92); this requires two intersessional Workshops and this is the final Workshop required to allow completion of the *Implementation* at the 2007 annual meeting. The funding is required to cover the costs of invited participants; Japan has kindly offered to host the Workshop which will probably take place 10-14 December 2006.

Aboriginal Subsistence Whaling Management Procedure
(2) AWMP developers fund
The developers fund has been invaluable in the work of the AWMP trials and other essential tasks of the SWG. It has been agreed as a standing fund by the Commission. The two primary developing tasks facing the SWG are the bowhead whale *Implementation Review* (a requirement of the Committee and Commission) and issues relating to the Greenlandic fisheries. The task facing the SWG with respect to the Greenlandic fisheries is a major one and of High priority to the Committee which has expressed its great concern at its inability to provide management advice on safe catch limits (see Items 8.1 and 9.4). The fund is essential to allow progress to be made.

(3) Greenland common minke whales – steering group on the use of sex ratio data to provide management advice
The Committee is unable to provide satisfactory management advice on the effects of aboriginal subsistence whaling on the common minke whale stocks off West Greenland. A major problem in terms of its ability to give management advice is that the total geographical area occupied by common minke whales potentially available to be harvested off West Greenland during summer is largely unknown and thus surveys consequently cover an unknown fraction of the range of the stock. There has been a fundamental difficulty in the AWMP discussions as to whether sex ratio data alone are a sufficient basis for management advice and for the development of an *SLA* for common minke whales. Given our inability to provide satisfactory management advice and the potential for the use of sex ratio data (alone or in conjunction with other information), it is essential that this issue be resolved.

(4) Two intersessional Workshops to allow completion of the bowhead whale Implementation Review
Last year, the Committee agreed that it would require two intersessional workshops to ensure completion of the Bowhead *Implementation Review* by the 2007 Annual Meeting. This is essential as the Commission will need management advice to set the forthcoming catch limits that run out after the 2007 season.

In-depth assessments
(5) SOWER circumpolar cruise
The Committee and the Commission have both given high priority to obtaining agreed abundance estimates for Antarctic minke whales and for explaining the differences between CPII and CPIII. The High priority plans for this year's survey are directed at experiments to address these problems as well as continue work related to:

Table 4

Computing tasks/needs for 2006/07.

RMP – general issues
Work to specify the additional environmental degradation trials for testing amendments to the *CLA* (see Item 5.3).

RMP – preparations for *Implementation*
Work in preparation for the intersessional Workshop for western North Pacific Bryde's whales: condition trials specified during this meeting and revise age dependent mixing trials if possible. Run all trials and prepare results for the intersessional Workshop.
Work resulting from intersessional Workshop for western North Pacific Bryde's whales (may include running of additional trials).
Preparation of a comprehensive list of North Atlantic fin whale catches including notations on data quality and ancillary information (in collaboration with Bloch and Gunnlaugsson).
Encoding of North Atlantic catch data from the early 1900s (as supplied by Bloch).

AWMP
Confirm preliminary results from AWMP-lite presented at this meeting and modify the code to remove priors on 1993 abundance and enable the program to be used for projections.
Work resulting from intersessional Workshops for the bowhead *Implementation Review* (incorporate final bowhead whale catch info).

In-depth assessment
Validation of the 2005/06 SOWER cruise data and incorporation into the sightings database.

Southern Hemisphere whale stocks
Preparation of a 'final' revised 1948/49-1971/72 Southern Hemisphere catch data series (including collaboration with appropriate scientists).
Encoding of the new individual catch data from the *Yury Dolgoruky* for the 1969/70 season.
Preparation of a Southern Hemisphere blue whale catch series.

Table 5

Summary of budget requests for the coming year. The number in parentheses after the short title refers to the number in the discussion in Item 21.

Short title	Reference item	Requested (£)	Reduced (£)
RMP (Annex D)			
North Pacific Bryde's whale *Implementation* – second intersessional Workshop (1)	6.1	7,500	7,500
AWMP (Annex E)			
AWMP developer's fund (2)	8	10,000	9,000
Greenland common minke whales: use of sex ratio data in assessments (3)	8.1.3, 9.4	4,000	3,500
Two intersessional workshops to allow completion of the *Implementation Review* in 2007 (4)	8.2	18,000	16,000
IA (Annex G)			
SOWER circumpolar cruise 2006/07 (5)	10.6.2.1	86,000	76,000
Investigation of likely precision of future abundance estimates using a single SOWER vessel (6)	10.6.2.1	4,000	4,000
Incorporation of 2005/06 data into IWC-DESS (7)	10.6.2.1	2,000	2,000
Analysis of previous data (BT mode) to *inter alia* allow finalisation of cruise planning (8)	10.6.2.1	6,000	6,000
Maintenance of IWC-DESS (9)	10.6.2	2,000	2,000
Further development of hazard probability method to estimate abundance of Antarctic minke whales (10)	10.1.1.2	3,000	1,700
Investigation of the relationship between minke whales and sea ice (11)	10.1.3	3,000	700
Antarctic minke whales: continuation of previous catch-at-age analysis study (12)	10.1.2	20,000	20,000
Digitise, catalogue and analyse blue whale photographs from the IWC IDCR and SOWER cruises (13)	10.6.1, 10.4	8,500	8,500
SH (Annex H)			
Antarctic humpback whale catalogue (14)	10.3.2	6,600	6,600
Humpback whale population dynamics model (15)	10.3.2	2,000	2,000
Forwarding the in-depth assessment of southern blue whales (16)	10.4	10,000	6,000
SD (Annex I)			
TOSSM development: generation of datasets (17)	11.2	16,000	16,000
BC (Annex J)			
Further simulations to investigate the performance of various sampling designs (18)	7.2.1	3,000	2,000
Development of standardised reporting of collisions between whales and vessels (19)	7.3.1	2,000	1,000
E (Annex K)			
CCAMLR-IWC steering group for joint Workshop on the Antarctic ecosystem and krill predators (20)	12.2	5,000	3,000
FAO expert consultation on modelling ecosystem interactions (21)	12.2	3,000	1,500
Completion of the Southern Ocean Collaboration database (22)	12.3.2	20,000	15,000
Continuation of analyses of high priority projects identified last year (23)	12.3.2	15,000	12,000
Possible collaboration with CCAMLR for a joint cruise in 2008 (24)	12.3.2	1,000	1,000
SOCER report	12.3.3	3,500	0*
SP (Annex O)			
JARPA review Workshop (25)	16.2.4	15,000	13,000
Scientific Committee general			
Finalise revised 1948/49-1971/72 catch data (26)	20.1	5,000	5,000
Invited participants fund (27)		38,000	38,000

*Money from the voluntary contributions fund (Austria) has been generously donated.

(1) estimating fin whale abundance;
(2) improving estimates of distance/angle estimation; and
(3) to continue research on blue whales and humpback whales which are the subject of a comprehensive assessment.

The funding is for equipment and participation by international scientists. The vessel is generously provided by the Government of Japan.

(6) Investigation of likely precision of future abundance estimates using a single SOWER vessel
It is difficult to consider the future strategy of the SOWER cruises with respect to estimating abundance without a fuller investigation of the effect of having only one vessel. This proposal will provide partial funding for one (Hedley) of three scientists (the others are Bravington and Peel) to use the existing data to examine the likely effects of new survey design and techniques on the CV of abundance estimates. An initial report will be available by the time of the planning meeting in Tokyo (end of September 2006) and a full report will be presented to the 2007 Annual Meeting.

(7) Incorporation of the 2005/06 survey data into IWC-DESS
Last year, a considerable amount of new experimental data was collected on the cruise (e.g. see point 8 below). It is essential that this is incorporated promptly into the IWC-DESS database so that appropriate analyses can be carried out, preferably before the planning meeting in Tokyo at the end of September 2006. This work will be undertaken by the IWC Secretariat in conjunction with Burt.

(8) Analysis of the BT mode data collected during the 2005/06 cruise
Last year, collection of BT mode data as part of a feasibility study was given high priority, since it can potentially incorporate estimates of $g(0)$ and incorporate reactive movement (if there is any) into abundance estimates of Antarctic minke whales. It is essential that these data are analysed in time to be considered at the planning meeting in Tokyo (end of September 2006). A full report will be presented (by Burt) to the 2007 Annual Meeting.

(9) Maintenance of IWC-DESS
DESS is vital to the Committee's work on abundance estimation, both with respect to providing estimates of abundance for past cruises and for future work on the abundance of Antarctic minke whales.

(10) Abundance estimates of Antarctic minke whales: method development
The Commission and the Committee have given High priority to obtaining agreed abundance estimates and trends for Antarctic minke whales. To maintain the progress expected by the Commission requires that this project and project 11 (below) are funded. This project is to further develop the hazard probability method (e.g. see SC/58/IA9) and in particular to further the incorporation of measurement errors into the analysis. The funding is for one (Kitakado) of the two collaborators, the other being Okamura who is employed by a governmental institute.

(11) Analysis of relationship between Antarctic minke whales and pack ice extent.
The Commission and the Committee has also given high priority to explaining the differences between CPII and CPIII. This project could help interpret the differences between abundance estimates from CPII and CPIII. The reduced budget reflects only funding the requested computer program license for *GIS* software for Shimada.

(12) VPA analysis and CAA analysis
This work has been recommended by the Committee in the past and is essential in furthering the work on exploring the reasons for differences in Antarctic minke whale abundance from CPII and CPIII and working towards an in depth assessment. The data have been generously been made available by the Institute of Cetacean Research (Tokyo) under the DAA.

(13) Analyses of the blue whale photographs from the SOWER cruises (with SH)
The Committee has agreed to begin an in-depth assessment of Southern Hemisphere blue whales. There is also considerable interest within the Commission with respect to the status of this species. The IWC IDCR and SOWER cruises have been taking photographs for individual identification for many years but, unlike the humpback whale photographs, these have not yet been catalogued. It is essential to the in-depth assessment that this work be undertaken. The money is for one researcher (Olsen) to digitise and catalogue the photographs, then analyse the available data. Database design will be undertaken in consultation with Donovan and the resultant catalogue and database will be publicly available. Initial priority will be given to photographs from Area III so that information can be made available to the Tokyo planning meeting at the end of September 2006.

Southern Hemisphere humpback and blue whales
(14) Antarctic Humpback Whale Catalogue
The Committee is already committed to funding this project, which represents only a partial cost of running the catalogue and is of great benefit to its in-depth assessment of Southern Hemisphere humpback whales (and see SC/58/Rep5). The work required to *inter alia* make the SOWER photographs more accessible is being carried out. The funds are mainly required for database management.

(15) Humpback whale population dynamics model
The Committee has placed high priority on completing the Comprehensive Assessment of Southern Hemisphere humpback whales. A number of modelling issues were identified to facilitate this. The Marine Resource and Assessment Group at the University of Cape Town will undertake this work and report to the 2007 Annual meeting.

(16) Forwarding the Comprehensive Assessment of southern blue whales (with IA)
The Committee has agreed to begin an in-depth assessment of Southern Hemisphere blue whales. There is also considerable interest within the Commission with respect to the status of this species. This project will allow progress to be made (by Branch and colleagues) intersessionally for discussion at the next Annual Meeting. It will address:

(1) blue whale distribution;
(2) revised abundance estimates for the Antarctic using IDCR and SOWER cruise data; and
(3) develop an abundance estimate for Chilean waters from the SOWER cruise in 1997/98.

Stock definition
(17) TOSSM development: specialist programmer
Stock definition issues are critical to the work of numerous sub-committees, including AWMP, RMP, NPM and SH. In particular, there has been insufficient testing (in a management context) of many of the statistical methods for examining stock structure. The TOSSM project represents a major step forward in this regard and critical to its success is the generation of a sufficient number of datasets and adapting potential boundary setting methods such that they can be more easily investigated. This is a major programming challenge which existing resources cannot quickly meet. The funding here is matching funding to allow one year's dedicated work by an expert programmer at SWFSC, California.

Bycatch
(18) Further simulation studies to investigate the performance of various sampling designs to estimate numbers of bycaught animals
Last year the Commission funded a study to investigate the ability or otherwise of mark-recapture/market sampling methods to estimate the number of bycaught animals for use in the RMP. This project expands on that work and will investigate the performance of different sampling designs and sensitivity to assumptions about market structure based on current knowledge. The simulations are needed before a decision can be made for the need for the planned 2nd stage Workshop. The funding is for ~4 weeks work including preparation of a report (by Leaper [Russell] and Cooke).

(19) Standardised reporting of collisions between whales and vessels
The Committee recommends that the intersessional email group develops a process by which data provided from a range of sources could be stored in a database in a standardised way that clearly identifies the level of uncertainty in the data. The funding is for ~ 3 weeks work (Van Waerebeek) including preparation of a report.

Environment
(20) Joint IWC-CCAMLR Workshop on modelling Antarctic krill predators and (21) FAO consultation on modelling ecosystem interactions
Ecosystem modelling is becoming more important to the Committee's work, particularly in attempting to understand what may have happened in the Antarctic as a result of intensive exploitation of whales and other marine mammals. The Committee agreed that a collaborative effort with CCAMLR would make an important contribution to its work. The funds are requested to enable IWC participation at the Steering Group meeting that will probably be held in Namibia in July 2006 and to progress IWC participation at the FAO consultation whose task is to review major ecosystem modelling approaches being applied to fishery-related topics and to provide advice on their use.

(22) Completion of the Southern Ocean collaboration database and (23) Continuation of analyses of high priority projects identified last year
This work will contribute to high priority analyses outlined in the sea ice Symposium held last year and to ongoing collaboration with SO-GLOBEC. Research on SO whales and their ecosystem is recommended by IWC Resolutions 1998-3 and 1998-6. Support for this activity complements the considerable in-kind support the IWC receives for the SO collaborative cruises. The SOC database comprises data for all IWC/SO-GLOBEC/CCAMLR and other multi-disciplinary survey data and sea ice data under international collaborative programmes. Completion of the database (to be undertaken by Thiele) will contribute to High priority analyses, outlined in IWC (2006b). The funds for project 23 are to be used to allow Thiele to complete High priority items identified at last year's sea ice Symposium and to represent IWC and forward collaboration with ICED.

(24) Possible collaboration with CCAMLR for a joint cruise in 2008
CCAMLR has invited the IWC to place observers on board one or more of its ships as part of International Polar Year. The funds are for Hedley to coordinate this effort.

Scientific Permits
(25) JARPA
The Committee agreed last year to hold a Workshop to review the results of the first JARPA programme. The funds are for invited participants to attend the Workshop which will be hosted by Japan in Tokyo in early December 2006.

Scientific Committee
(26) Finalise revised 1948/49-1971/72 catch data
Funds are requested for Mikhalev to try to obtain copies of technical, administration and inspection reports which might help clarify some remaining inconsistencies in the data and to meet with Allison to confirm the final revised 1948/49-1971/72 Southern Hemisphere catch series. Funds are also requested to enable Tormosov to transfer the new individual catch data sheets for the *Yury Dolgoruky* for the 1969/70 season to the IWC.

(27) Invited Participants fund
The Committee **draws attention** to the essential contribution made to its work by the funded Invited Participants (IPs). The IWC-funded IPs play an essential role in the Committee's work including the critically important roles of chairs and rapporteurs. They represent excellent value as they receive only travel and subsistence costs and thus donate their time, which is considerable. As was the case for previous meetings, where possible, effort will be made to accommodate scientists from developing countries.

22. WORKING METHODS OF THE COMMITTEE

Donovan clarified the rules governing the two procedures by which funding can be sought from the IWC for research projects.

(1) Unsolicited research proposals. A fixed procedure is in place for such proposals, but a lack of funds in recent years has meant that implementation of the procedure

has rarely been necessary. This route should be used for either new research proposals or those that are not considered to be of the highest priority by the Scientific Committee.

(2) Research generated within the Scientific Committee. This funding route aims to ensure that the Committee's priorities are met. When high priority work is identified during sub-committee deliberations the sub-committee can quickly bring a proposal to the Committee, identifying the person(s) who will do the work, the timeframe in which it must be completed and if necessary a full research proposal. It is not appropriate for individuals to develop unsolicited research proposals and submit them to the sub-committees.

23. ELECTION OF OFFICERS

The Committee agreed that there was no need for elections this year. Bjørge reminded the Committee of the change in procedure in 2004, in which the vice-Chair automatically succeeds the current Chair. Thus no new elections are expected until 2008.

24. PUBLICATIONS

Donovan reported that a large number of papers had been published in the previous year and that the Journal continues to attract increasing numbers of submissions. He reminded delegates to encourage their institutions to subscribe to the Journal. The success of the Journal will be greatly increased as it becomes established in more libraries.

It was noted that papers presented to the Workshop on the Comprehensive Assessment of Southern Hemisphere humpback whales, Hobart, 2006, may be incorporated into a special issue along the lines of that on Right Whales (JCRM, Special Issue 2). The submission procedure is outlined in SC/58/Rep5 and potential authors will be contacted.

Donovan reported he and Hammond will complete the long-anticipated special issue on the RMP before the next meeting.

Finally, Donovan thanked all those involved with Publications, Stella, Helen, Andrea and Jemma, for all their hard work, particularly with respect to the production of the Supplement, which requires much work following the completion of the Annual Meeting.

25. ANY OTHER BUSINESS

Following the end of the Scientific Committee meeting, Berggren stepped down as the Convenor for the sub-committee on estimation of bycatch and other human-induced mortality. Bjørge acknowledged his hard work in evolving the sub-committee and praised his punctuality in submitting his report every year. Several excellent successors had been suggested, but Perrin was appointed and Bjørge wished him well in his new role.

Bjørge thanked his predecessor, DeMaster, for all his advice and guidance in what had been his first year as the Chair of the Scientific Committee. He also thanked Donovan and Palka for all their help during the build up to the meeting and hoped that the support shown towards him by all members of the Committee this year would be extended into his second year as Chair.

On behalf of the entire Scientific Committee, Bjørge expressed his gratitude to Joseph Simmonds, who had organised both a cricket match and dinner for the Committee. He also thanked the Government of St. Kitts and Nevis for providing the excellent facilities and logistical support and the Secretariat for ensuring the smooth running of the meeting.

26. ADOPTION OF REPORT

The report was adopted at 15:35hrs on 6th June 2006. As usual, final editing was carried out by the Convenors after the meeting.

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