Report of the Scientific Committee

*This Report is **CONFIDENTIAL***

until

10.00am** on **Monday 22nd June

International Whaling Commission, Madeira, 2009

Scientific Committee Report

Madeira, Portugal, 31st May – 12th June 2009

Contents

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The meeting was held at the Casino Park Hotel, Funchal, Madeira, Portugal from 31 May-12 June 2008 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 Regional Government of Madeira and the Government of Portugal for hosting the meeting and for providing excellent facilities in such beautiful surroundings. He also thanked Luis Frietas from the Madeira Whaling Museum for all his help with arrangements both within and outside the meeting. In accordance with the procedure agreed last year, Bjørge announced that there would be an additional presentation aimed at improving understanding of the *Implementation* process by those not involved in the Revised Management Procedure sub-committee.

Frietas addressed the Committee and wished everyone a pleasant stay. He hoped that participants would be able to enjoy the beautiful scenery and weather as well as to have a successful meeting. He noted that there are plenty of things to see and do on Madeira if time permits.

1.2 Appointment of rapporteurs

Donovan was appointed rapporteur with assistance from 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

The Aboriginal Whaling Management Procedure (AWMP) Standing Working Group (SWG) met from 29-30 May, during which agenda items covered were incorporated into their main agendas and reports (Annex E).

A number of sub-committees and Working Groups were established. Their reports were either made annexes (see 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;
Annex G – Sub-Committee on In-Depth Assessments;
Annex G1 – Working Group on the In-Depth Assessment of Western North Pacific Common Minke Whales, with a Focus on J Stock;
Annex H – Sub-Committee on Other Southern Hemisphere Whale Stocks;
Annex I – Working Group on Stock Definition;
Annex J – Working Group on Estimation of Bycatch and other Human-Induced Mortality;
Annex K – Standing Working Group on Environmental Concerns;
Annex K1– Working Group to Address Multi-species and Ecosystem Modelling Approaches;
Annex L – Standing Sub-Committee on Small Cetaceans;
Annex M – Sub-Committee on Whalewatching; and
Annex N – Working Group on DNA

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 R. The Agenda took into account the priority items agreed last year and approved by the Commission (IWC, 2009e, pp.64-66). 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. This year, 23 people opted to receive their primary papers entirely electronically and he hoped that this number would grow in future years. The list of documents is given as Annex C.

3.2 National Progress Reports on research

National Progress Reports presented at the 2002-09 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, 1993c). Non-member nations wishing to submit progress reports are welcome to do so. The Secretariat is looking into the

Table 1
List of data and programs received by the IWC Secretariat since the 2008 meeting.

Date	From	IWC ref.	*Details*
Catch data from the previous season:			
10-05-09	Norway: N. Øien	C08	Individual minke catch records from the Norwegian 2008 commercial catch. Access restricted (specified 14-11-00).
29-05-2009	Iceland: G. Víkingsson	C08	Individual catch records from the Icelandic commercial catch 2008.
31-05-2009	Japan: H. Okada	C08	Individual catch records from the Japanese 2008 North Pacific special permit catch (JARPN II) and 2008/09 Antarctic special permit catch (JARPA II).
1-06-2009	Russia: R.G. Borodin	C08	Individual catch records from the aboriginal harvest in the Russian Federation in 2008
Historic Catch data:			
25-11-08	D. Tormosov		Individual whale passports for right and pygmy blue whales taken by *Yuri Dolgoruky* 1961-9
30-10-08 + 21-5-09	P. Best		Donkergat 1947 official whaling reports, 1960 and 61 platform records and 1965 log book. *Abraham Larsen* 1956/7 log book.
Sightings data/programs:			
05-09-08	H. Shimada		Films and prints for photo identification from 4 SOWER cruises (2001/2 - 2004/5)
18-11-08	G. Donovan	CD87-89	Photographs from 2007/8 SOWER cruises (catalogued).
02-03-09	P. Ensor		2008/9 SOWER cruise data (sightings, effort, weather, ice edge etc and photographs)
30-05-09	D. Palka		Simulated IDCR line transect data sets 2009
Other data/programs:			
08-06-09	A. Brandão		Programs for the W. Greenland minke sex-ratio estimation methods used in SC/61/AWMP7 and during SC61
08-06-09	L. Witting		Programs for the W. Greenland minke sex-ratio estimation methods used in SC/61/AWMP5 and during SC61

possibility of online submission of the data included in national Progress Reports.

A summary of the information included in the reports presented this year is given as Annex O; the modified report template, taking account of recent updates, will be made available on the IWC website (*www.iwcoffice.org*) by 5 January 2010. The importance of using the agreed template was **emphasised** by the Committee. Suggestions for changes to the progress report template made by sub-committees will be incorporated into the new template.

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 2008 meeting.

3.3.2 Progress of data coding projects and computing tasks

Allison reported that work has continued to enter catch data into both the IWC individual and summary catch databases. This includes data received from the 2008 season and also the historic data listed in Table 1. Detailed validation of the revised Southern Hemisphere individual catch data 1948-72 has continued including entry of detailed biological information. Version 4.2 of the catch database is now available.

Allison requested that members of the Committee inform her of any potential new sources of data for incorporation into the catch databases.

Bycatch data from the 2005-07 seasons were entered into a database using a format developed by Simon Northridge.

Data from the 2007/08 SOWER sightings cruise have been validated and incorporated into the DESS database and work on encoding and validation of data from the 2008/09 cruise has begun. In addition, validation of the data from the 1995-97 blue whale cruises has been initiated.

Programming work during the past year has focussed on the completion and application of the control program for North Atlantic fin whale *Implementation Simulation Trials* and is discussed further under Item 6.2. In addition, following a request from the Workshop on MSYR for baleen whales (SC/61/Rep6), a program was created to generate simulated datasets for estimation of MSYR in the presence of environmentally induced variability (see Item 5.1).

4 COOPERATION WITH OTHER ORGANISATIONS

4.1 Convention on the Conservation of Migratory Species (CMS)

4.1.1 Scientific Council

The report of the IWC observer at the Scientific Council meeting held in Rome, Italy from 27-28 November 2008 is given as IWC/61/4D. Progress was noted on development of a work plan to comply with a COP resolution on adverse human impacts on cetaceans. The following proposals for listing species and regional populations on Appendices were reviewed and endorsed:

Appendix I (complete protection):

(1) Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*) - proposed by Monaco;
(2) Irrawaddy dolphin (*Orcaella brevirostris*) – proposed by Philippines;
(3) Atlantic humpback dolphin (*Sousa teuszii*) – proposed by Senegal.

Appendix II (would benefit from international cooperative research; appropriate for inclusion in regional agreements):

(1) Harbour porpoise (*Phocoena phocoena*) Northwest African population – proposed by Mauretania;

(2) Risso's dolphin (*Grampus griseus*) Mediterranean population – proposed by Monaco;
(3) Bottlenose dolphin (*Tursiops truncatus*), change of listing from western Mediterranean population to Mediterranean population;
(4) Clymene dolphin (*Stenella clymene*) West African population – proposed by Guinea-Bissau.

The Council reviewed and endorsed resolutions proposed for the COP on: (1) the impacts of climate change on migratory species (including cetaceans); (2) adverse anthropogenic impacts of noise on cetaceans; and (3) bycatch. Progress in implementing a programme of work on bycatch was reviewed. The taxonomic split of *Orcaella brevirostris* into *O. brevirostris* and *O. heinsohni* was noted. Further information can be found at *www.cms.int*.

4.1.2 Conference of Parties

The Conference of Parties was held in Rome, Italy from 1-5 December 2008. The proposed additions to Appendices I and II were adopted as were the resolutions described under 4.1.1. An additional resolution was adopted calling for increased research, increased international cooperation among IGOs and elevation of other activities concerning migratory marine species. The Ganges River dolphin (*Platanista gangetica gangetica*) and the Black Sea bottlenose dolphin were added to the list of species for Concerted Action. The classification in the second edition of the *Encyclopedia of Marine Mammals* (Perrin, Würsig and Thewissen, eds., 2009) was adopted as the standard nomenclatural reference for marine mammals.

The Committee thanked Perrin for the report and **agrees** that he should represent the Committee as an observer at the next CMS Conference of Parties.

4.1.3 Agreement on Small Cetaceans of the Baltic and North Seas (ASCOBANS)

The report of the IWC observer at the 16th meeting of the Advisory Committee to ASCOBANS held in Bruges, Belgium from 20-24 April 2008 is given as IWC/61/4I. The main topics of relevance to the IWC are summarised below.

(1) Workshops and meetings held in conjunction with ASCOBANS in 2007/08:
    (a) Jastarnia group fourth meeting (23rd to 25th February 2008) in Sweden;
    (b) joint ASCOBANS/HELCOM Workshops, 8-10 October 2007; and
    (c) workshop on 'Selection Criteria for Marine Protected Areas for Cetaceans' held at the European Cetacean Society's 21st Annual Conference, San Sebastian, Spain, 22nd April 2007.
(2) The Jastarnia Plan (for the conservation of harbour porpoises in the Baltic) final draft will be forwarded to the Meeting of Parties (MoP) (Bonn, September 2009) along with a draft resolution.
(3) The ASCOBANS Conservation Plan for Harbour Porpoises in the North Sea is expected to be presented to the MoP.
(4) Review of new information on bycatch and other causes of mortality: the high level of bycatch of harbour porpoises in the Western Baltic Sea was highlighted and new information indicates that these are not sustainable.
(5) The results of the joint ASCOBANS/HELCOM workshops on genetics and population structure were discussed. These included recommendations for management units for harbour porpoise, bottlenose dolphin, white-beaked dolphin, Atlantic white-sided dolphin and short-beaked common dolphin.
(6) Review of new information on pollution, underwater sound and disturbance:
    (a) potential implications for harbour porpoises in the Baltic Sea of the fixed Fehmarn-Belt link were discussed;
    (a) documents indicated a correlation between the timing of historical declines of coastal bottlenose dolphins in the UK and the peak time of PCB concentrations in the environment;
    (b) attention was drawn to the need to investigate on the potential impact of noise and disturbance arising from the current increase of construction of marine wind farms research;
    (c) the controlled detonation of unexploded ordnance in German waters and its potential danger to small cetaceans and other animals was discussed and a potential mitigation method using bubble curtains was presented;
    (d) noise pollution was highlighted as an issue of concern several projects are underway in the ASCOBANS area to investigate potential effects of noise on cetaceans; and
    (e) progress by the IMO Marine Environment Protection Committee Correspondence Group on incidental noise from commercial shipping was discussed.

The Committee thanked Scheidat for her report and **agrees** that she should represent the Committee as an observer at the next ASCOBANS Advisory Committee meeting. Further information can be found at *www.ascobans.org*.

4.1.4 Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)

No meetings of ACCOBAMS occurred during the intersessional period, but cooperation continues on a number of issues, including ship strikes (see Item 7). Donovan agreed to continue represent the Committee with respect to ACCOBAMS. Further information can be found at *www.accobams.org*.

4.1.5 Memorandum of Understanding (MoU) on the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia

The report of the IWC observer documenting the 2008 activities of the MoU on the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia is given as IWC/61/4D. The MoU was signed at the second intergovernmental meeting on the aquatic

mammals of western Africa and Macaronesia held in Lomé, Togo 2-3 October 2008. Signatories included representatives of 15 nations (Angola, Benin, Cape Verde, Chad, Congo Brazzaville, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea-Bissau, Liberia, Mali, Mauritania, Niger and Togo). Three NGOs also signed the MoU; Wetlands International Africa, Wildlife Trust and GSM (Society for the Conservation of Marine Mammals. Expected additional parties include Nigeria, Spain and Portugal (Macaronesia encompasses Madeira, the Canary Islands and the Cape Verde Islands). The MoU is the culmination of 8 years of effort to develop a regional agreement covering the aquatic mammals of West Africa; the first workshop to this end was held in Conakry in 2000. Also adopted were action plans for the manatee and for small cetaceans.

The Committee thanked Perrin for his report and **agrees** that he should represent the Committee at future activities related to the MoU on the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia.

4.2 International Council for the Exploration of the Sea (ICES)

The report of the IWC observer documenting the 2008 activities of ICES is given as IWC/61/4B. The ICES Working Group on Marine Mammal Ecology (WGMME) met in February 2008. There are currently no reliable long-term time series for abundance (or abundance indices) available for endemic arctic marine mammals. The lack of this data makes it difficult to reliably assess current impacts of changes in climate on these species' populations. WGMME also noted that no reliable current bycatch estimates for marine mammals in the North Sea are available.

Cetacean conservation objectives and criteria were reviewed and realistic monitoring options considered, including those recommended by the SCANS II project. The project evaluated and developed methods for monitoring trends in abundance of small cetacean species and provided a comparison of cost-effectiveness of the different methods. Additionally, a simulation model considering a wide range of parameters and incorporating uncertainties in e.g. abundance estimates, was used to tune a specific bycatch management procedure so that one would expect to achieve the conservation objective in practice. This is discussed under Item 14.1.

The 2008 ICES Annual Science Conference (ASC) was held in Nova Scotia, Canada, 22-26 September 2008. Several ICES committees dealt with marine mammal issues. A number of sessions were of relevance to the Committee, including those describing:

(1) how changed ice conditions may have influenced distribution and migrations of minke whales and killer whales;
(2) the seasonal distribution of sperm whales;
(3) trends in diseases of marine organisms, including studies of harbour porpoises;
(4) the question of how to keep vulnerable mammals away from fishing grounds was raised;
(5) comparative dynamics of populations in the Baltic Sea and Gulf of St Lawrence ecosystems, included ecological studies of blue whales; and
(6) new methodology for tracking fish, mammal, and seabird behaviour and migrations.

A joint symposium with NAFO and NAMMCO entitled 'the role of marine mammals in the ecosystem in the 21st century' took place in Dartmouth, Canada, 29 September-1 October 2008.Sessions were held covering the following topics:

(1) biological and environmental factors affecting life history traits;
(2) foraging strategies and energetic requirements;
(3) theoretical considerations on apex predators and multispecies models; and
(4) marine mammal – fisheries interactions.

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)

No observer for the IWC attended the 2008 meeting of IATTC.

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

No observer for the IWC attended the 2008 meeting of ICCAT.

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

The report of the IWC observer at the 27th Meeting of the CCAMLR Scientific Committee (CCAMLR-SC), held in Hobart, Australia from 23-27 October 2008 is given as IWC/61/4A. The main items considered at the CCAMLR meeting of relevance to the IWC included:

(1) fishery status and trends of Antarctic fish stocks, krill, squid and stone crabs;
(2) incidental mortality of seabirds and marine mammals in fisheries in the CCAMLR Convention Area;
(3) harvested species (krill, fish, and stone crabs and their assessment);
(4) ecosystem monitoring and management;
(5) management under conditions of uncertainty about stock size and sustainable yield;
(6) scientific research exemption;
(7) CCAMLR Scheme of International Scientific Observation;
(8) new and exploratory fisheries;
(9) joint CCAMLR-IWC workshop with respect to ecosystem modelling in the Southern Ocean; and
(10) the CCAMLR performance review.

The joint IWC-CCAMLR workshop was held in Hobart, Australia, 11-15 August 2008. A full discussion of the workshop and its outcomes can be found in under Item 13.1 and in Annex K1.

Guidelines on the identification of Vulnerable Marine Ecosystems were developed and discussions by CCAMLR

and the CEP (Committee of Environmental Protection). They concluded that priority should be given to determining where and how a system of marine areas for the conservation of biodiversity in the Southern Ocean can be established.

No reports on cetacean-fisheries interactions were received by CCAMLR in 2008. No cetaceans were killed in any of the fisheries in the Southern Ocean and modified longline gear has been increasingly used in the 2007/08 season to deter cetaceans.

The Committee thanked Kock for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next CCAMLR-SC meeting.

4.6 Southern Ocean GLOBEC (SO-GLOBEC)

The synthesis and analysis process under SO-GLOBEC has continued and has produced a number of papers relating cetacean distribution to prey and other environmental variables. There is no active work with respect to SO-GLOBEC at this time.

4.7 North Atlantic Marine Mammal Commission (NAMMCO)

Scientific Committee

The report of the IWC observer at the 15th meeting of the NAMMCO Scientific Committee held in Greenland, 11-14 April 2008 is given as IWC/61/4L. It was not possible for the report to be presented at the 2008 Annual Meeting as the content was confidential until it had been received by the NAMMCO Council meeting in September 2008 (see below).

The NAMMCO-SC recommended the revival of the Working Group on Marine Mammals-Fisheries and its terms of reference were expanded to include all areas under NAMMCO jurisdiction and to investigate dynamic changes in spatial distribution due to ecosystem changes and functional responses.

Iceland presented preliminary results from the research programme on the feeding ecology of minke whales, which significantly correct the prey composition data input to the model presented to the 2008 ICES meeting.

Updates on the 4-year Greenlandic research programme on narwhals and white whales were presented. A narwhal tagging programme had been conducted in West and North Greenland. Ten animals were satellite tagged in 2007 in West Greenland. An aerial survey for narwhals was planned for 2008 in East Greenland and an East Greenland narwhal tagging programme was planned as were surveys in 2009/10 in the North Water area for white whales and walrus, depending on funding.

The NAMMCO-SC noted that Greenlandic catch quotas are still higher than the advised maximum take (NAMMCO 2005, 2006) and expressed continued concern about this. However, preliminary data on abundance of narwhals and white whales show higher estimates and Greenland was encouraged to submit fully corrected estimates derived from the March 2006 and August 2007 surveys to the Committee.

The report from the WG on pilot whales was presented. This WG had been established in response to a request from NAMMCO-Council 'to develop a proposal for the details of a cost-effective scientific monitoring programme for pilot whales in the Faroes'. The WG was unable to conclude its work at the meeting, but did make some important recommendations and suggestions for designing and implementing a monitoring programme.

The Sixteenth Meeting of the NAMMCO Scientific Committee was held in Reykjavik, Iceland, 19-22 April 2009. The report is currently confidential, but will be released following the Council meeting in Tromsø on 8-10 September. It will then be available from *www.nammco.no*.

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.

Council

The report of the IWC observer at the 17th Annual Meeting of NAMMCO held in Greenland in September 2008 is given as IWC/61/4K. In the light of interest expressed by Greenland in resuming a catch of humpback whales in its waters, NAMMCO recommended that the total quota of humpback whales in West Greenland in 2009 (including bycatch) should not exceed 10 animals. This recommendation was based on the 2006 advice from the NAMMCO Scientific Committee that such a level of catch is well within sustainable limits. The recommendation is in conformity with the 2008 recommendation from IWC's Scientific Committee on the same subject (IWC, 2009e, p.23).

NAMMCO noted that new abundance estimates for a number of other key whale stocks in the North Atlantic, including fin whales, minke whales and pilot whales were expected to be completed in the near future. These will be based on data from the comprehensive Trans North Atlantic Cetacean Sightings Survey (T-NASS) carried out in July 2007 and coordinated by the NAMMCO Scientific Committee. The results of the T-NASS survey, as well as the Icelandic minke whale research programme, fisheries surveys and other studies, point to significant changes in North Atlantic marine ecosystems in recent years. NAMMCO therefore requested its Scientific Committee to examine the latest information on these changes and the nature of predator-prey relations, and their implications for the management of all marine resources.

The health benefits of consuming whale (and seal) oil were the subject of a specialist workshop and its report on the most recent research findings and further research requirements was presented to the meeting. The health risks associated with high levels of pollutants in some species of small whales and seals warrants continued monitoring. However, the documented health benefits of a diet rich in marine fats need to be balanced against these risks. NAMMCO members stressed that stronger global efforts to reduce pollution in the marine environment were crucial to ensuring that the high quality food provided by marine mammals.

The Committee thanked Samsing for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next NAMMCO Council meeting. Further information on NAMMCO can be found at *www.nammco.no.*

4.8 International Union for the Conservation of Nature (IUCN)

Cooke and Larsen, the IWC observers, reported on the considerable cooperation with IUCN that had occurred during the past year and this is given as IWC/61/4J. IUCN held its 4th Quadrennial World Conservation Congress in Barcelona 5-14 October 2008. The Member's assembly 11-14 October was preceded by the World Conservation Forum 5-9 October consisting of over 500 separate symposia. The following three Forum events related specifically to cetaceans:

(1) ship strikes with cetaceans: solutions for a global issue;
(2) whales and fisheries interactions: are the great whales a threat to fisheries; and
(3) whales of the Mediterranean Sea.

In addition there were several events related to the management of Marine Protected Areas in which cetaceans were also mentioned.

The following three cetacean-related Resolutions were passed by the Members' Assembly:

(1) 4.027 Relationship between fisheries and great whales;
(2) 4.115 Non-lethal utilisation of whales; and
(3) 4.025 Avoiding extinction of the vaquita *Phocoena sinus.*

Revised Red List entries for Cetacea

The Red List entries for mammals have been subject to a major overhaul as part of the Global Mammal Assessment (GMA). The new entries for cetaceans were released in August 2008 and are available on *www.redlist.org*. The criteria for the categories of threat were last reviewed in 2001[1].

Western gray whales

Two meetings of the Western Gray Advisory Panel (WGWAP) have been held since IWC/60. The task of WGWAP is to advise on the impact of industrial activities on western gray whales in their main feeding area on the Sakhalin shelf and on appropriate mitigation measures. In view of the apparent shift in distribution away from the main feeding ground in 2008, and the possibility that this was linked to industrial activities, the Panel at its 5th meeting in December 2008 recommended a moratorium on industrial activities with the potential to impact the gray whale feeding ground from the 2009 season, pending new information on gray whale distribution and development of mitigation measures. At its 6th meeting in April 2009 the Panel specifically recommended that a proposed seismic survey close to the feeding ground be postponed until the changes in gray whale distribution are better understood. Two task forces of the WGWAP met during the year: one on photo-id research and one on seismic surveys. Reports of the WGWAP and its Task Forces can be downloaded from *www.iucn.org/wgwap/*. Further discussion of the WGWAP can be found under Item 10.5 and in Annex F.

IUCN launched its Western Gray Whale Rangewide initiative with a workshop in Tokyo in September 2008. The aim of the initiative is draw up and seek involvement in a conservation plan for western gray whales that addresses the threats throughout the known and likely year-round range. The report of the workshop will be posted on the IUCN website shortly. Further discussion of the Rangewide initiative can be found under Item 10.5 and in Annex F. Further information on the WGWAP can be found at *www.iucn.org/wgwap*.

4.9 Food and Agriculture Organisation (FAO) related meetings – Committee on Fisheries (COFI)

The report of the IWC observer at the 28th session of the FAO-COFI held 2-6 March in Rome, Italy is given as IWC/61/4C. Member Governments reported on their legislation to incorporate the FAO Code of Conduct for Responsible Fisheries and their policies, plans and strategies related to implementation of the precautionary approach, the ecosystem approach, measures to protect vulnerable marine ecosystems and participatory management. No other issues of direct relevance to the IWC were discussed.

The Committee thanked Goodman for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next FAO-COFI meeting. Further information on FAO can be found at *www.fao.org*.

4.10 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

No information on the activities of CITES was provided. Information on CITES can be found at *www.cites.org.*

4.11 North Pacific Marine Science Organisation (PICES)

The report of the IWC observer at the 17th annual meeting of PICES held 23 October-2 November 2008 in Dalian, People's Republic of China is given as IWC/61/4G. Aspects of the new PICES science programme (FUTURE) were discussed, specifically (1) understanding climate change and anthropogenic on marine ecosystems; and (2) forecasting future ecosystem change. The panel believe that research on birds and mammals could be used to assess how much of the observed ecosystem variability could be attributed to natural or anthropogenic effects. It was recommended that new efforts be made to integrate marine birds and mammals into PICES models of energy and trophic interactions, food web studies and comparative responses of ecosystems to climate changes.

[1] They can be downloaded from *www.iucnredlist.org/static/categories_criteria_3_1.*

The Committee thanked Kato for attending on its behalf and **agrees** that he should represent the Committee as an observer at the next PICES meeting. Further information on PICES can be found at *www.pices.int*.

4.12 Eastern Caribbean Cetacean Commission (ECCO)

No information on the activities of ECCO was provided.

4.13 Protocol on Specially Protected Areas and Wildlife (SPAW) of the Cartagena Convention for the Wider Caribbean

The report of the IWC observer at the 4th meeting of the Scientific and Technical Advisory Committee (STAC) to the Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region (STAC4) is given as IWC/61/4E. The meeting took place in Gosier, France from 2-5 July 2008 and the main topic of the meeting relevant to the IWC was to review the Draft Action Plan for the Conservation of Marine Mammals (MMAP) in the Wider Caribbean Region and agree on further action. The Meeting agreed on a number of priority areas in the MMAP, which included: (1) the expansion of workshops on stranding response in other languages; (2) workshops for building capacity and information gathering on whalewatching; (3) a workshop on pollution/marine mammal health; and (4) to continue expanding knowledgebase and information-sharing on status, distribution, threats and management strategies, including the establishment of a user-friendly and informative web-based database.

The Committee thanked Carlson for attending on its behalf and **agrees** that she should represent the Committee as an observer at the next SPAW meeting. Further information on SPAW can be found at *www.cep.unep.org/cartagena-convention*.

4.14 Indian Ocean Commission (IOC)

No information on the activities of IOC was provided. Further information on the IOC can be found at *www.coi-ioc.org*.

4.15 Permanent Commission for the South Pacific (CPPS)

The report of the observer documenting CPPS activities is given as IWC/61/4H. In 1992 the countries of the Southeast Pacific (Chile, Colombia, Ecuador, Panama and Peru) adopted the Plan of Action for the Conservation of Marine Mammals in the Southeast Pacific. The main objective of the Plan is to assist participating governments to improve policies for the conservation of marine mammals in the region. In May 2009, with the support of the United Nations Environment Program (UNEP), began the implementation of pilot projects to reduce the impact of fisheries on marine mammal populations in the Southeast Pacific countries. Ongoing projects include:

(1) implementation actions for the conservation of Chilean dolphins in Constitution, Chile;
(2) reduction of the impact of fishing gear on cetaceans in the Machalilla National Park, Ecuador;
(3) reduction of the inpact of gillnets on cetaceans in coastal areas of the Gulf of Chiriqui, Panama; and
(4) a pilot study to test the use of pingers to reduce the bycatch of small cetaceans in Peru.

A workshop on legal aspects around whalewatching activities in the Southeast Pacific countries will be held in August 2009 in Ecuador.

The Southeast Pacific Integrated System (SEPIS) is being developed, which aims at developing an integrated information system in support of research and management in priority marine species and habitats in the Southeast Pacific (including cetaceans).

The Committee thanked Felix for his report and **agrees** that he should report future continue to represent the IWC at future CPPS activities. Further information on CPPS can be found at *www.cpps-int.org*.

4.16 International Maritime Organisation (IMO)

The report of the IWC observer at the 58th session of the Maritime Environment Protection Committee (MEPC) held in Rome, Italy, 6-10 October 2009 is given as IWC/61/4H. The IWC and IMO both share a common interest in ship strikes and habitat degradation (via noise, chemical pollutants oil spills etc). At the meeting a guidance document on minimising the risk of ship strikes with cetaceans was agreed. A correspondence group was tasked with, *inter alia*, developing voluntary technical guidelines for ship-quieting technologies as well as potential navigation and operational practices. The IWC is a member of this correspondence group.

The Committee thanked Grandy for her report and **agrees** that she should represent the Committee at the next IMO meeting. Further information on IMO can be found at *www.imo.org*.

5 REVISED MANAGEMENT PROCEDURE (RMP) – GENERAL ISSUES

The development of the RMP arose out of the work on the Comprehensive Assessment endorsed by the Commission as a priority for the work of the Scientific Committee (Donovan, 1989). The RMP was adopted by Commission Resolution 1994-5, with the first specifications, annotations and Guidelines (for Conducting Surveys and Analysing Data; for Collecting Data not Directly Required by the *Catch Limit Algorithm* (*CLA*) developed in the mid-1990s (IWC, 1994d; 1994e; 1995b; 1995f; 1995g). *Implementation* of the RMP i.e. enabling it to be used in a specific situation (see item 6) has led to the identification of a number of general issues associated with the RMP requiring clarification or modification. The Committee agreed a set of Guidelines for *Implementations* in 2004 (IWC, 2005c). These have subsequently been modified to clarify the process for defining acceptable performance of RMP variants[2] (IWC, 2007d). The major task of the

[2] RMP variants include setting catches by *Small Areas*, and applying catch cascading and catch capping over groups of *Small Areas*.

Committee this year was to re-evaluate the range of values for MSYR. These values form part of the basis for selecting the *Catch Limit Algorithm*, *CLA*, (and thus evaluating any proposed changes to it) and when implementing the RMP for proposed whaling operations. The sections below summarise the work of the sub-committee on the RMP (Annex D).

5.1 Review MSY rates

5.1.1 Report of Intersessional Workshop

The Workshop chair, Donovan, reported the results of the second intersessional Workshop on MSYR held in Seattle, 6-9 February 2009 (see SC61/Rep6). Its first task had been to update summary data on MSYR developed at the first Workshop (IWC, 2009d). That update (Table 1, SC61/Rep6) included: (1) an assessment of reliability (high, medium or low); and (2) a coarse assessment as to whether the population (at the time of the trend estimate) was considered to be low (<1/3), medium (<1/3-2/3) or high (>2/3) relative to pre-exploitation abundance. The Workshop considered undertaking a meta-analysis, using both a Bayesian approach (Punt, 2009) (Annex D of SC/61/Rep6) and a linear mixed effects model (Annex C of SC/61/Rep6). These two methods gave essentially the same results. A key assumption of both approaches was the assumption that stocks were interchangeable (i.e. a random subset of stocks). The Workshop recognised that there are many ways in which this assumption might be violated. It also agreed that meta-analyses should be based on a model in which there is between-stock variation in the rate of increase but not between-species variation.

In discussing the incorporation of environmental variability into models of net recruitment rate and yield curves, the Workshop reviewed a revised version of Cooke (2007). It contained three major changes from the original related to fixing not estimating MSYL, estimating initial population size, and improving the fitting process. The author found that estimates of MSYR tend to be positively biased, especially for low true MSY rates for scenarios with high environmental variability. Possible causes of the bias were discussed, and the Workshop spent some time discussing appropriate levels of environmental variability and correlation. It recommended that all available data sets with information on recruitment variability in whales be examined. In this regard, after considerable discussion the Workshop agreed that *inter alia* eight items required further consideration, as detailed in Annex D, item 2.1.1.

The Workshop also considered the questions of the circumstances in which the standard deterministic density-dependent model could be tested using observations of recovering stocks, and how likely it is that this model would be rejected by the data. It agreed that, even when the simulations suggested that the assumption of constant *K* reduced the bias in MSYR estimates, it would be unrealistic to expect the Scientific Committee to accept assessments that were so clearly rejected by the data as in the case of eastern gray whales and North Atlantic humpbacks. To explore this question the Workshop agreed that three analyses need to be undertaken for eastern North Pacific gray whales and North Atlantic humpback whales:

(1) determine the size of effects needed to explain the observed trend using the breeding disruption hypothesis of Reeves *et al* (in prep);

(2) determine the level of environmental variability that is required to fit the trends in gray and humpback whales using the aggregated stochastic model of Cooke (2007); and

(3) repeat task 2 for an age-structured stochastic model, such as that used in Punt (In press).

The Workshop then considered the approaches to estimating MSYR and their limitations. With respect to the use of trends in abundance, it was noted that the Scientific Committee has discussed the relationship between the rate of increase in the limit of zero population size and MSYR extensively in the past. Two main views have emerged. One, based on Butterworth and Best (1990), argues that estimates for $MSYR_{1+}$ can be inferred from estimates of r_0 given the bound $MSYR_{1+} \geq r_0/2$. The other is based on the 'basin model' and 'hypercompensation' arguments (de la Mare, 1994) and that the impact of stochasticity in the population dynamics will reduce (or eliminate) the difference between $MSYR_{1+}$ and r_0 for some stocks.

The Workshop agreed that while both views remained, the fact that there is no evidence for a reduction in the growth rates for the right (and particularly) humpback whales that have been monitored regularly over the past two decades (some humpback stocks are now in the region of 0.3*K*) implies that the 'hypercompensation' (Fowler and Baker, 1991) and 'basin model' arguments are not as plausible as was the case in the past.

The Workshop then considered how its deliberations affected progress with respect to proposals to amend the RMP. In reviewing the protocol for evaluating proposed amendments to the RMP, the Committee had agreed in 2006 (IWC, 2007e) that three factors needed to be considered further: (1) the appropriate range of MSYRs to be used in trials; (2) development of an appropriate set of simulation trials; and (3) definition of an appropriate set of performance statistics.

The Workshop had focussed on (1) above and agreed that in finalising the trial specifications for proposals to amend the RMP, the Scientific Committee should take into account: (1) the results of the additional work regarding the appropriate range of MSYRs it had recommended; and (2) the approach used in Cooke (2007, revised) as a possible basis for further robustness trials with respect to environmental variability. It noted that any new trials should also be applied to the existing *CLA*. It also agreed that as the ultimate use of the analyses was to determine the appropriate range of MSYR values to be used in the RMP, then it was essential that any computer programs used in the process must be validated by the Secretariat. The Workshop developed a work plan, progress on which is reported in Item 5.1.2.

In reviewing the Workshop report, the Committee expressed appreciation to Workshop participants and particularly to Donovan for his chairmanship.

5.1.2 Matters arising

The Committee considered three main items in this context: (1) population models incorporating environmental variation; (2) information available related to MSYR for stocks of baleen whales; and (3) inferences related to the range of values for MSYR for stocks of baleen whales.

5.1.2.1 POPULATION MODELS INCORPORATING ENVIRONMENTAL VARIATION

SC/61/RMP13 provided results of simulation trials of the estimation of *MSYR* for scenarios agreed in SC/61/Rep6, based on the environmental variability model of Cooke (2007 revised) and assumptions about environmental variability. The results confirmed earlier findings that *MSYR* can be substantially overestimated when the true *MSYR* is low. When the true *MSYR* is 1%, the median *MSYR* estimate can be up to 5% in scenarios with high environmental variability. Furthermore, there is a high probability (which exceeds 50% in some scenarios) that a model with the conventional assumption that the population is at is carrying capacity *K* at the start of exploitation will fail to fit the observed time series. The overestimation of *MSYR* rates is less severe if the assumption that the population is at *K* at the start of exploitation is retained, even when the data are incompatible with this assumption. The Committee noted that the extent of positive bias in MSYR was a function of both the extent of environmental variation, σ, and the auto-correlation in the impact of the environment on productivity, ρ. It **agrees** that that it was necessary to confirm that the values for the parameters considered in the simulations were plausible for baleen whales.

The Committee noted that the average size of the population in the absence of exploitation (stochastic carrying capacity) was not the same as the nominal carrying capacity (*K*). The median realised stochastic carrying capacity levels increase above deterministic levels by 1 - 13% for most of the scenarios considered (σ=0.5, ρ=0.5), although stochastic carrying capacity exceeded K by 50% for the scenario with the largest variability (σ=1) and serial correlation (ρ=0.9) values considered.

The Committee noted that the population dynamics model on which SC/61/RMP13 was based was designed so that the expected net recruitment rate at any population size equals the value for the net recruitment rate based on the deterministic form of the relationship between net recruitment rate and density. However, most simulated net recruitment rates are higher than the mean net recruitment rate when there is environmental stochasticity because there is an upper bound on the extent to which the population can increase when resources are plentiful, but there is no limit on the extent to which it can decline when resources are scarce. Thus population trajectories tend to increase faster than the average rate of increase for fairly long periods after which there is a (stochastically) abrupt reduction in population size. One consequence is that the median rate of increase at low population size is positively biased relative to the true rate of increase although the mean rate of increase is closer to the true rate of increase, as detailed in Table 1 and Figure 2 of Annex D.

INFORMATION AVAILABLE RELATED TO MSYR FOR STOCKS OF BALEEN WHALES

Three amendments were agreed to the summary of information on MSYR assembled in SC/61/Rep 6 table 1 (Annex D, item 2.1.2). The Committee **agrees** that the populations to be included in a meta-analysis of growth rate at low levels of abundance should include all stocks considered to have been less than about 0.33*K* at the time monitoring of their abundance commenced, but with some amendments and inclusions as (Annex D, item 2.1.2). Table 2 lists the stocks on which the Bayesian meta-analysis is based, along with their rates of increase at low population size, r_0. The Committee **agrees** that these values are the best currently available for the purpose. It discussed the extent to which inferences based on the values in Table 2 can be extrapolated beyond the species (and stocks) represented therein as detailed in Annex D (item 2.1.2).

Table 2

Estimates of r_0 used in the meta-analyses.

Stock	r_0 (%) (95% CI)	SE
Blue		
Central North Atlantic	9.0 (2.0, 17.0)	3.83[a]
Southern Hemisphere[c]	8.2 (1.6, 14.8)	3.37[a]
Eastern North Pacific	3.2	1.4
Fin		
North Norway	5 (-13, 26)	9.95[a]
Eastern North Pacific	4.8 (-1.6, 11.1)	3.24[a]
Humpback		
Western Australia	10.1 (0.9, 19.3)	4.69[a]
Eastern Australia	10.9 (10.5, 11.4)	0.23[a]
Eastern North Pacific	6.4	0.9
Hawaii	10 (3-16)	3.32a
Gulf of Maine	6.3	1.2
Gray		
Western	2.9 (1.9, 4.0)	0.54[b]
Bowhead		
Bering-Chukchi-Beaufort	3.9 (2.2, 5.5)	0.84[b]
North Atlantic Right		
Western	2.23 (1.23, 3.23)	0.51[a]
Southern Right		
SE Atlantic	7.3 (6.6 ,7.9)	0.33[a]
SW Atlantic	6.8 (5.8 ,7.8)	0.51[a]
SE Indian	8.10 (4.48-11.83)	1.88[a]

a – computed from the 95% confidence interval by dividing by 3.92; b – computed from the 90% confidence interval by dividing by 3.28; c – not a single stock, excluded in a sensitivity test

Table 3 of Annex D Item 2.1.2 summarises the lower percentiles for the rate of increase for an 'unknown stock' and additional information on the Bayesian analysis on which Table 3 is based is given in Annex D, Appendix 2. In regard to the two views of how the results of Table 3 in Annex D Item 2.1.2 might be used to refine the range for MSYR used in simulation trials discussed at the Workshop, Cooke (2007) examined the relationship between net recruitment rate and density when there is a convex relationship between net recruitment rate and the environment. The author had found that the relationship between net recruitment rate and density was convex, but not as convex as that between net recruitment rate and the environment. After considering the arguments presented at the Intersessional Workshop, the Committee **agrees** that there was no direct evidence that the relationship between net recruitment and density was not convex, and **agrees** accordingly that in this context estimates of $r_0/2$ provided negatively biased estimates of $MSYR_{1+}$.

The Committee reviewed some biases evident in SC/61/RMP13, but was informed that their effect was largest at low MSYR and that the mean bias is lower than the median bias. The Committee **agrees** that the impact on the posterior distribution for r_0 of the bias due to environmental variation on r_0 should be explored further (to include details summarised in Annex D Item 2.1.1). This should include, *inter alia,* investigation of datasets that might assist in providing information on plausible values of environmental variability. An intersessional group has been established to co-ordinate this work (Q3 under Butterworth). Potential datasets were for North Atlantic, SW and SE Atlantic right whales, Eastern North Pacific gray whales, BCB Bowhead whales, California, Gulf of Maine, and SE Atlantic humpback whales, and California blue whales.

INFERENCES RELATED TO THE RANGE OF VALUES FOR MSYR FOR STOCKS OF BALEEN WHALES

The meta-analysis considered in Annex D leads to values for r_0 for the 'unknown stock' which are biologically implausible and fails to account for the impact of environmental variation. The Committee **agrees** that these issues require resolution before it is possible to finalise the selection of MSYR values for use in RMP trials. The most appropriate way to finalise this work is to hold an intersessional workshop (terms of reference as listed in Annex D, Item 2.1.2), to be convened by Butterworth (Q3). A work plan to finalise discussions on MSYR is given as Annex P.

5.2 Finalise the process for evaluating amendments to the *CLA*

The Committee was pleased to see the progress made at the MSYR intersessional workshop and during the current meeting, in particular the agreement on a list of values for r_0 (Annex D, Table 2), but recognised that it could not complete discussions on amendments to the *CLA* until the range for MSYR in the RMP was finalised.

5.3 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

6 RMP – PREPARATIONS FOR IMPLEMENTATION

Implementation of the RMP is the process of determining whether any variants of the RMP exist that perform adequately in terms of conservation and then ranking RMP variants based on their catches. The need for *Implementations* arises from the annotations to the RMP (IWC, 1994e) which were adopted by the Commission in 1994 through Resolution 1994-5. An *Implementation* is based on a set of simulation trials, the *Implementation Simulation Trials*, which capture the key uncertainties related *inter alia* to stock structure, abundance and catches. Since 1995, the work of the Committee on this matter has been based on Guidelines for *Implementations* (IWC, 2005c) that were subsequently refined and clarified in 2006 (IWC, 2007d). The *Implementation* process is summarised schematically in Fig. 1. The Committee conducts regular (normally every five years) *Implementation Reviews*, during which new data are reviewed in terms of whether they imply the need to revise the *Implementation Simulation Trials*. The Committee has completed *Implementations* for Antarctic minke whales (IWC, 1995e), North Atlantic (IWC, 1994c) and western North Pacific common minke whales (IWC, 2004c) and the western North Pacific Bryde's whales (IWC, 2008f), although only the last *Implementation* used the 2004 Guidelines for *Implementations*. An *Implementation Review* for the North Atlantic minke whales was conducted in 2003 (IWC, 2004c) and was begun but not completed last year (IWC, 2009f). No other *Implementation Reviews* have been conducted.

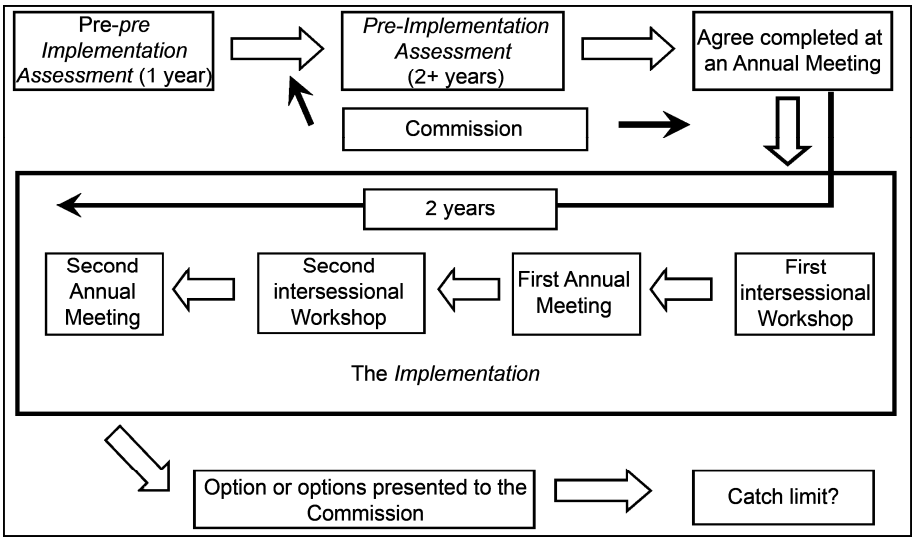

Fig.1. Schematic diagram of the *Implementation* process (see text).

Under the accepted Guidelines for reviewing the results of *Implementation Trials*, if the performance of one of the variants (specification with respect to operational details, *Small Areas*, *catch-cascading* or *Catch-capping* etc.) performs 'unacceptably' but only on trials that relate to a contentious hypothesis (e.g. with regard to stock structure), then a government is entitled to ask the Committee to investigate the performance of a 'hybrid variant'. This variant would comprise 10 years of the 'unacceptable' variant followed by one of the acceptable variants. If this performance acceptably in the trials then the country is offered the choice of using that variant provided:

(1) The country develops a research programme that the Committee agrees has a good chance of confirming or denying the contentious hypothesis within 10 years (if the hypothesis is not ruled out at the end of the period, the catch limits revert to those set by the second variant);
(2) That the Committee review progress on the research programme annually and agrees that it is being undertaken acceptably;
(3) The option can only be used once.

The tasks before the Committee this year are to complete one outstanding aspect of the *Implementation* for the western North Pacific Bryde's whales (evaluating a research programme to accompany an RMP variant), to finalise the *Implementation* for the North Atlantic fin whales and to finalise the *Implementation Review* for North Atlantic common minke whales.

6.1 Western North Pacific Bryde's whales

6.1.1 Research proposal for the 'variant with research'

In 2007, the Committee agreed (IWC, 2008e) that three of the four RMP variants considered during the *Implementation* for western North Pacific Bryde's whales performed acceptably from a conservation perspective and recommended that they could be implemented without a research programme. It also agreed that one variant was not 'acceptable without research' because conservation performance was 'unacceptable' for stock hypothesis 4 (two stocks of Bryde's whales in sub-areas 1 and 2, one of which is found in sub-area 1 and consists of two sub-stocks).

Last year, the Committee reviewed a research proposal (Pastene *et al.*, 2008) which aimed to determine whether or not sub-stocks occur in sub-area 1 of the western North Pacific (130-180°E; 10-42°N). The Committee had recommended that the *Implementation Simulation Trials* for western North Pacific Bryde's whales be used to determine whether differences in age-compositions between sub-areas 1W and 1E could be used to resolve whether there are sub-stocks in these sub-areas and that results from previous (and any new) power analyses that assess the use of genetic methods to evaluate stock structure hypothesis 4 be included in the revised proposal.

The Committee noted that no new research proposal had been provided this year. It was advised that a revised research proposal will be submitted once the required analyses are completed. The Committee **recommends** that the tasks identified last year be completed for next year's meeting.

6.1.2 Other

SC/61/O7 reported that successful satellite tagging of two Bryde's whales in the western North Pacific by JARPN II one each in 2006 and 2008, showing movement in both cases from temperate to subtropical waters. The Committee welcomed the information noting that the use of satellite tags was one way to evaluate the plausibility of stock structure hypothesis 4. It **recommends** that the trade-off between the cost of finding Bryde's whales and successfully attaching satellite tags and the value of this information to address questions of stock structure be evaluated. It **encourages** further satellite tagging of western North Pacific Bryde's whales.

6.1.3 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

6.2 North Atlantic fin whales

The Committee agreed that the *pre-Implementation* process was complete at the 2007 Annual Meeting (IWC, 2008f). The first intersessional Workshop was held in April 2008 (IWC, 2009c) and work continued at the 2008 Annual Meeting (IWC, 2009f).

6.2.1 Complete Implementation

6.2.1.1 REPORT OF INTERSESSIONAL WORKSHOP

The Workshop chair, Donovan, reported the results of the Workshop held in Copenhagen from 19-22 March 2009 (SC/61/Rep3). In the *Implementation* process, the 2nd intersessional workshop is essentially technical, to review the results of final trials agreed by the Committee at its previous Annual Meeting following agreed quantitative guidelines, and to make recommendations for consideration by the full Committee on:

(1) Management Areas;
(2) RMP variants;
(3) suggestions for future research (either within or outside whaling operations) to narrow the range of plausible hypotheses/ eliminate some hypotheses; and, if required,
(4) 'less conservative' variants(s) with their associated required research programmes and associated duration.

Last year, the Committee had agreed that the conditioning had been completed satisfactorily (IWC, 2009f). However, Allison had subsequently noted some issues that required further discussion as discussed under item 2 of SC/61/Rep3 where, in summary, the Workshop agreed: (1) to account for additional variance where this could be estimated and apply this to all trials (see Annex C of SC/61/Rep3); and (2) to clarify of the specification of Trial N15. The full set of trials is given in table 2 of SC/61/Rep3. In view of this discussion, the Workshop agreed that it was appropriate to rerun all of the conditioning trials. Details of the Workshop's consideration of the results of the revised conditioning are given in Annex D Item 3.2.1.1. After some discussion (SC/61/Rep3 item 3) the Workshop agreed that

Table 3

Summary of variants and their performances

	Description of variant	Comments	Conclusion
1	sub-area WI is a *Small Area*	'acceptable' performance on all 'high' and 'medium' weight trials.	'acceptable without research'.
2	sub-area (WI+EG) is a *Small Area*. All of the catch is taken in the WI sub-area.	'acceptable' performance on all but one of the 27 'high' trials; 'borderline' performance on 11 of the 28 'medium' weight trials; 'unacceptable' performance resulted for trials NF-04-1, NF-20-1 and NF-28-1, all of which are based hypothesis IV	not 'acceptable without research'
3	sub-area (WI+EG+EI/F) is a *Small Area*. All of the catch is taken in the WI sub-area	'acceptable' performance on all of the 27 'high' trials and all except three of the 28 medium weight trials (NF04-1, NF20-1 and NF28-1), for which performance was 'borderline' but closer to acceptable.	'acceptable without research'.
4	sub-area WI is a *Small Area*. Catch limits are set based on survey estimates for the WI sub-area north of 60°N (both historic and future surveys)	See variant 1 comments	'acceptable without research'.
5	sub-areas WI and EG are taken to be *Small Areas* and sub-areas WI and EG are taken to be a *Combination area*. The catch limits set for the EG *Small Area* are not taken	See variant 1 comments	'acceptable without research'.
6	sub-areas WI, EI/F and EG are taken to be *Small Areas* and sub-areas WI, EI/F and EG are together taken to be a *Combination area*. The catch limits set for the EG and EI/F *Small Areas* are not taken.	See variant 1 comments	'acceptable without research'.

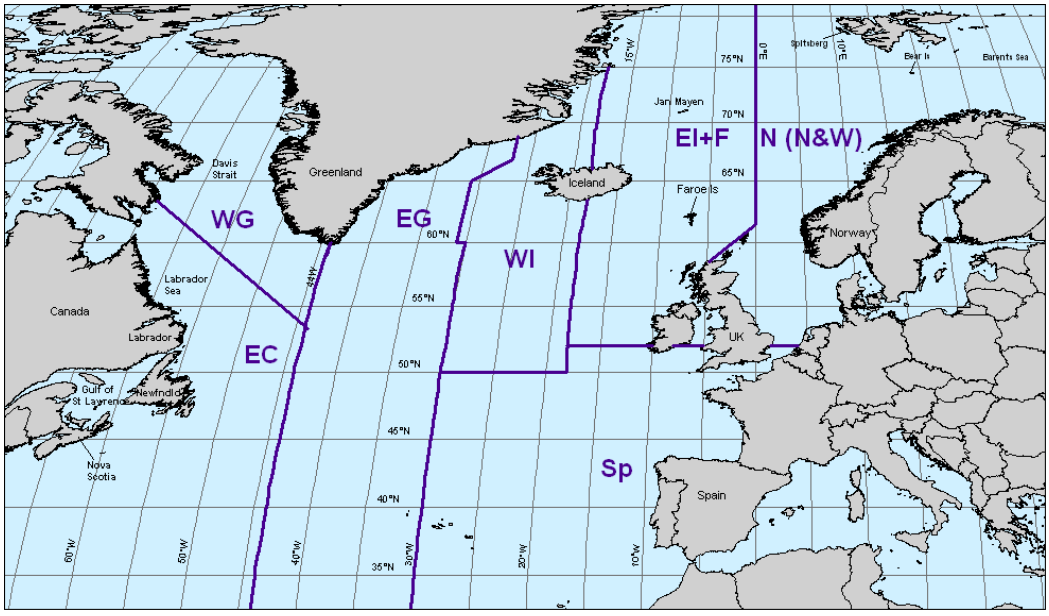

Fig. 2. Map of the North Atlantic showing the sub-areas defined for the North Atlantic fin whales

conditioning was satisfactory. The full conditioning plots are available on the IWC website[3].

The Workshop then reviewed the results of the agreed *Implementation Simulation Trials.* The Committee has agreed a quantitative approach to reviewing such trials and a standard graphical and tabular presentation of the results, as given under items 4.1 and 4.2 of SC/61/Rep3. A schematic summary of the procedure is given in Fig. 4 of Annex D. The variants, their performance evaluated following the Guidelines and the associated *Management Areas* are shown in Table 3 and Fig. 2.

In summary, Variants 1, 3, 4, 5, 6 and were all 'acceptable without research', but variant 2 had 'unacceptable' performance for some of the trials, all related to stock structure hypothesis IV (see Fig. 3). In terms of catch-related performance, the Workshop noted that variant 2 gave, by an appreciable margin, the best catch-related performance over the trials as a whole. It was followed in this respect by variant 3. Iceland indicated that they wished to pursue the option of presenting a research programme to the Committee that would allow variant 2 to be classified as 'acceptable with research'. The results of analyses to allow evaluation of this option were undertaken after the Workshop, and thus not reviewed by it, but are included in the report for completeness. The Workshop recommended that they be reviewed by the Committee. The Workshop made a number of detailed recommendations to the Committee, covering: *Management Areas*; variant(s); inputs for the *CLA*, including estimates of abundance, past removals and future removals. They are contained in Annex D, Item 3.2.1.1.

[3] *http://www.iwcoffice.org/_documents/sci_com/sc61docs/condplots.pdf*

The Committee thanked Donovan for his leadership in running a successful Workshop and ensuring that the *Implementation* process for North Atlantic fin whales can be completed as scheduled. In turn, Donovan paid tribute to the hard work of Allison and Rademeyer assisted by Punt, who undertook a considerable amount of computing work during the Workshop itself.

6.2.1.2 MATTERS AND RECOMMENDATIONS ARISING

The Committee noted that the new abundance estimate for 2007 for sub-area EI/F fell outside the simulation intervals for the variants of the trials examined by the Committee last year. However, the approach adopted to account for this, allowing for additional variance led to wider simulation intervals and a lower median population size, factors which would pose more of a challenge to the RMP variants.

SC/61/RMP10 presented estimates of the abundance of fin and other baleen whales in the European Atlantic in an area covering offshore waters beyond the continental shelf of the UK, Ireland, France and Spain. Total abundance estimated for the entire survey area was 9,019 (CV=0.11) fin whales and 9,619 (CV= 0.11) large baleen whales. The fin whale estimate is probably an underestimate because it excludes unidentified large whales, of which a large proportion was likely to have been fin whales. The design-based estimate of abundance of fin whales in the northern survey block that contributes to the EI/F area was 248 (CV=0.45).

In discussion, the Committee noted that collection of biopsy samples would assist in reviewing the basis for the southern boundary for the EI/F sub-area and hence the basis for its abundance estimates. It noted that densities were low south of the (current) southern boundary of sub-area EI/F, such that small changes in that boundary would not impact the estimated abundance.

The Committee reviewed the recommendations arising from the Workshop and **endorses** those regarding *Management Areas* and the variants which were 'acceptable' for implementation without research (see item 6.2.1.1). It also **endorses** the Workshop recommendation that the 'best' series of catches should be used when applying the RMP.

6.2.1.3 'VARIANT WITH RESEARCH'

Designating variant 2 as 'acceptable with research', involves two steps. The first stage is to determine whether performance is 'acceptable' if variant 2 is replaced by an acceptable variant after a 10-year initial period. If so, the second stage is for Iceland to demonstrate to the Committee's satisfaction that a research programme has a good chance (within the 10-year period) of being able to clarify the situation with respect to stock structure, and in particular to confirm or deny that stock structure hypothesis IV is implausible

The Committee noted that while variant 2 alone was not 'acceptable', the combination of variant 2 for ten years following by variant 1 led to performance which was 'acceptable' for all trials (Annex E of SC/61/Rep3). The Committee therefore **agrees** that the requirements for stage 1 of the process for implementing a 'variant with research' had been met.

SC/61/RMP9 had been written in response to the outcomes of the Workshop where variant 2 performed unacceptably for three trials that had been assigned medium plausibility (despite objections by the primary author to the assignment of plausibility). These trials had MSYR(mat)=1% and were based on stock hypothesis IV which assumes no interchange between three breeding sub-stocks in the Central North Atlantic. SC/61/RMP9 also noted that trials based on hypothesis IV are difficult to reconcile with the known catch history off West Iceland. Appendix 6 of Annex D outlines the concerns of the authors of SC/61/RMP9 with this hypothesis in more detail. SC/61/RMP9 also identified several aspects of a research programme which could be used to refute hypothesis IV.

The Committee was informed that a research proposal would be developed for next year's meeting. An Advisory Group - Q4 - Allison, Butterworth, Donovan, Punt and Skaug - (IWC, 2008f, p.96) was established to advise the Icelandic scientists as needed. The Committee noted the need to follow the *pro forma* agreed in 2007 (IWC, 2008f, pp.96-97, 115) and suggested that power analyses (perhaps based on *Implementation Simulations Trials*) be conducted as needed.

6.2.1.4 ABSOLUTE ABUNDANCE ESTIMATES FOR USE IN THE *CLA*

No abundance estimates were provided for adoption at this meeting although several were reviewed at the First Intersessional Workshop (Wade, 2009). The Committee **agrees** that final estimates need to be assembled and provided for consideration at next year's meeting.

6.2.1.5 RECOMMENDATIONS

The Committee **agreed** that if the RMP is implemented, variants 1, 3, 4, 5 and 6 can be implemented without an associated research programme; of these, variant 3 showed the best catch-related performance. The recommended *Management Areas* for each variant are given under item 6.2.1.1. The Committee further **agrees** that variant 2 cannot be implemented except in conjunction with a research programme that the Committee agrees could feasibly show that the trials on which variant 2 performs 'unacceptably' should have been assigned 'low' plausibility (Table 4). The Committee anticipates being provided with such a research programme and reviewing it at the 2010 Annual Meeting.

Table 4

A summary of the trials for which performance was 'unacceptable' for variant 2; all were for medium weight trials and stock structure hypothesis IV.

Trial	Stock structure hypothesis	Features
NF04-1	IV	4 stocks without sub-stock interchange
NF20-1	IV	Tag loss =20% in yr 1; 10%/yr thereafter
NF28-1	IV	Estimate rate of mixing of C1 sub-stock in WI

6.2.2 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

6.3 North Atlantic common minke whales

6.3.1 Complete the Implementation Review

6.3.1.1 CONSIDERATION OF REVISION OF BOUNDARIES

During the *Implementation Review* begun last year a stock structure issue related to the boundary between sub-areas EW and EB had remained unresolved (IWC, 2009f). It was suggested then that the heterogeneity apparent in the 1997-2002 data (considered in the 2003 *Implementation Review*) absent in the 2003-2006 data could have been a laboratory artefact. The Committee had recommended that the 1997-2002 data be analysed in more detail but no new analyses were presented this year. In the absence of new information the Committee **agrees** that it should retain the current boundary. The boundaries agreed at the 2003 *Implementation Review* (IWC, 2004c) would therefore remain the same for the present *Implementation Review*.

6.3.1.2 ABUNDANCE ESTIMATES AND ADDITIONAL VARIANCE

The issue of using methods other than conventional line transect sampling to calculate estimates of abundance that would be acceptable for use in the RMP was discussed. The two methods were mark-recapture analysis of genetic data and spatial modelling of data from multipurpose surveys. The Committee referred to its *Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme* (IWC, 2005c). Although the RMP does not preclude the use of direct methods of estimating absolute abundance other than shipboard or aerial sightings surveys, until the properties of such estimates and the implications for their use in the RMP have been further examined, sightings surveys remain the primary methods. However, it is important to consider this issue and the Committee **agrees** that it should be placed on its agenda for its 2010 meeting. It **encourages** members to submit papers for consideration next year.

The Committee received a number of analytical papers related to obtaining abundance estimates from the Norwegian surveys (SC/61/RMP3 described the duplicate identification routine used when analysing the data from Norwegian minke whale sighting surveys; SC/61/RMP4 concluded that distance estimates made by naked eye at sea are unbiased on a log scale; and SC/61/RMP5 presented a new method for estimating variance).

It also received a number of papers related to telemetry, dive times and cue rates. SC/61/RMP7 provided information on a new VHF series of dive times collected from a common minke whale in the southeastern Barents Sea in 2008; the variation in blow rates seen on an individual basis is at least as large as that recorded as means between individuals. SC/61RMP6 compared surfacing rates from VHF tagged animals with the surfacing rate observed in the sighting surveys and found that the latter was higher in the surveys than the former. Although the reason for this is unclear, it was not found to lead to a positive bias in abundance estimates. The Committee **welcomes** this work because of its previous concerns about the surfacing rate data used in the estimation of abundance. The results indicate that there are no apparent problems of bias with the use of these data.

SC/61/O2 presented an analysis of the effect of unmodelled heterogeneity in detectability in the context of line transect surveys. The Committee noted the main result, viz. that ignoring heterogeneity in cue rate or cue strength can lead to negative bias in abundance, as expected. It further noted that the intention of presenting the work to the Committee was to show the lack of any positive bias. The Committee noted that this did not require additional data and was informed that the method could readily be incorporated into the abundance estimation models. The Committee **encourages** further work but noted that care should be taken not to generate estimates that could contain elements of positive bias. It referred the authors to its Requirements and Guidelines referred to above (IWC, 2005c).

SC/61/RMP2 contained an abundance estimate for northeastern Atlantic common minke whales based on surveys conducted over the period 2002-2007. Survey methods were as for earlier survey periods but some modifications had been made to the analysis method, as outlined in papers SC/61/RMP3-5. Total abundance for the areas covered by the survey was 108,000 (95% CI 69,200-168,500), and the estimate for the *Eastern Medium Area* only was 81,000 (95% CI 51,900-126,400). These estimates are in accordance with the corresponding estimates from the previous survey period 1996-2001, although the uncertainty is larger. The uncertainty estimates had been corrected for inter-annual variation in the spatial distribution of whales. The Committee discussed the possible reasons why the CVs of the new estimates for 2002-2007 were higher than for the previous period, 1996-2001. Fewer sightings were made in 2002-2007, but the abundance estimate is very similar. The authors suggested that the difference might be partly related to the bias correction procedure. Notwithstanding this, the Committee **agrees** to adopt the estimates of abundance for 2002-2007 presented in SC/61/RMP2.

The new methods used to analyse the 2002-2007 data have not been applied to data from previous surveys. The Committee **agrees** that this is desirable so that the time series of abundance estimates used in the RMP are as consistent as possible. However, from the perspective of the *CLA* the priority is to reduce bias. The Requirements and Guidelines discussed earlier (IWC, 2005c) consider this issue in the context of data collection but are not specific with respect to data analysis. The Committee **agrees** that the new methods should be used to update previous estimates, as far as possible, and requests that the results are presented to the Committee. Notwithstanding this, Committee **agrees** that any issues regarding consistency should be minor and that this should not delay the completion of the *Implementation Review*.

SC/61/RMP12 presented analyses of TNASS 2007 data from six vessels operating in the central North Atlantic. The paper was the subject of detailed discussion (Annex D, item 3.3.1.2). The Committee expressed some concerns about the analysis and the Committee concluded that the information in the paper was insufficient to assess fully the methodology and diagnostics. The Committee **agrees** that it is premature to adopt the estimates in SC/61/RMP12 for use in the RMP. A revised version of the analyses that

address the concerns expressed should be considered by the Committee in the near future.

SC/61/RMP11 presented the results of a partial aerial survey of coastal Icelandic waters conducted in the Faxaflói area of southwest Iceland in late June-July 2008. The relative cue distribution, duplicates and measurement errors in the 2008 survey were reported and sighting rates were compared to earlier surveys in this block. Details are given in Annex D Item 3.3.1.1. A full scale survey is planned for June-July 2009. The Committee **welcomes** the paper and appointed Donovan to provide oversight for the surveys on behalf of the Committee.

SC/61/RMP8 summarised a sighting survey conducted in the Svalbard area, the *Small Area* ES, in the summer 2008 as the first year in a new six-year survey programme for minke whales in the Northeast Atlantic over the period 2008-2013. The area was last covered in 2003.

6.3.2 Recommendations

The Committee **recommends** that the estimate of abundance for the Eastern *Medium Area* of 81,000 (CV 0.23) for 2002-2007 be adopted for use in the *CLA*.

The Committee **agrees** that the *Implementation Review* for the North Atlantic minke whales is now complete.

6.4 North Pacific common minke whales (RMP/NPM)

In 2007, the Committee agreed to discuss and synthesise new information, in the spirit of a *pre-implementation assessment*. However, it was also suggested that it would be better to delay the full *Implementation* process until the JARPN II review and the in-depth assessment were completed (IWC, 2008e). Last year, the Committee agreed to discuss this further at this year's meeting (IWC, 2009e). However, in light of the discussions under Item 22, it agreed to delay consideration at this meeting and await the results of discussions within the Commission.

6.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

7 ESTIMATION OF BYCATCH AND OTHER HUMAN-INDUCED MORTALITY

The report of the working group on estimation of bycatch and other human-induced mortality is given as Annex J. This subject was introduced onto the Agenda in 2002 (IWC, 2003c) because as part of the Revised Management Procedure, recommended catch limits must take into account estimates of mortality due to *inter alia* bycatch, ship strikes and other human factors in accordance with Commission discussions at the 2000 annual meeting (IWC, 2001a), although of course such mortality can be of conservation and management importance to populations of large whales other than those to which the RMP might be applied. Subsequently, the issue of ship strikes has become of interest to the Commission's Conservation Committee (IWC, 2006b).

7.1 Collaboration with FAO on collation of relevant fisheries data and progress on joining the Fisheries Resource Monitoring System (FIRMS)

It is expected that sharing data on bycatch and ship strikes held by the IWC with the data held by FAO in FIRMS should contribute to our ability to estimate mortality due to these causes. The IWC is presently an observer to FIRMS and will be eligible for full partnership when all of its bycatch and ship-strike data from the past National Progress Reports have been collated in a format suitable for integration into the FAO database. This work is in progress by the Secretariat and the Sea Mammal Research Unit, UK. Some results of the collation are ready and will go to FAO in September this year. Details are given in Annex J.

7.2 Estimation of bycatch mortality of large whales

SC/61/BC8 reported that in an analysis of whale meat samples from Japan purchased in 2008-2009, more individual fin whales (20) were detected than can be accounted for by recent JARPA II takes (13) and two reported bycatches. The authors took the dates of release of Icelandic meat into account. Their understanding was that the imported meat was not released from Japanese customs until October 2008. Only three fin whale products (representing two individuals) were purchased after this date. One was labelled 'Antarctic fin whale meat' and one of the other two advertised as from the reported Wayakama bycatch. Consequently, they expected to find no more than 15 market individuals over all surveys, 2006-2009. The individual identity or regional origin of any IUU (illegal, unreported or undocumented) whales among the 20 could not be determined. It was noted that access to relevant data in the national DNA registries (in this case of Japan and Iceland) could assist in improving estimates of bycatch as well as resolve discrepancies such as that noted above. The Committee **recommends** that such access be granted under the Data Availability Agreement and **encourages** the holders of these registries to facilitate such requests under Procedure B of the DAA (IWC, 2004e).

Morishita reported that meat from Iceland from seven individual fin whales had been released to the market around the end of 2008 and the beginning of 2009 when market sampling for this paper had been conducted and therefore all the individuals (20) can be accounted for. He further pointed out the possibility that bycaught individuals from previous years, which had been reported in Japan's National Progress Report, could have been available in the market. He also stated that if the authors can provide the results of their DNA analysis to the Government of Japan, it will compare them with the DNA registry and report the findings to the Committee. It is not in a position to open the DNA registry to the Committee because it is not scientifically necessary to have access to the whole registry for the analysis. In addition, the registry has an enforcement function. He finally stated that he could not agree with the strong preoccupation of the authors about the existence of IUU whaling without direct evidence.

Goto commented that microsatellite analysis would be needed to accurately identify the number of individual fin whales in the market samples. He further noted that

phylogenetic analysis should also be conducted to investigate the geographic source of the samples, using reference mtDNA sequence data submitted to GenBank.

In another genetic analysis (Lukoschek *et al.*, In press), the geographic distribution and temporal changes in stock composition of common minke whale products sold in Japanese markets between 1997 and 2004 were re-examined, using microsatellite genotypes, mitochondrial sequence variation and molecular sex information. The authors concluded that the J/O stock[4] composition of the bycatch did not change in 2001 when Japanese domestic regulations regarding use of bycatches changed, suggesting that the magnitude of bycatches was the same before and after the change. The overall proportion of J-type whales was 44% in their market samples. A mixed-stock analysis based on haplogroup frequencies yielded an estimate of 46.1% of market individuals originating from the J-stock. This is higher than would be expected if the proportion of J-stock in the bycatch were 60% as previously assumed (IWC, 1999d). The proportion of J-stock in the bycatch may be higher, and/or the proportion of J-stock in the scientific hunt may be higher than was reported for 1994-98. These findings have implications for ongoing discussions in the Committee of present and possible future whaling for common minke whales around Japan, especially given recent evidence that the distribution of the J-stock is broader than was previously thought (related stock structure and distributional issues are discussed under Item 10.2).

Goto noted that Lukoschek *et al.* (In press) is a revised version of Lukoschek *et al.* (2005) with additional samples from March 2004 to June 2004 and that this paper was already discussed by the Committee in 2005. In his opinion there are several flaws in the present paper:

(1) The localities of market samples does not tell us the original place of catch, because the same individuals were sold within different prefectures in several cases (see fig.1 in Lukoschek *et al.*). In addition, geographic differences in the distribution of haplogroups and stock-type proportions among the three coastal regions were investigated, but the samples in each prefecture have representation of each region.
(2) The methods used for the differentiation of O and J stock using specific sequences of DNA have not been completely established (IWC, 2006e). Also, it was noted in 2005 (IWC, 2006c) that 'Waples queried the conclusion that 'differences in microsatellite allele frequencies between O type and J type were not as great as expected if the breeding cycle of the two stock is six month out of phase', since some misidentification of individuals would be expected to blur these differences.'
(3) There are too many individuals of unknown sex in Table 2 in Lukaschek *et al.* to support the conclusion of an increase in the proportion of females.

Goto concluded that therefore the market samples do not provide information for constructing stock structure hypotheses and estimating the number of bycaught J-stock minke whales.

Statements regarding Lukaschek *et al.* can be found in the Minority Statements Annex R.

It was noted that scientific delegates from Japan were not members of the bycatch working group, where the two market-sampling papers were discussed at length, and it was suggested that participation in the working group sessions in future would facilitate plenary discussion.

An IWC workshop on the use of market samples for estimation of bycatch was held in 2005 (IWC, 2006c). The Committee has in the past noted that a second workshop would be useful but would require more detailed information on market operations than is presently available. The possibility exists of organising a workshop jointly with other organisations and agencies interested in similar issues was raised last year (IWC, 2009l) and this will be investigated intersessionally.

7.3 Estimation of risks and rates of entanglement

SC/61BC3 presented an estimate of mortality due to entanglement in fishing gear for humpback whales in the Gulf of Maine, the first time that such an estimate has been available to the Committee. The study used annual estimates of the non-lethal entanglement rate (based on longitudinal observation of peduncle scarring in individual whales) and an estimate of entanglement survival from eye-witnessed events (76.6%). Assuming a minimum population of 783 whales, this approach suggested an annual entanglement mortality rate of 29 whales per year, or 3.7%. By contrast, only 2.8 entanglement deaths were directly observed per year on average during the same period (Glass *et al.*, 2008). The fact that the present estimate exceeds observed deaths by an order of magnitude may account for the relatively low rate of growth of the humpback population in the Gulf of Maine and adjacent regions of the western North Atlantic (0-6.5%) compared to those in some other regions (Clapham *et al.*, 2003; Stevick *et al.*, 2003). While the Committee noted that this estimate of mortality rate may be applicable for humpback whales or even other species in some other regions, entanglement rates could be expected to vary with size and nature of fisheries operating in a region.

7.4 Progress on including information in National Progress Reports

Reported bycatches and ship strikes in this year's Progress Reports (total 290-292) are comparable in nature and number to those in 2008. This is not thought to represent the total mortality due to these causes, and member countries are again urged to report bycatches and ship strikes. Further, the Committee **recommends** that Progress Reports specifically state whether zero mortality has been reported rather than just leaving blank fields.

Electronic submission of data, including reports of bycatches and ship strikes, for the Progress Reports would simplify the task and facilitate data retrieval and analysis, including liaison with FIRMS. The change-over would require careful consideration by the Committee and the

[4]See Item 10.2.1 for a discussion of stock structure of western North Pacific common minke whales.

Secretariat. Some suggestions for investigating this are given in Appendix 2 of Annex J.

7.5 Methods for estimating mortality from ship strikes

7.5.1 New information on ship strikes

Information was received on several cases of ship strikes (SC/61/BC2, 4, 5, 7) and on rates of ship strike involving sailing vessels (SC/61/BC1). The data are welcome and will be incorporated into the IWC ship strike database (7.7 below).

7.5.2 Estimating mortality

A high rate of ship strikes involving fin and sperm whales in the Mediterranean is of special concern (SC/61/BC2), and a project planned within ACCOBAMS, primarily to address possible mitigation, includes activities relevant to the Committee's remit: data gathering and collation and mapping the spatial distribution of whales and ship traffic.

The Conservation Committee continues to work on issues related to ship strikes, and IWC/61/CC5 outlines plans for a joint IWC/ACCOBAMS workshop on mitigation. Some aspects of the workshop relate to estimating mortality. The workshop will be hosted by ACCOBAMS in Monaco, preferably in September 2010. The Committee notes that several tasks identified in preparation for this workshop have arisen directly from its recommendations of previous years and **endorses** the project and participation by its members.

7.6 Development of a global database of ship strike incidents

The format and structure of an international ship strike database was agreed by the Committee in 2007 in collaboration with the Conservation Committee, and as of 2008 there were 763 records entered (SC/61/BC9). A Ship Strike Data Review Group was established last year (IWC, 2009l). An intersessional working group has succeeded in designing and establishing a web-based entry system, hosted on the IWC website[5]. Messages sent to shipstrikes@iwcoffice.org indicating that there is new information to be considered will be forwarded to the data review group for possible inclusion in the database. Work remains to further develop and maintain the database and clarify policies for access and interchange with national databases. The Committee **recommends** that this work go forward intersessionally; a proposal with budget is given in Appendix 4 of Annex J and is discussed further under Item 24.

7.7 Other issues

The Committee noted plans for the workshop on cumulative impacts of underwater noise (SC/61/E15), including relevance to estimating mortality due to noise, and looks forward to a report from the workshop next year.

[5] http://www.iwcoffice.co.uk/sci_com/shipstrikes.htm.

7.8 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

8 ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995a). The report of the SWG on the development of an aboriginal whaling management procedure (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; (2) review of management advice for the humpback whale fishery of St. Vincent and The Grenadines; (3) preparation for the *Implementation Review* for eastern gray whales. The Chair of the SWG noted that its work this year had been considerably assisted by the progress made at the intersessional workshop on Greenland fisheries held in Copenhagen (SC/61/Rep5).

In addition, he noted that last year (IWC, 2009e), the Committee had tested and agreed a safe method to provide interim advice (i.e. catch limits for up to two 5-year blocks) such that the catch limit is 2% of the lower 5th percentile of the most recent estimate of abundance.

8.1 Sex ratio methods for common minke whales off West Greenland

The Committee has been evaluating assessment methods for common minke whales off West Greenland that rely on the relationship between the observed sex ratio of catches and that inferred from population models parameterised in terms of carrying capacity, productivity and how the distribution of males may have changed relative to that of females. This concept was introduced in 2005 (IWC, 2006d; Witting, 2005). The major factor which suggests that sex-ratio data may be informative about population size is that catches have consistently been female-dominated. 'Best' estimates of population size from sex ratio based methods are infinite, in effect indicating that any level of past catches would not have impacted this population of minke whales. However it is standard Scientific Committee practice, in accordance with a precautionary approach, to base management advice primarily on lower confidence bounds for such estimates. The Committee has therefore focussed attention on developing the novel assessment approach required to calculate these bounds.

Considerable technical work was undertaken by the SWG during the intersessional period (see SC/61/Rep5), during two days of pre-meeting and during the present annual meeting (see Annex E, item 2.1); Brandão, Witting, Butterworth, Schweder and Punt are particularly thanked for their hard work. As a result, the Committee noted that sufficient progress had been made to overcome the technical difficulties related to the specification and implementation of sex ratio-based methods of assessment, that it **agrees** that the method is ready to be evaluated using simulation testing.

It is particularly important to evaluate fully this method as it is a new and novel approach for conducting assessments. Considerable discussion on how best to achieve this occurred in the SWG (e.g. see Annex E, appendix 4). Four types of calculations were agreed:

(1) retrospective analyses (dropping off years of data one by one starting from the most recent year (for the 10 most recent years)).

(2) assessments based on different models (Closed, Site Fidelity, Influx – see Fig. 3) and MSYR rates.

(3) simulations based on different population models.

(4) model-free simulations (i.e. adjustment of existing data).

Table 5

An initial list of robustness tests based on population models (unless specified otherwise the estimator should match the population model used to generate the data). These may require modification during the intersessional process (see text). Case 1 will be run first by the Secretariat to identify whether there are any major specification problems

Case	Population model	K[1]	Overdispersion	MSYR	Other	Priority
1	Influx	150,000	Estimated	2%		1
2	Closed	150,000	Estimated	2%		1
3	Model 5	150,000	Estimated	2%		2
4	Influx	75,000	Estimated	2%		2
5	Influx	50,000	Estimated	2%		2
6	Influx	20,000[1]	Estimated	2%		1
7	Influx	150,000	Estimated	2%	Closed estimator	1
8	Closed	150,000	Estimated	2%	Influx estimator	1
9	Influx	150,000	2 x Estimated	2%		1
10	Influx	150,000	1	2%		2
11	Influx	150,000	Estimated	1%		1
12	Closed	150,000	Estimated	1%		2
13	Influx	150,000	Estimated	2%	+ 20 ys extra data	2
14	Closed	150,000	Estimated	2%	+ 20 ys extra data	2

Table 6

Specifications for the model-free robustness tests (separately for each data set and for all data sets at the same time). These may require modification during the intersessional process (see text). Case 3 will be run first by the Secretariat to identify whether there are any major specification problems.

Case	Slope	Mean	Priority
1	Unchanged	Unchanged	1
2	+0.05	Unchanged	2
3	-0.05	Unchanged	1
4	Unchanged	+0.05	2
5	Unchanged	-0.05	1

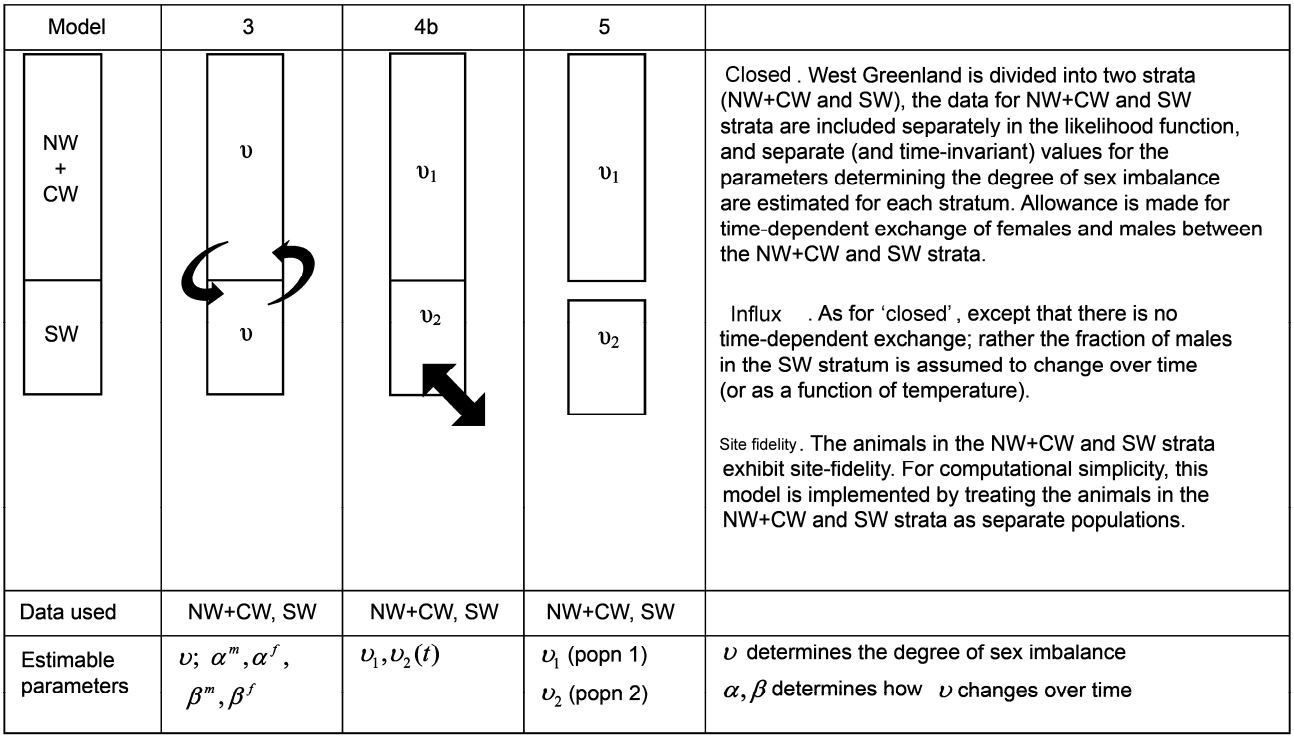

Fig. 3. Sex ratio models for common minke whales off West Greenland (see text). For detailed specifications of the models see IWC (2009b).

The Committee **endorses** the SWG's technical agreements with respect to ensuring the most efficient approach to the simulation process (Annex E, item 2.1). Since the intention is that the ultimate goal is to use this approach for providing management advice, the assessment calculations and robustness evaluations will be conducted by the Secretariat. This will require the Secretariat to develop code (based on the current versions of the sex-ratio method) which implements the estimation methods.

The Committee also **endorses** the initial set of robustness trials (Tables 5 and 6) and priority ranking for intersessional work. For both AWMP and RMP, the Committee has in the past had difficulty fully specifying simulation tests in one iteration. It therefore **agrees** that there may be a need for an intersessional workshop to refine the specifications and implementation of the assessment methods and robustness tests. The values in Tables 5 and 6 (particularly those for *K* and the slopes in mean sex ratio) are preliminary and may need to be refined once initial results are available. The intent of the values for *K* in Table 5 is to examine a range of stock status levels.

The need for/length of such a workshop will depend on whether the Intersessional Steering Group (Convenor Donovan - Q2) is able to resolve any major problems identified. In this respect, the SWG identified that the Secretariat should first implement Case 1 in Table 5 and Case 3 in Table 6, as these should allow major problems with the specifications to be identified.

8.2 Preparations for an *Implementation Review* of eastern gray whales

Last year, the Committee had expected to carry out an *Implementation Review* of eastern gray whales. However, as discussed fully in Annex F (item 4.2) it was not possible to undertake the review this year, primarily as the revised series of abundance estimates are not yet available. The purpose of an *Implementation Review* is not to undertake an in-depth assessment but rather to examine whether there is any information to suggest that the 'parameter space' used to evaluate the *Gray Whale SLA* was inadequate. SC/61/AWMP3 described an operating model and a number of scenarios that might be used for the *Implementation Review* for the gray whale *SLA* to be conducted before or during the 2010 Annual Meeting. Primary responsibility for determining this is given to the SWG on the AWMP. It may be necessary to conduct further trials incorporating the new information, as envisioned in SC/61/AWMP3. The best manner in which to conduct the *Implementation Review* should be apparent by the time that papers need to be submitted under the data availability agreement i.e. 28 February 2010.

Information on new information and analyses likely to be presented next year are summarised in Annex F (item 4.2.4) and under Item 9.2.2.

All data to be considered during the *Gray Whale Implementation Review* need to satisfy the data availability agreement Procedure A. The requisite deadlines (assuming the Scientific Committee meeting starts at the beginning of June) are:

Datasets/type of paper	Time before	Deadline
Final datasets available	6 months	30 November 2009
Papers using 'novel methods'	3 months	28 February 2010
Papers using 'standard methods'	2 months	30 March 2010
Papers responding to those above	1 month	30 April 2010

8.3 Development of long-term management advice for the Greenland fisheries

Progress towards developing an *SLA* for common minke whales off West Greenland requires the selection of a set of operating models; finalisation of the sex ratio assessment method will provide an important basis for this selection. Development of an *SLA* for common minke whales off West Greenland will be facilitated by having several potential developers. As a result of past experience, the Committee last year (IWC, 2009e) had made the technical recommendation that the trials for common minke whales off West Greenland should be coded such that the *SLA*s are standalone programs to assist in the development process. The development of an *SLA* requires a 'need envelope' (e.g. IWC, 1998c). The Committee **encourages** the Chair of the SWG to discuss this matter with the relevant delegation (Denmark and Greenland) as had been done previously with relevant delegations for the *Bowhead* and *Gray Whale SLA*s and report back next year.

The Committee also **reaffirms** its view on the importance of making progress with the development of an appropriate *SLA* for West Greenland fin whales (the issue of a 'need envelope' is relevant here also). SC/61/Rep5 noted that the set of trials developed in an RMP context to evaluate variants of the *CLA* for North Atlantic fin whales and those used last year to compare alternative methods for providing interim management advice, are an appropriate starting point for developing trials for this case. The trials for the North Atlantic fin whales were focused on the areas likely to be subject to whaling off Iceland and will need to be modified to focus more on the uncertainties pertinent to West Greenland if they are to form the basis for evaluation of *SLA*s for fin whales. A short paper on appropriate operating models for West Greenland fin whales will be presented to the SWG at next year's meeting.

8.4 Other matters

The Greenlandic need statement is expressed in terms of tonnes, not numbers of animals. At last year's Commission meeting (IWC, 2009a), the Chair of the Commission asked the Scientific Committee to take note of a request from Argentina seeking clarification of factors used to convert whales to tonnes (e.g. whether and how this included edible products in addition to meat). Discussion within the Committee focussed on whether it was possible to estimate a conversion factor per strike per species from the available data and if not, how it should be done, rather than the way that it had been done within the Commission in the past. It noted that it had not been requested to review the conversion factors used when they had been accepted by the Commission previously.

The Committee received two analyses addressing this question.

The first (SC/61/AWMP6) used length data from the Greenland aboriginal hunt and from the IWC catch database, along with a formula to convert length to weight developed by Lockyer (1976) to estimate average body weights of fin and minke whales, and the yield of edible products (meat and blubber) from these species. The authors obtained higher conversion factors than those in use in Greenland and noted that logistical considerations may well affect actual yield in the hunt, but were unable to assess the extent to which this may be the case. The second approach by Witting (Annex E item 10.1) used hunter's reports from Greenland with respect to edible products (meat, blubber[6] and skin). Reported yields per whale were quite variable but the author noted that it was not possible from the available information to know how much of the variation was real and how much may be due to unreliable weight estimation and/or misreporting. This approach resulted in somewhat lower estimates of the conversion factors *per strike* (using yield per strike incorporates an estimate of actual efficiency) than those used in Greenland. He also presented an approach for using this information to determine the probability that the current strike limits would satisfy need.

The Committee welcomed these papers but **agrees** that neither provided sufficient information to allow it to answer the question referred to it by the Chair. The approach in SC/61/AWMP6, for example, treated the formula given by Lockyer (1976) as precise while some estimate of the uncertainty should be incorporated. In addition, her analysis for humpback whales was primarily for Southern Hemisphere animals which are larger than their northern counterparts (as is generally the case). Although the approach of Witting did use the relevant data from the Greenlandic hunt to calculate a yield per strike in order to examine the strike limit that would be needed to meet the need request from Greenland, Witting agreed that the reliability and representativeness of the data from the Greenlandic hunt that he obtained from the hunters' reports was unknown (e.g. whether weights are measured or estimates).

The Committee **agrees** that for it to be able to adequately address the question and to determine a conversion rate per strike, it would require reliable, representative data from the Greenlandic hunt. This would involve data on the measured weight of obtained edible products (meat, ventral grooves, skin) from an adequate sample of animals of each species and associated information on the individuals (sex, length, date of capture, position of capture). The Committee **requests** that Greenland collect such information and provide it, along with sampling and validation protocols and information on factors that may affect yield, to the Committee for its consideration.

8.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

[6]Although termed 'blubber' it was clarified after the meeting that in Greenland the ventral grooves are consumed, as well as some of the blubber.

9 ABORIGINAL SUBSISTENCE WHALING MANAGEMENT ADVICE

The Committee's has a responsibility to provide advice to the Commission on Paragraph 13 of the Schedule. Discussions under this item are based on the work of the sub-committee on bowhead, right and gray whales (Annex F) and the SWG on the AWMP (Annex E).

9.1 Eastern Canada and West Greenland bowhead whales

9.1.1 Assess stock structure and abundance of Eastern Canadian and West Greenland bowhead whales

The Committee has agreed at the previous two Annual Meetings to consider a single stock of bowhead whales in this region as the 'working hypothesis' while acknowledging that there is still some uncertainty about the population structure of bowhead whales in eastern Canada and Western Greenland (IWC, 2009h). The Committee **expresses disappointment** that the expected genetic analyses were not supplied this year to test the single stock hypothesis. The Committee **agrees** that a 'working' hypothesis of one stock implies that alternative hypotheses are still considered and therefore there should be consideration of both one stock and two stock hypotheses. The Committee **strongly encourages** provision of genetic analysis to evaluate the appropriateness of the hypotheses considered.

In 2008, the Committee agreed on a negatively biased estimate of 6,344 (95% CI = 3,119-12,906) which pertains to the Baffin Bay-Davis Strait population (IWC, 2008e, p.28) i.e. that relevant to West Greenland.

Some members of the Committee noted that there was considerable uncertainty associated with treating the current estimate as an estimate of the total Eastern Canada/Western Greenland bowhead population size and that it would be difficult to obtain adequate aerial survey coverage of the large and fragmented summer range to provide a more accurate and precise estimate. These members recommended that the possibility of photographic survey be investigated to obtain a capture-recapture estimate, similar to that presented for the BCB stock in Koski *et al.* (2009) and discussed under Item 9.3.1.

9.1.2 Review of recent catch information

Three bowhead whales were harvested under licence in the eastern Canadian Arctic in 2008, two in Nunavut and one in Nunavik, northern Quebec (Reeves, pers. comm.). No bowhead whales were harvested by Greenlandic whalers in 2008.

9.1.3 Management advice

In 2007, the Commission agreed to a quota (for the next five years) of two bowhead whales struck annually off West Greenland but the quota for each year shall only become operative when the Commission has received advice from the Scientific Committee that the strikes are unlikely to endanger the stock. In 2008, the Committee was pleased to have developed an agreed approach for determining interim management advice (IWC, 2009e). The Committee again **agrees** that the current catch limit

will not harm the stock**.** It was also aware that catches from the same stock have been taken by a non-member nation, Canada. It noted that should Canadian catches continue at a similar level as in recent years, this would not change the Committee's advice with respect to the strike limits agreed for West Greenland.

9.2 Eastern North Pacific stock of gray whales

It had been anticipated that there would have been an *Implementation Review* of eastern gray whales at this year's meeting (see Item 8.2). However, given the difficulties outlined in SC/61/AWMP1 (below) in obtaining a suitable set of abundance estimates, this has been postponed until next year. Planning for the review is discussed under Item 8.2.

9.2.1 New scientific information

SC/61/AWMP1 reviewed the 23 shore counts for the Eastern North Pacific (ENP) stock of gray whales, and documented how the counting procedures have changed over time. In attempting to provide a new abundance series it was realised that, due to inconsistencies in the analytical methods that have been used over time, all the correction factors would have to be re-estimated in a more consistent manner. The results of this approach will be better suited to trend analysis. Data from 1967/68 – 1979/80 were originally analysed by Reilly *et al.* (1980; 1983) and reanalysed by Buckland and Breiwick (2002). Data from subsequent surveys have not been analysed in a way totally consistent with Reilly *et al*. (1980; 1983). SC/61/AWMP1 outlined an extensive plan which will be used to revise the time series of abundance estimates for the Eastern North Pacific gray whales.

SC/61/AWMP2 introduced a stochastic population dynamics modelling framework that incorporated a hypothesised relationship between an environmental variable and process error in life history parameters for a cetacean population. It was anticipated that revised versions of the data used in these analyses would be considered within this framework during next year's *Implementation Review*. SC/61/AWMP3 presented the results of a set of simulation trials used to test the performance of the *Gray Whale SLA*. The operating model was based on the framework presented in SC/61/AWMP2. This allowed future projections to be explicitly conditioned on available information pertaining to the population dynamics of eastern North Pacific gray whales, including survey estimates of 1+ abundance, calf counts, strandings data and the extent of sea-ice in the early season feeding grounds in the Bering Sea. The scenarios considered in the analyses explored the impact of different sources of environmental variation, including scenarios in which future environmental forcing and episodic events are driven by the hypothesised relationship between the extent of sea-ice and deviations in life history parameters. In discussion it was noted that in order to perform future projections of this kind, it is necessary to have an environmental index for which there exist not only observations, but also a relevant forecast from global climate models.

SC/61/BRG5 reported on investigations of eastern gray whales taken in Mechigmensky Bay during 2007/08. Gray whale distribution was found to be uneven and varied by month although numbers appeared to increase during October in both years. This might be related to the start of the southbound migration. The paper also included information on biological parameters from hunted whales included weight, sex, length (and other morphometric measurements), sexual maturity, stomach content, blubber thickness and presence or absence of abnormal smell or taste to the meat. This is discussed in detail in Annex F. With respect to the 'stinky' whale phenomenon also being examined by the Commission's Conservation Committee, the paper noted that in 2007, two stinky whales were killed whilst there were eight in 2008. The cause of the odour/taste remains unknown and samples were collected in anticipation of further cooperative research effort. SC/61/BRG12 summarised the research efforts in 2008 on this phenomenon. Samples were collected from two stinky whales and two normal whales, which were frozen for later analyses. Further samples were collected later in the summer/early autumn. Permitting efforts are underway to split these samples between Russian, Japanese and US analytical laboratories.

The Committee noted that there are plans for a new marine port to be developed on the south side of Punta Colonet (Baja California, Mexico) approximately 150 miles south of the US-Mexico border. The port is scheduled to be operational by 2014. Gray whales pass in close proximity to Punta Colonet during their south and north migration to and from the calving lagoons along the coast of Baja California. In the past, the Committee has expressed concern about development projects in gray whale critical habitats along the coast of Baja California because of the presence of gray whales (Compean *et al.*, 1995). For this reason, the Committee **re-emphasises** the statement made in 1994 i.e. '*to plan development compatible with the conservation of the animals and their critical habitats, the effects of past and current potential impacts of development require study*' (IWC, 1995e, p.78). In the case of the port development at Punta Colonet, there is a need to implement an ongoing research and monitoring programme to collect baseline (pre-development) data on how gray whales use the Punta Colonet regions during their south and north bound migration. In addition, it would be important to gain knowledge on the planned routes of maritime traffic that will operate in accordance with the port development, in order to understand potential impacts to other mysticetes distributed in the area. These data will serve to benefit the design of best-practice mitigation measures to minimise potential ship strikes as marine traffic increases in the location when the port becomes operational.

The Committee noted that due to population increases and some environmental changes during the last decade (e.g., retreating sea-ice and a regime shift in the Bering Sea), eastern gray whales have begun foraging much more extensively in the Chukchi Sea. This is a region of increased interest for the development of offshore petroleum resources, and the Committee **urges** the Commission to request national governments to ensure that appropriate resource agencies pay additional attention to the changing role and habitat use of gray whales in the Arctic.

9.2.2 Provide information to the SWG on AWMP for Implementation Review *in 2010*

The goal of the *Implementation Review* is to evaluate new information about the Eastern North Pacific gray whale stock that has become available since the *SLA Implementation* to determine whether the new information is outside the realm of plausibility covered by the *Implementation* trials. If so, it may be necessary to conduct further trials incorporating the new information.

From discussions at this meeting it appears that at least the following will be required:

(1) Data used in the revised series of abundance estimates from the 1967/68-2006/07 counts of Eastern North Pacific gray whales on their southern migration past Granite Canyon, CA. Data used to produce new estimates of calf production during 1994-2008 from the northbound migration at Point Piedras Blancas, CA (e.g. Perryman *et al*., 2002).
(2) Data on the number of stranded gray whales on the coast of CA, OR, and WA, 1975-2009.
(3) An index of March and April sea-ice conditions which covers as much of the assessment period as possible and can be projected into the future.
(4) An updated catch series, 1930-2008, that incorporates catches discovered since the catch series used in this SC meeting was created. In particular it will need to include the catches by *California* in the 1930s and further consideration of aboriginal/subsistence catches prior to the 1960s.

In addition to these data sources, any information regarding stock structure (or lack thereof), priors for biological parameters and other relevant data (e.g., that from studies in the Baja lagoons) will need to be considered.

9.2.3 Review of recent catch information

A total of 127 gray whales (63 males, 64 females) were taken in the aboriginal hunt in Chukotka waters in 2008 and three were struck and lost. Further details about the captured animals are given in Annex F, item 4.2.2.

In discussion, it was noted that sex ratios in the aboriginal hunt in Chukotkan waters have historically been skewed towards more females. However the present sex ratio is more even. One reason for this difference is that the selectivity of the hunt changed after the early 1990's, when the harvest transitioned from using a catcher ship to shore based small boats.

9.2.4 Management advice

As part of its work on an Aboriginal Subsistence Whaling Management Procedure (AWMP), the Committee completed its work on the simulation-tested *Gray Whale SLA* (*Strike Limit Algorithm*) in 2004 (IWC, 2005b). The Committee **reaffirms** its previous advice that the *Gray Whale SLA* remains the most appropriate tool for providing management advice for this harvest. Use of this confirmed that the current limits will not harm the stock. An *Implementation Review* is now scheduled for 2010.

9.3 Bering-Chukchi-Beaufort (BCB) Seas stock of bowhead whales

9.3.1 New scientific information

A considerable amount of information was presented this year in 11 papers on BCB Seas stock of bowhead whales, and these are discussed in Annex F, item 5.1.1. Only a brief summary of selected papers of that extensive work is given here.

SC/61/BRG1 introduced a probability model for data arising from aerial line transect surveys, with the goal of estimating large- and medium-scale relative animal density for BCB bowhead whales during their autumn migration. This model included consideration of animal clustering and censored observations due to effort truncation and flights with zero animal sightings. Terms were also included for spatio-temporal covariates that affect detection probabilities and animal presence. The analysis shows significant results including a region of lower relative density north of Prudhoe Bay and strong evidence of a region of high density immediately east of this region in an area the whales would pass through before approaching the region of low density. These findings are consistent with the hypothesis of industrial impact. Conversely another model indicates that the region of low density may have persisted since about 1990, which is more consistent with a hypothesis of long-term environmental effects like prey availability.

SC/61/BRG3 reported on bowhead whale distributions in the Central Beaufort Sea during late summer and early autumn of 2006-08 during periods with and without seismic exploration. Data came from aerial surveys, vessel-based surveys and acoustic buoys. Feeding whales appeared to remain in that area for 16 days in 2007 and for 6 days in 2008 while seismic surveys were conducted 10-50km east of them. It appears that bowhead whales may tolerate higher levels of seismic sounds when feeding than when travelling. Similar tolerance to seismic activity has been seen in the summer feeding areas in Canadian waters.

The Committee received new information on how operators of seismic surveys mitigate for potential impacts on marine mammals. Sound levels emitted from seismic operations were measured at distances up to ~80km from the airgun sources and equations fitted to the measurements. These distances included measurements at presumed distances where marine mammals could undergo potential temporary threshold shifts (TTS) and permanent threshold shifts. Support vessels were employed ahead of source vessels to detect whales before they enter presumed radii where TTS might occur and airgun operations were modified if whales were present in those areas. Industry also moved operations this year when a large aggregation of feeding bowhead whales was found near their operation even though whales were well outside of the presumed TTS zone; seismic efforts in that area resumed later in the season.

The Committee considered three papers relevant to abundance estimates. SC/61/BRG21 investigated how information builds up in a sequential capture-recapture study. Information builds up as effort increases. The information gain per extra capture in a sequential capture-recapture experiment was found to grow faster than linear

in number of captures when the population is closed and homogeneous. A similar pattern was found for open populations, with information gain growing faster to its maximum the shorter the longevity.

Schweder *et al.*(2009) described a model for estimating abundance, mortality and population growth of bowhead whales from systematic photographic surveys conducted during the spring migration when most of the BCB population of bowhead whales migrates past Point Barrow, Alaska.

Koski *et al.* (2009) provides an abundance estimate for BCB bowheads based on photo-identification data. Specifically, photo-identification data were collected in 2003-05 for use in capture-recapture analyses. A screening procedure was used to define which whales photographed were marked and could be re-identified if photographed on another occasion. Further, an estimate of the number of marked whales was obtained using a closed population model for capture-recapture data. To account for unmarked whales, this estimate was divided by an estimate of the proportion of the bowhead population that was marked based on the 1989-2004 spring photographic surveys near Barrow.

The Committee **agrees** that the 2004 abundance estimate of 11,800 (CV 0.255, 95% confidence interval [7,200; 19,300], and 5% lower limit 7,800) from the photo-identification data is an acceptable estimate of the abundance of the BCB stock of bowhead whales. This estimate is suitable for use in the *Bowhead Whale SLA*.

During discussion of SC/61/BRG23, which described the ice-based survey attempted near Barrow in spring 2009, it was noted that changing ice conditions are increasing the difficulty of on-ice efforts to count bowheads. In 2010, there will likely be another attempt to conduct an on-ice census, including estimation of detection probability via an independent observer experiment. Schweder *et al.* (2009), Koski *et al.* (2009) and SC/61/BRG21 provided details about using photo identification data to estimate bowhead abundance using capture-recapture techniques. If funding allows, conducting both an on-ice count and a photographic survey will occur in 2010.

The Committee further discussed the potential for future abundance estimates being based on photo-identification data from systematic aerial surveys. In Schweder *et al.* (2009) a refinement of the capture-recapture technique for analyzing such data from the spring migration is suggested. A likelihood function summarising the data from previous systematic photo-surveys is developed. The information gain in data obtained from a new survey, as evaluated from the archive of captures from previous surveys, is discussed in SC/61/BRG21. From the results of that paper, and data on costs, a cost and information-benefit analysis might be undertaken. This would provide grounds for deciding how much effort should be allocated to on-ice versus photographic surveys for abundance estimation. The Committee would welcome such an analysis.

9.3.2 Catch information

SC/61/BRG6 summarised data from the 2008 Alaskan hunt. A total of 50 bowhead whales were struck resulting in 38 animals landed (including an autumn calf, 7.2m in length), similar to the 10-year average of 40.4 (SD=7.1). Of the landed whales, 18 were males, 19 were females, and sex was not determined for one animal. Hunters reported that one female was pregnant with a foetus ~3m in length. Hunters mistakenly harvested a calf thinking it was a small independent whale. Autumn calves are close in body length to yearlings and it is difficult to determine their status when swimming alone. Other details are given in Annex F item 5.1 2.

In 2008, two female bowhead whales were landed in Chukotka. The whales measured 11.5 and 12.5m and were 44 and 39 tons respectively.

9.3.3 Management advice

As part of its work on the AWMP, the Committee completed its work to develop a *Bowhead Whale SLA* in 2002 (IWC, 2003a) and an *Implementation Review* in 2007 (IWC, 2008e). The Committee **reaffirms** its advice from last year that the *Bowhead Whale SLA* remains the most appropriate tool for providing management advice for this harvest. The results from the *SLA* show that the present strike limits are acceptable.

9.4 Common minke whale stocks off Greenland

9.4.1 West Greenland

9.4.1.1 ABUNDANCE

SC/61/AWMP4, the report of an aerial line transect survey conducted off West Greenland in August-September 2007 is a revision of a paper presented and discussed at the intersessional workshop held in Copenhagen in March (SC/61/Rep5, item 2.1) and taking into account recommendations and comments made there. A total of 8,670 km of survey effort covered 14 strata, with a total stratum area of 213,996 km^2. The sightings of common minke whales in sea states <3 (n=22) were all within a strip width of 300m and the average time from first detection to when the sighting passed abeam was 1.7 sec. Due to the uniform and narrow distribution of the detections, strip census methods were used to analyse the survey. Two methods were deployed to correct the strip census estimates for whales missed by the observers and whales that were submerged during the passage of the plane.

Method 1 provides an uncorrected estimate of 1,866 (CV=0.30). It uses a simple mark-recapture estimate to correct for whales at the surface missed by observers, resulting in a partially corrected estimate of 1,904 (CV=0.31). The correction for availability bias using sequences of aerial photographs of surfacing and/or diving minke whales (n=39) leads to a fully corrected abundance estimate of 17,307 (95% CI 7,628 to 39,270) minke whales.

Method 2 used only the 14 detections of minke whales that were observed to break the surface to give an uncorrected estimate of 1,208 (CV=0.36) and a partially corrected estimate of whales at the surface of 1,233 (CV=0.37). The restriction to whales observed to break the surface was because the adjustment for availability bias was based on readings from satellite-linked recorders that could only occur when the whales were above the surface and the

transmitters were dry (tags from 5 animals). The fully corrected abundance estimate from Method 2 was 22,952 (95% CI 8,444 to 62,383).

The Method 1 and Method 2 estimates in SC/61/AWMP4 were not substantially different and both methods had merit. Discussion focused on which estimate was most appropriate to use for management purposes. The CI for both estimates were wide, reflecting the inclusion of the variance of forward detection time in the variance of the abundance estimate. However, the Method 1 estimate was more precise, based on more sightings and data from more whales were used in the availability bias correction. On balance, the Committee concluded that the Method 1 estimate, although it might be more negatively biased, was the best estimate to use for management. The Committee therefore **recommends** the estimate of 17,307 (95% CI 7,628-39,270).

9.4.1.2 CATCH DATA

A total of 148 common minke whales were landed in West Greenland (86 females; 55 males; 5 unidentified sex) and 5 were struck and lost during 2008 (SC/61/ ProgRepDenmark). No information was available on the number of genetic samples taken from the harvested whales at this time. The Committee **recommends** that this information, along with any updated information on sex of the animals caught, be provided to the Secretariat.

9.4.1.3 MANAGEMENT ADVICE

In 2007, the Commission agreed that the number of common minke whales struck from this stock shall not exceed 200 in each of the years 2008-2012, except that up to 15 strikes can be carried forward. As it has said on several occasions in the past, the Committee has never been able to provide satisfactory management advice for this stock, although in recent years, the situation has been improving. This year, in addition to the progress made with the sex ratio method for assessment, the Committee has adopted a new abundance estimate (see Item 9.3.1.2) although it is negatively biased (see Item 9.3.1.1). As noted under Item 8, the Committee also has an agreed the method for providing interim management advice and this was confirmed by the Commission. Such advice can be used for up to two five-year blocks whilst *SLA*s are being developed (IWC, 2009g). Based on the application of the agreed approach, and the lower 5th percentile for the 2007 estimate of abundance (i.e. 8,918), the Committee **agrees** that an annual strike limit of 178 will not harm the stock.

9.4.2 East Greenland

9.4.2.1 MANAGEMENT ADVICE

One female common minke was landed in East Greenland in 2008. In 2007, the Commission agreed to an annual strike limit of 12 minke whales for East Greenland for 2008-2012. The present catch limit represents a very small proportion of the Central Stock (see Table 7). The Committee **repeats its advice** of last year that the present catch limit will not harm the stock.

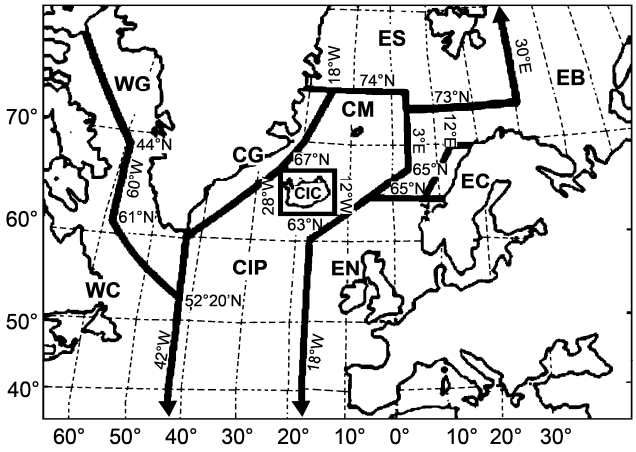

Fig. 4. Map showing North Atlantic common minke whale *Small Areas*.

Table 7

Most recent abundance estimates for the Central North Atlantic (for details see Annex D).

Small Area(s)	Year(s)	Abundance and CI
CM	2005	26,739 (CV=0.39)
CIC	2007	10,680 (CV 0.29)
CG, CIP	2001	23,592 (CV=0.26)

9.5 Fin whales off West Greenland

9.5.1 New information

SC/61/Rep5 reviewed a revised analysis of the results of aerial line transect survey of fin whales conducted off West Greenland in 2007 (Heide-Jørgensen *et al.*, 2009). The revisions were made in response to past comments by the SWG (IWC, 2009g). Results were presented based on conventional distance sampling (CDS) techniques and mark recapture distance sampling (MRDS) techniques. The Committee had previously recommended the CDS approach pending clarification on some matters. The Workshop had focused on comparisons between the CDS and MRDS approaches and which estimate should be recommended for use in assessments.

With respect to pod size estimation, in the CDS analysis, the mean pod size is estimated by averaging over all strata, while in the MRDS analysis, mean pod sizes differ between strata. This is important for the MRDS analysis because there was a very large aggregation in one stratum. Despite the increased sample size for the MRDS, the Workshop concurred with the earlier view of the Committee that the amount of data available to support the approach was insufficient and consequently recommended that the estimate of 4,359 whales (95% CI 1,879-10,114) should be used for the purpose of assessment.

The Committee **concurs** with the Workshop conclusion and **recommends** that the CDS estimate of 4,359 fin whales (95% CI 1,879-10,114) be used to provide management advice. It noted that this estimate was negatively biased because no correction was applied for whales submerged during the passage of the survey plane.

9.5.2 Management advice

9.5.2.1 SUMMARY OF PREVIOUS SEASON'S CATCH DATA

A total of 11 (8 males; 3 females) fin whales were landed, and 3 struck and lost, in West Greenland during 2008

(SC/61/ProgRepDenmark). No information was available on the number of genetic samples taken from the harvested whales. The Committee **recommends** that this information be provided to the Secretariat when it becomes available.

9.5.2.2 MANAGEMENT ADVICE

In 2007, the Commission agreed to a quota (for the years 2008-2012) of 19 fin whales struck off West Greenland. As noted under Item 8, last year the Committee agreed an approach for providing interim management advice and this was confirmed by the Commission. Such advice can be used for up to two five-year blocks whilst *SLAs* are being developed (IWC, 2009g). Based on the application of the agreed approach, as last year, the Committee **agrees** that an annual strike limit of 19 whales will not harm the stock.

9.6 Humpback whales off West Greenland

9.6.1 Management advice

The Committee was first asked to provide management for humpback whales off West Greenland in 2007 (IWC, 2008g).

Humpback whales found off West Greenland belong to a separate feeding aggregation whose members mix on the breeding grounds in the West Indies, with individuals from other similar feeding aggregations and the Committee has agreed that the West Greenland feeding aggregation was the appropriate management unit to consider when formulating management advice (IWC, 2008g). Last year (IWC, 2009e) it had agreed a fully corrected estimate for 2007 (3,039, CV=0.45) for use in assessments and a rate of increase for humpback whales off West Greenland of $0.0917yr^{-1}$ (SE 0.0124).

No new information was available for this stock since the thorough review that occurred last year. Last year, the Committee agreed an approach for providing interim management advice and this was confirmed by the Commission. It had agreed that such advice could be used for up to two five-year blocks whilst *SLAs* were being developed (IWC, 2009e). Using this approach, as last year, the Committee **agrees** that an annual strike limit of 10 humpback whales will not harm the stock.

9.7 Humpback whales off St Vincent and The Grenadines

9.7.1 Review of new information

No catch report has been provided to the Scientific Committee by St Vincent and the Grenadines for this year. In 2008, one female (33'6") was landed and one struck and lost. Samples of blubber and muscle tissue were collected and underwater fluke photographs are available. Clapham advised the SWG that he had been informed that a whale had been taken on 27 April 2009. The Committee noted that St Vincent and Grenadines has submitted detailed catch information directly to the Secretariat during the Commission meeting over the past few years. It **encourages** St Vincent and the Grenadines to also submit as much information as possible about any catches to the Committee via an annual progress report. It again **strongly encourages** collection of genetic samples for any harvested animals as well as fluke photographs, and submission of these to appropriate catalogues and collections. In respect of genetic samples, the North Atlantic Whale Archive maintained by Per Palsbøll at Stockholm University was an appropriate facility.

9.7.2 Management advice

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 adopted a total block catch limit of 20 for the period 2008-12. The Committee **agrees** that this block catch limit will not harm the stock

9.8 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

10 WHALE STOCKS

10.1 Antarctic minke whales

The Committee is currently conducting an in-depth assessment of the Antarctic minke whale. To complete an in-depth assessment, the following information is needed: stock structure, abundance estimates, trends in abundance, and catch histories. These data are then input into an assessment model to evaluate the status of the species. Two different types of catch-at-age assessment models are currently being developed (see Item 10.1.3). During the present meeting, abundance estimates, catch histories and the catch-at-age assessment models are discussed.

10.1.1 Produce agreed abundance estimates of Antarctic minke whales using IDCR/SOWER data

10.1.1.1 ABUNDANCE ESTIMATES

A workshop was held in St Andrews, Scotland, from 7-10 April, 2009 (SC/61/Rep9). The aim was to facilitate the completion of the analyses of Antarctic minke whale data from the second and third circumpolar IDCR/SOWER surveys (CPII and CPIII). Two external reviewers were invited to attend (Borchers and Buckland). Substantial progress was made in specifying diagnostics additional variance.

This year, the Committee was pleased to receive two papers (SC/61/IA6 and SC/61/IA14) reporting estimates of Antarctic minke whales from CPII and CPIII. The OK hazard probability model (SC/61/IA6) estimated total abundance as 1,287,000 (CV= 0.202) for CPII and 688,000 (CV= 0.182) for CPIII. The SPLINTR (SPatial Line TRansect) method (SC/61/IA14) estimated total abundance as 747,000 (CV= 0.13) for CPII and 461,000 (CV=0.09) for CPIII.

It was noted that while $g(0)$ estimates from SPLINTR were well below one, abundance estimates from SPLINTR were not much larger than those from the 'standard' IWC method (e.g. Branch, 2006), which assumed g(0) was 1. However, the authors of SC/61/IA14 considered that because of un-modelled spatial correlations between school size, school density, and good sighting conditions in the IDCR/SOWER surveys, the 'standard' method, but not the SPLINTR method, is positively biased.

The Committee thanks the developers of the OK and SPLINTR models (Okamura, Kitakado, Bravington and

Table 8
Issues investigated to determine the reason(s) for the difference between abundance estimates from the OK and SPLINTR methods and the recommended future work needed.

Topic	Issue/Work done already	Recommended future work
Lack of fit as seen in diagnostics plots	Radial distance fits from the OK model showed underestimation of numbers seen at small radial distances. Predicted numbers of duplicate sightings at small perpendicular distances from the OK model was generally too high.Fits to perpendicular distances by SPLINTR (and to a lesser extent, OK) failed to capture the observed spike in the data at very small distances.	1) Identify the platform that made the sightings at small radial distances 2) explore effects of removing the bridge data from the analyses when using both methods to estimate the abundance. 3) Using the SPLINTR method, investigate other functions that more closely fit the 'spike' to the real data.
Spatial vs stratified approach to estimate density	SPLINTR uses spatial methods and OK uses stratification. When the the SPLINTR method was modified to use a stratified approach and some approximates, abundance estimates increased substantially. It is not known if the approximates used are appropriate.	1) Fit SPLINTR model with a uniform density within each stratum. 2) Adjust the knot spacing for spatial modelling of the 2003/04 survey when using the SPLINTR method, to improve the lack of fit in the CPIII Ross Sea.
Effective strip widths of whales	A prior, the detection probability is not expected to vary by Area, when accounting for sightability, school size and vessel effects. However, ESW from the OK method varied more than could be explained by sampling variation and were very low in some strata, particularly for small groups sizes.	1) Produce scatterplots of esw of whales. against density, by stratum. 2) OK model could be refitted excluding Area-specific parameters for esw for whales.
Compare g(0) estimates from these two methods to independent estimates of g(0)	Estimates of g(0) from OK were lower than those from SPLINTR, particularly for some strata and group sizes of one. SC/61/IA18 used the BT mode experiments to estimate g(0) for the topman. For group sizes of one, SPLINTR estimates were similar to the BT estimates. For group sizes of 2+, both methods were less than the BT estimates, where SPLINTR was closer to the BT estimates.	1) Investigate the effect on the BT estimates due to the lack of complete separation between the search area of the two teams. 2) Compare OK and SPLINTR estimates of g(0) [and other parameters] to those from Branch et al. (2006) when like minke whales are included.
Use of confirmation information	OK assumes group size in confirmed sightings (whether in IO or Closing mode) were correct. SPLINTR assumes group sizes in sightings in Closing mode (whether confirmed or not) were correct. When the OK method was modified to assume all Closing mode group sizes were correct, the resulting abundance estimates increased, surprisingly.	Conclusion: this difference made no appreciable contribution to the difference in abundance estimates between the OK and SPLINTR models.
Use of different distances for duplicate sighitngs.	OK assumes the correct distance to the duplicate sighting was the distance reported last. SPLINTR assumes the distance is from the platform that saw it first. This difference would make a difference if there was responsive movement. After inspecting, there was no evidence of responsive movement.	Conclusion: this difference made no appreciable contribution to the difference in abundance estimates between the OK and SPLINTR models.
Track line length	SPLINTR adds 1 nm to the end of each section of effort prior to a significant break in effort. OK does not do this.	1) Tabulate area (n.miles2), and separately for IO and Closing mode, by stratum, tabulate number of sightings (ns), and effort (L) in nm. 2) SPLINTR re-estimate abundance when this additional trackline was not added in.
Allocation of data to a stratum	It is possible to do this using the location of the ship as described by the latitude/longitude or by the reported time each stratum was surveyed. These should be consistent, but they are not in all cases.	1) For each circumpolar survey, and by Area, tabulate number of sightings per platform combination. 2) Ensure same stratum boundaries are being used by both methods. 3) Evaluate the effect of the two ways of allocating data to a stratum.
Data included in analyses	OK used the 1991/92 data in Area V for estimation of the detection function, but not the abundance estimate. SPLINTR did not use these data at all.	SPLINTR will use these data in the same way as OK does.

Hedley) for the huge amount of work they have invested in producing Antarctic minke whale estimates from the IDCR/SOWER data.

The two fundamental differences between the OK and SPLINTR models are: (i) in the way that detection probability (and associated parameters) are estimated – the OK model uses a two-dimensional cue-based hazard probability model which assumes independence in the probability of detecting a cue, whilst SPLINTR uses a detection probability model based on perpendicular distances to sightings, and assumes detections are independent on the trackline; and (ii) in the way that stratum density is estimated – the OK model uses a Horvitz-Thompson-like stratified design-based approach, whilst the SPLINTR model uses modelling to estimate a density surface which is integrated over space.

SC/61/IA10 found that the hazard probability model is fairly robust. The largest observed bias in the estimated effective strip half-width was around 8%, while for most situations there was almost no bias.

10.1.1.2 SIMULATED DATASETS

Simulated datasets were produced to examine the robustness of the new methods to various factors which may affect abundance estimation. The simulated datasets were intended to capture, at least partially, the complexities of the real IDCR/SOWER data.

Results from applying the IM (Cooke, 2009), OK, SPLINTR and IWC 'standard' analysis method (Branch, 2006) to the simulated datasets were presented in SC/61/IA7 and SC/61/IA9. Comparisons between the estimated and true density of whales, schools and group size indicated that both methods performed well, except for the cases with high rates of duplicate mis-

identification. For the more complex scenarios, SPLINTR estimates were generally less biased than the OK estimates, and *vice versa* for the less complex scenarios. In most cases, estimates from the OK model were higher. Factors associated with higher OK estimates were scenarios with unmodelled heterogeneity, specifically those scenarios which contained the following factors: (i) detection probability dependent on initial cue (blow versus body); (ii) complex interactions between school size, weather and density gradients; and (iii) non-synchronised diving.

It was pointed out that new data for the IWC/SOWER experiments that are now available could be used to either parameterise the scenarios differently or to be used in creating new scenarios.

The results in SC/61/IA9 focussed on assessing bias in the point estimates. The Committee **recommends** that a limited amount of testing of the estimated variances should be done.

10.1.1.3 DIFFERENCES BETWEEN ESTIMATES FROM OK AND SPLINTR

The Committee examined the diagnostics from the two methods in detail and noted that for most of the specified diagnostics, both the OK and SPLINTR models fitted the data well, with a few exceptions. However, because of the ways that the components of both models were inter-dependent, the resultant effect on the abundance estimates from lack-of-fit to the diagnostics was not necessarily easy to infer. Specifically, discrepant diagnostic fits do not necessarily imply serious bias in estimation. The Committee **agrees** that these discrepancies on their own may not necessarily be of sufficient concern to fail to adopt the estimates in either paper. However, the fact that the point estimates between the two different approaches were so different meant that further detailed examination of the methods was necessary.

Taking the diagnostics together with the simulation results, it was clear that there was no simple answer to the reason for the difference in the estimates. The Committee considered many possible reasons for these differences and **recommends** ways to further investigate these (summarised in Table 8). The Committee therefore **agrees** that it is not at this time in a position to recommend the acceptance of the abundance estimates provided by either the OK or SPLINTR models.

10.1.1.4 ADDITIONAL VARIANCE

SC/61/IA8 outlined some approaches for estimating the extent of process errors, which are attributed to inter-annual changes in whale distribution. The standard errors of the preferred OK abundance estimates in SC/61/IA6 were inflated by taking into account the extent of the additional standard errors estimated from the fixed effect model.

The Committee **agrees** that this method was a good approach for estimating additional variance and thanked the authors for providing the code used to estimate additional variance to the developers of the SPLINTR and IM models.

10.1.1.5 WORK PLAN

To facilitate explanation of the differences between the estimates explained and thus allow an abundance estimate to be accepted during the 2010 annual meeting, the Committee **recommends** the work plan given in Table 1 and Annex G (Appendix 3) for an intesessional email working group, convened by Skaug (Q11). This involves considerable work and will require an iterative approach. To achieve this intense work plan, an intersessional workshop and/or a one-day meeting held during the pre-meeting days directly before SC/62 may be needed. The intersessional working group should determine which of these meetings will be needed to complete their work plan.

10.1.2 Conduct an analysis of ageing errors that could be used in catch-at-age analyses

Last year, a proposal involving independent age reading of 250 earplugs by Lockyer was recommended to help resolve questions concerning ageing of Antarctic minke whales (Butterworth and Punt, 2009). These questions need to be resolved in order to finalise the catch-at-age models.

The final logistic arrangements for this experiment are being made and it is expected that the work will be undertaken during November-December 2009, in Tokyo. The Committee re-iterates its previous statement that it considers this work to be critical in order to be able to finalise the current catch-at-age modelling work and **recommends** that the experiment be undertaken as a matter of high priority.

To verify the age estimates obtained from earplug readings using a different method, last year the Committee considered the feasibility of using bomb radiocarbon chronometer techniques. This would be particularly valuable for aging older animals, which tend to be difficult. The Committee **recommends** that this technique be further investigated. Lockyer said she would check the feasibility, assess the cost of this technique, and report the conclusions at next year's meeting.

Another approach to examining the extent of aging errors data from whales be used to compare the time between marking and recapture (Discovery marks[7]) to the corresponding age based on earplug reading. Matching of the Discovery-marked data (Buckland and Duff, 1989) with the age data was not straightforward but was feasible. The Committee **recommends** that analyses of the marking and corresponding age estimates be undertaken.

It was also reported that analyses of fatty acids in killer whale blubber had been successful in aging killer whales. The Committee **suggests** that this methodology should be investigated as to whether such techniques could be used to age minke whales.

10.1.3 Continue development of the catch-at-age models

Two catch-at-age models have been previously developed (Mori *et al.*, 2007; Punt and Polacheck, 2008) to assess the status of Antarctic minke whales. Previously these models

[7] Discovery marks are numbered metal darts that were fired into whales and were recovered when the whale was captured – see for example Brown (Brown, 1977).

indicated historical increases in carrying capacity. To investigate if this pattern is true or an artefact, the effects of aging errors and the use of the JARPA data were examined. In addition, this year the Committee was informed that there has been misreporting of Soviet length data (SC/61/IA20). The effects of this are discussed below.

10.1.3.1 EFFECTS OF AGEING ERRORS

SC/61/IA2 used simulations to assess the implications of different levels of ageing bias on the performance of the statistical catch-at-age method of Punt and Polacheck (2008). Simulations based on deterministic data suggested that a 20% under-estimate of age in 1970 which changes linearly to zero in 1986 will lead to estimated time-trajectories of historical increases in carrying capacity which match those from actual applications of the statistical catch-at-age analysis method when the true carrying capacity is time-invariant. Allowing for observation error makes the results more variable.

The Committee notes that these results further confirm the importance of undertaking the independent ageing experiment and **reiterates** its previous recommendation that the highest priority task for the catch-at-age modelling work is the development of 'appropriate error models for the catch-at-age data to be used in the population modelling to take into account potential errors and biases in the ageing and length data and how these may have been changed over time'.

10.1.3.2 EFFECTS OF PAST CATCH HISTORY

SC/61/IA20 reported that, contrary to general belief, illegal whaling by the USSR continued after introduction of the International Observer Scheme (IOS) in 1972. Data from the *Sovetskaya Ukraina* factory fleet showed that many Antarctic minke whale catches were not reported to the IWC, and that data on the biological characteristics of these whales were falsified. In particular, lengths were exaggerated to hide the fact that additional whales had been taken (e.g. three whales would be killed and only two were reported, but the lengths of the two were increased in the reports).

SC/61/IA21 noted that the apparent lack of reliability of the post-IOS Soviet catch data introduced significant problems for the use of the existing catch record in the In-depth Assessment of Antarctic minke whales. The authors proposed that a work plan be developed to determine whether sufficient records exist to clarify the extent of data falsification after 1972.

The Committee thanked the authors of SC/61/IA20 for the reporting of this new, regrettable information. It considered the potential impact on its work, particularly the catch-at-age analyses which require data on the number of whales caught, their lengths and the age-length key. Therefore it is important to have at least some idea of the extent to which the length mis-reporting occurred. The Committee **recommends** that further information sources be investigated to provide the percentage of the catch record that was in error. Mikhalev agreed to undertake to find such data and to present it at the 2010 Annual Meeting.

The type of misreporting described in SC/61/IA20 is a common phenomenon in many other managed fisheries, and the Committee **agrees** that some alternative scenarios for the catch-at-age modelling need to be developed to assess the sensitivity of the results to such misreporting. It **recommends** that some scenarios need to consider that misreporting may have occurred in all fleets. Some members considered that, unlike the situation for the Soviet fleet, there had been no incentives for the Japanese fleet to misreport length data because there had not been any restrictions on length applicable to the catching of minke whales at that time. Kato commented that based on his experience on factory vessels, Japanese catch numbers had not been misreported either. Best added that as an independent researcher for a month on the *Nishin Maru* No. 3 in the 1978/79 season, he was unaware of any such practices in the Japanese whaling operations. Therefore, in their view, there was no reason for the catch-at-age analyses to consider scenarios where misreporting may have occurred in the Japanese fleets.

10.1.3.3 EFFECTS OF JARPA DATA

SC/61/IA1 provided the results from additional sensitivity tests conducted to examine the impact of ignoring data from JARPA on the outputs from the statistical catch-at-age analysis method of Punt and Polacheck (2008). The results suggest that the estimates of trends and natural mortality are most sensitive to ignoring the JARPA length-composition and age-at-length data, while these estimates are not very sensitive to ignoring the JARPA indices of relative abundance.

The Committee considers the lack of sensitivity to the JARPA abundance estimates as unexpected and may be due to structural constraints of the model. Thus, the Committee **agrees** that this outcome warrants further investigation and suggestions were made on how to investigate this.

10.1.3.4 WORK PLAN

The Committee re-iterates its previous agreement that resolution of questions concerning ageing of Antarctic minke whales was the highest priority task for the catch-at-age modelling work and the work proposed last year (Butterworth and Punt, 2009) be undertaken. The Committee **recommends** the development of both catch-at-age models should be continued intersesssionally and the data for this should be made available to the developers. The development work needs to include the development and application of error models for the catch at age data derived from the independent age reading experiment, construction of scenarios for possible misreporting of catches and size data, and evaluation of the sensitivity of the catch at age models to these alternative scenarios.

The Committee **recommends** that the intersessional working group on catch-at-age analyses of Antarctic minke whales be continued to facilitate the work, with Punt as the convenor (Q12). Since the current data access agreement ended with the 2009 meeting, the Committee **recommends** a renewal of the data access agreement provide for access to the previous data and to the data resulting from the independent age reading experiment. Kato responded that he and his colleagues would respond regarding the data requested under the Data Availability protocols, when the request was received.

10.1.4 Continue to examine the differences between abundance estimates from CPII and CPIII

In 2001 (IWC, 2002c) and 2002 (IWC, 2003b) hypotheses were proposed that could account for the apparent change in abundance estimates from CPII and CPIII, as analysed by the Branch (2006) standard analysis method. Recent studies are indicating that factors that influence differences between CPII and CPIII may be acting in complex and interrelated ways that may be acting differently for different areas. This year, one particular hypothesis was discussed – namely that the difference may be explained, at least partially, by changing ice conditions and extent between the two sets of surveys, resulting in many more Antarctic minke whales being present in unsurveyed areas (within the pack ice itself and in polynyas) during CPIII than during CPII.

Relationships between sea ice condition and abundance estimates of Antarctic minke whales in the Ross Sea were examined using IDCR/SOWER and JARPA II survey data (Mori *et al.*, 2002). For both IDCR/SOWER and JARPA II surveys in the Ross Sea, the abundance estimates were lower in years of high sea ice extent.

In discussion, it was noted that the Ross Sea is a large embayment, where the relationships between whale density and ice may not be typical of other regions of the Antarctic which have less complex ice configurations and dynamics.

SC/61/IA17 examined the effect of days after sea ice melting on the estimated density of Antarctic minke whales in the Weddell Sea (0°-60°W; Area II). They found minke whale densities were high in regions immediately after sea ice melting and they declined subsequently. The authors concluded that consideration of effects of days after sea ice melting on the abundance estimates of minke whales is important to understand the reasons for the difference in estimates between the CPII and CPIII surveys. The authors plan to extend their investigations to examine this relationship in other Areas and to investigate the effects on the estimation of effective strip width and mean school size.

Noting that these papers were both provided in response to requests last year for such work to be undertaken, the Committee **thanks** the authors of SC/61/IA16 and SC/61/IA17 and looked forward to receiving results from the extended study noted in SC/61/IA17.

The Committee considers the work on the relationship between sea-ice characteristics and Antarctic minke whale abundance estimates to be important in the investigation of potential reasons for the difference between the abundance estimates of Antarctic minke whales during the two CPII and CPIII time periods. To facilitate this work, the Committee **recommends** that the sea ice and abundance estimate intersessional working group be re-established under Kitakado as convenor (Q16). The terms of reference are: (1) create the timing of the ice melt index for the entire time series of CPII and CPIII; then (2) investigate the relationship between abundance estimates and sea ice characteristics by modelling the abundance estimates using this index and other sea ice characteristics, and possibly including interactions between the sea ice characteristics. The Committee expects this work to take two years to accomplish. It looks forward to receiving a progress report next year.

10.1.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

10.2 Western North Pacific common minke whales

The Committee began work on an in-depth assessment of western North Pacific minke whales in 2004 (IWC, 2005d), in response to concerns about the conservation status of J-stock that arose from the RMP *Implementation* completed in 2003 (IWC, 2004a).

The report of the Working Group on an in-depth assessment of western North Pacific common minke whales, with focus on J-stock is given in Annex G1. One of primary issues this year's was work to integrate abundance estimates for minke whales in the Sea of Japan and Yellow Sea, where Japan and Korea have conducted sighting surveys since 2000. Another primary issue was further investigation of stock structure for western North Pacific common minke whales including J-stock animals.

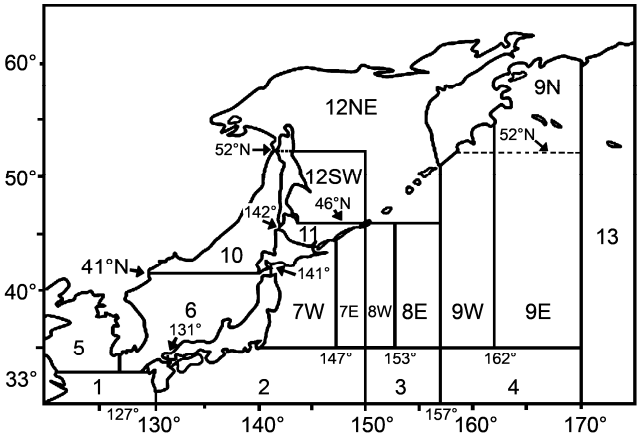

Fig.5. The 18 sub-areas used for North Pacific common minke whales.

10.2.1 Distribution and Abundance

The Committee **welcomes** the report of Korean sighting survey conducted in the Yellow Sea in 2008 (SC/61/NPM1). The survey introduced two Chinese researchers so that the same kind of survey could be applied in Chinese waters. A planned IO mode survey had not been possible. The Committee noted that as in previous surveys (see SC/61/NPM2) minke whale sightings were concentrated in the north of the survey area. The apparent lack of migration in the area at this time suggests that the direction of surveying is probably not important in the Yellow Sea. Nevertheless, the Committee **suggests** further consideration of survey design and it **agrees** that it was valuable to have multiple surveys in the same season. The consistent distribution of animals primarily in the north of the survey area at this time (April/May) suggests that there may be more animals further north in North Korean and Chinese waters and possibly that minke whales in the Yellow Sea could form part of a separate stock/sub-stock migratory or non-migratory (cf. IWC, 2009i).

SC/61/NPM2 reported the results of analyses of abundance for the common minke whales in block 5E in the Yellow Sea and 6WS in East Sea (see Figure 1 in Annex G1) from Korean closing mode surveys, assuming g(0)=1. Most of the surveys were conducted from April to May except for 2000, 2002 and 2004. Abundance in a survey area in 5E was estimated as 1,552 (CV=0.54) in 2001, 837 (CV=0.34) in 2004 and 713 (CV=0.39) in 2008. Abundance in a survey area in 6WS was estimated as 1,216 (CV=0.41) in 2000, 936 (CV=0.65) in 2002, 575 (CV=0.34) in 2003, 1,015 (CV=0.29) in 2005, 505 (CV=0.47) in 2006 and 695 (CV=0.44) in 2007. These estimates are not corrected for g(0). The Committee **welcomes** the report. Discussion focussed on the lack of sightings in the eastern Korean Strait (south of the East Sea), except in 2006. Survey(s) of the western Korean Strait would provide further information on the apparent hiatus in distribution between the northern Yellow Sea and the East Sea. This would further inform the possibility of whether there could be a separate stock/sub-stock in the Yellow Sea. The question of trends in abundance was addressed in SC/61/NPM6 and discussion arising from it can be found in Annex G1.

SC/61/NPM7 reported the results of analyses to estimate abundance for common minke whales from Japanese surveys in the Sea of Japan, assuming g(0)=1. The surveys were conducted from three vessels, in mid-April to late-June from 2002 to 2007. In 10W, abundance in 2006 was estimated as 2,855 (CV=0.33). Block 10E was surveyed in 2002, 2003, 2004, 2005 and 2007; abundance estimates were 816 (CV=0.66), 405 (CV=0.57), 474 (CV=0.54), 666 (0.44) and 575 (CV=0.33), respectively. Block 6EN was surveyed in 2002, 2003 and 2004; abundance were estimated as 891 (CV=0.61), 935 (CV=0.36) and 727 (CV=0.37), respectively. The southernmost block 6ES was covered in 2002 and 2003; abundance was estimated as 905 (CV=0.68) and 124 (CV=0.58), respectively. The authors believe that the timing of surveys from mid-April to June can be treated as single period without a large risk of double-counting because: (1) J-stock animals migrate into the Sea of Okhotsk in April; (2) the timing of conception of J-stock animals is in autumn; (3) mother-calf pairs are observed in the northern Sea of Japan in the period. This indicates that the peak of the northward migration finishes before April to June, and the animals stay in the Sea of Japan during this period. The Committee **welcomes** the report. In discussion, the Committee noted that although it would be desirable to investigate potential improvements including model averaging to the model fit it would unlikely to have a large effect.

SC/61/NPM6 reported the results of analyses leading towards the integration of abundance estimates from Japanese and Korean surveys (SC/61/NPM2 and SC/61/NPM7) since 2000 in sub-areas 5, 6 and 10, which are the primary areas for the J-stock. No trends were detected. The authors estimated total abundance in the surveyed areas in May-June as 5,851 (CV=0.19) under the model with no annual trend, and the spatially extrapolated estimate in the whole of sub-areas 5, 6 and 10 was 13,790 (CV=0.17); the assumption of $g(0)=1$ leads to negative bias. The authors also noted that J-stock animals are also found in the East China Sea, along the Pacific coast of Japan and in the southern part of Sea of Okhotsk (IWC, 2004b), SC/61/JR5); this should be taken into account if the abundance from these surveys is used in assessments. The Committee **welcomes** this analysis, which was presented in response to its request for information on the integration of abundance estimates.

There was considerable discussion of the analysis and the data used (see Annex G1 for details). This focussed on three issues relevant to the use of the abundance estimates in the assessment: timing of surveys in the context of migration; estimation of trend; and extrapolation to unsurveyed areas. In the light of these discussions, despite the progress made, the Committee is not yet ready to accept the abundance estimates for the Yellow Sea and the Sea of Japan as a whole. However the Committee did reach agreement on a number of issues:

(1) careful consideration is needed on how migration is to be incorporated into the assessment models and any *Implementation Simulation Trials*;
(2) SC/61/NPM6 had demonstrated that trend could be estimated from the available data; this was valuable for the assessment;
(3) estimates in Korean waters of sub-area 6 given in SC/61/NPM2 are suggestive of a decline. A trend analysis of abundance in this area could be informative;
(4) in SC/61/NPM6, simple extrapolation of average density for all sub-areas was used to extrapolate to unsurveyed areas; other methods should also be considered;
(5) how any such extrapolation is incorporated (if at all) into the assessment requires careful consideration - estimates of abundance extrapolated into unsurveyed areas can be used in *Implementation Simulation Trials* but cannot be used in the application of the *CLA* itself.

The Committee noted that the use of abundance data in the assessment would include spatial and temporal considerations. In addition, the model was sex and age structured. It was likely that it would also be necessary to stratify existing sub-areas into at least East and West. The Committee noted the points made in Appendices 5 and 6 in Annex G1, and further noted that the assessment should take them into account.

SC/61/NPM5 presented revised abundance estimates including $g(0)$ estimation for sub-areas 10 and 11 using the 2006 and 2007 IO survey data. The model used was the hazard probability model, which was simplified in comparison with the Antarctic version (Okamura and Kitakado's model, see SC/61/IA6) because there are no complicated school size issues for common minke whales. The estimated $g(0)$ was 0.75 for the top barrel, 0.67 for the IO platform, 0.45 for the upper bridge and 0.82 for the top barrel and upper bridge combined. In discussion, the Committee noted that although there had been no IO data collection in surveys in previous years, in the absence of direct estimates of $g(0)$, the estimates of $g(0)$ presented in SC/61/NPM5 could be used for the top barrel and the upper bridge for these earlier surveys.

Appendix 7 in Annex G1 updated the integrated abundance estimates presented in SC/61/NPM6 by extending the model to incorporate the estimates of $g(0)$

and their uncertainties (SC/61/NPM5) but this was not discussed. A plan for a sighing survey in the East Sea in April/May 2010 was presented (SC/61/NPM3). The survey will be conducted in IO mode to obtain information on $g(0)$ to correct estimates of abundance from this and previous surveys. The Committee **welcomes** this survey plan and appointed An to provide Committee oversight.

10.2.2 Stock structure

Last year, the Committee received the results of cooperative research on stock structure between Japan and Korea. Following discussion, several additional analyses were proposed which the Committee hoped would allow investigation of stock structure for western North Pacific common minke whales. This year, the Committee reviewed two sets of primary papers, with 'JR' and 'NPM' designations. The three JR papers are revised versions of papers that were presented to the Expert Panel for the JARPNII review (see SC/61/Rep1). These papers responded to specific recommendations by the Panel for additional analyses that might be accomplished before this meeting. The three NPM papers had covered material not submitted to the Panel. Whereas the JR papers included all western North Pacific common minke whales captured as part of JARPN and JARPNII programmes (including many offshore samples), the NPM papers focused more narrowly on supposed J-stock individuals captured near Japan.

Palsboll summarised comments of the JARPNII Review Expert Panel to papers on stock structure. The Panel was impressed with the amount of new data that had been collected and found that the analyses that had been conduced were generally sound. The Panel also had a number of specific recommendations and some important concerns (see SC/61/Rep1), including (1) a heavy reliance on statistical tests and p-values, often with no mention of effect size; (2) it is important to include power analyses to determine under what conditions additional stocks could be reliably detected; (3) most of the analyses assume mutation-drift equilibrium, but there are good reasons to believe this is not the case in at least some circumstances; and (4) multiple testing adjustments that were made likely compromised ability to detect real differences or departures from assumptions.

Before discussion, it was clarified that the objective of this meeting was not to review or audit the Panel's Report regarding the earlier JR papers, nor to evaluate the sufficiency of the responses in the revised JR papers. Rather, the objective was to consider how the revised papers and other new information advance our understanding of stock structure for western North Pacific common minke whales.

SC/61/JR5 attempted to separate minke whales into genetically distinct stocks using the samples (N=2542) of the offshore and coastal components of JARPN and JARPNII, and from bycatches along the Japanese coast that were analyzed using 16 microsatellite loci. Results from STRUCTURE (Pritchard *et al.*, 2000) indicated that the samples came from two genetically different groups of minke whales. Assignment of the individuals (with > 90% assignment probability) into one of two 'stocks,' with their sampling locations indicated that these two stocks were the J and O stocks. In addition, it was found that (1) the O stock individuals appeared to migrate, although rarely, to the Sea of Japan; (2) the J stock individuals migrated to the 7W area of the North Pacific side and very rarely to further east; and (3) sub-area 2 (Pacific coast of Japan) was mainly occupied by J-stock.

In discussion, a number of concerns over the use of STRUCTURE, that have been raised previously in the Scientific Committee (e.g. IWC, 2007b) were noted, in particular the well-documented difficulty that STRUCTURE has in detecting weakly differentiated populations. The Committee **agrees** that the STRUCTURE results in SC/61/JR5 provide clear evidence for two populations/stocks, and that these generally conform to what have been referred to as O and J stocks. The difficulty is to determine under what circumstances the failure to find evidence for additional stocks might simply be an inability to detect presence of an additional gene pool(s) that is genetically similar to one of the two detected stocks.

The problem of circularity in analyses that depend on adjusted samples based on STRUCTURE results was also raised. For example, SC/61/JR5 found an F_{st} value of 0.049 between groups of individuals that were assigned to the 'O' and 'J' stocks with high probability. However, this exercise excluded the ~10% of individuals that could not reliably be assigned to one stock or the other. If, as seems likely, this process excludes individuals that are genetically intermediate to the mean O and J genotypes, the result would be to upwardly bias the estimate of difference between the two stocks.

Several suggestions were made for additional STRUCTURE runs using different scenarios. It was also suggested that it might be useful to evaluate usefulness of the program Geneland, which is similar to STRUCTURE but allows one to input spatially explicit collection information for each individual. However, it might be difficult to tune the program to produce believable results for highly mobile species such as whales.

SC/61/JR7 presented the results of analyses based on genetic variation at the mtDNA control region to examine the plausibility of four stock-structure scenarios adopted at the final stage of the *Implementation Simulation Trials* in 2003 using a total of 1,639 whales collected during JARPN and JARPNII surveys from 1994 to 2007. The authors concluded from the results of the heterogeneity tests that (1) whales from the J stock occurred in area 7W in low but sufficient numbers to cause the genetic heterogeneity observed within the 7W samples as well as differences between the 7W and other samples; (2) apart from J stock whales, the survey area was mainly occupied by O stock; and (3) the baselines C and D were not supported because no other genetically distinct stock was observed in the survey area. However, the genetic heterogeneity found in sub-area 9 by the Fst analysis in a single year should be further investigated in the context of baseline scenario A. The author also noted that mtDNA designations and STRUCTURE assignments to O and J stocks were consistent in sub-area 11.

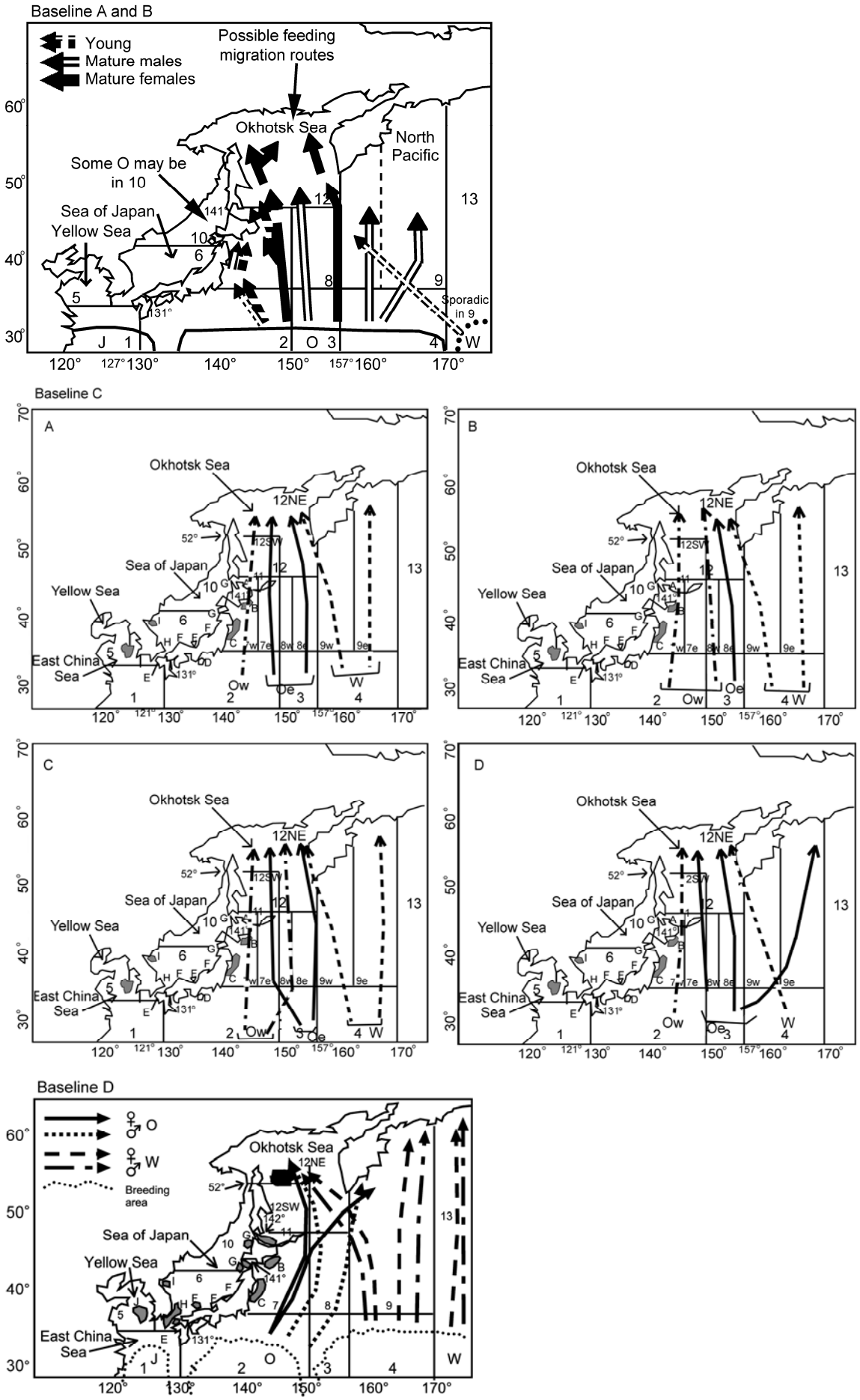

Fig. 6. Schematic diagram of the four baseline stock scenarios: (a) A and B; (b) C; and (c) D. For details see text.

SC/61/JR8 examined the plausibility of four stock baseline scenarios (A, B, C, and D) of North Pacific common minke whales using 16 microsatellite loci for that samples of common minke whales collected during JARPN II as well as JARPN conducted from 1994 to 2007. The authors concluded from the results of the heterogeneity tests among the samples that: (1) whales from the J stock occurred in area 7W in low but sufficient numbers to cause the genetic heterogeneity observed within the 7W samples as well as differences between the 7W and other samples; (2) apart from J stock whales, the survey area was mainly occupied by O stock; and (3) the baselines C and D were not supported because no other genetically distinct stock was observed in the survey area. Simulation studies conducted using population sizes, numbers of loci, and sample sizes comparable to those found in western North Pacific common minke whales indicated that statistical power for testing the baseline scenarios with the data set in SC/61/JR8 was quite high.

In discussion it was noted that the power analyses conducted in SC/61/JR8 were a direct response to a suggestion by the JARPNII Panel; the author simulated genetic data for scenarios intended to be representative of stock structure hypotheses referred to as Baselines A, C, and D. The Committee **thanked** the author for the substantial work involved in conducting the power analyses and **agrees** that the results represent a valuable contribution to its work. In terms of fully evaluating the results of the power analyses (and hence reaching final conclusions) it was noted that: (1) migration rate per year would be useful; (2) migration rates estimated from equilibrium genetic methods (e.g., using F_{ST}) might not reflect current levels of dispersal; and (3) unequal population sizes (and hence uneven migration rates) could affect results. It was suggested that results obtained to date through TOSSM (and future TOSSM-related work) could complement the power analyses conducted here.

SC/61/NPM4 examined genetic variation at the mtDNA control region in common minke whales around Japanese waters using the samples from offshore and coastal components of JARPN/JARPNII (7W and SA11), and from bycatches along the Japanese coast. Based on the results of individual assignment using microsatellites (SC/61/JR5), heterogeneity tests were conducted. Results of the analysis using all by-catch individuals suggested seasonal genetic differences in sub-area between early (April to September) and late (October to March) samples, most likely due to different proportion of J and O stocks. SA2 on the Pacific side was mainly occupied by the J stock. No significant differences were found among J stock animals from SA2, SA6 and SA7, which suggest that a single J stock distributes around Japanese waters. It is important to note that analysis of mtDNA markers independent from the assignment procedure conducted in SC/61/JR5 showed the same pattern of the stock structure to microsatellite analysis (SC/61/NPM8).

SC/61/NPM8 examined stock structure of J stock common minke whales existing around the Japanese water using microsatellite from the same samples used in SC/61/NPM4. On the basis of the results from SC/61/JR5, whales were assigned to either J stock, O stock, or unknown origin, and heterogeneity tests were conducted. Seasonal genetic differences were found in SA7 between samples from April to September and from October to March, most likely due to different proportions of J and O stock individuals. No evidence of genetic difference was detected in samples from all subareas when only J stock individuals were included. The SA2 was mainly occupied by the J stock, which was not genetically different from the J stock in the Sea of Japan. Simulation studies indicated that statistical power for testing the J sub-stocks (especially in the SA2 and SA6) with the data set was quite high. SC/61/NPM8 demonstrated that only the single J stock with no sub-structuring existed around the Japanese waters.

The Committee **thanked** the authors for presenting these important papers that contain much valuable new information. Some general issues (for a full discussion see Annex G1, item 6) that will need to be addressed in the future for some or all of the papers submitted relate to: the approach of first carrying out tests of overall heterogeneity, and then undertaking pairwise comparisons if the overall test was significant; and conducting analyses after adjusting datasets based on results of STRUCTURE analyses in SC/61/JR5.

It was noted that the information about the origin of bycaught individuals should be reliable, as since 2001 a new ordinance has mandated that DNA be registered for all bycaught individuals, and that prefecture officials must sign off on the reporting (a photograph is required as well).

The Committee discussed the implication of the results of these analyses for stock structure for western North Pacific common minke whales.

SC/61/NPM9 attempted to see how consistent the results from recent genetic studies of common minke whales from the Japanese waters by Japanese scientists (SC/61/JR5, SC/61/NPM4 and SC/61/NPM8) are to the stock structure hypotheses agreed by Committee. These genetic studies found that: (1) only two stocks, the J and O stocks, appeared in Japanese waters; (2) no seasonal genetic difference was detected in the sample from SA6; (3) SA2 was mainly occupied by the J stock with some O stock migrating in; and (4) no sub-structuring of the J stock was found around Japan. Two independent genetic markers showed the same results, increasing the authors' confidence in these conclusions. SC/61/NPM9 indicated that only one J stock exists around Japan with mixing with the O stock in the northern Pacific coast that migrated from the offshore area. The authors cautioned that the sampling locations of the bycatches were restricted within 3 n.miles and that most of them were immature whales, so that the number of the O stock whales migrating into the offshore area of the SA2 may be higher. No genetic data was available from SA12 for the Sea of Okhotsk, but according to past studies a small proportion of J-stock appears to be found only in the southern part and only the O stock enters the north part.

The Committee **agrees** that this paper helped advance the understanding of stock structure hypotheses. However, some felt that additional hypotheses merited consideration. There was considerable discussion and differences of opinion over the methods and conclusions presented in the

new papers on stock structure, as reflected in detail in Annex G1. As a result, the Committee was unable to reach agreement on firm conclusions with respect to their implications for stock structure at this time.

However, as noted in Annex G, an *ad hoc* working group was formed to exchange ideas on the following three issues:

(1) integrate the various stock structure hypotheses for areas east and west of Japan into a consistent framework;
(2) discuss available datasets and what additional data and/or analyses are needed to assess relative plausibility of the various hypotheses;
(3) investigate methods to determine the ranges of values of breeding-ground dispersal and migration/feeding-ground mixing that are consistent with available data.

The discussions and ideas with respect to (1) are summarised in schematic form Annex G1, Appendix 8 and the Committee **agrees** that these form a useful basis for further discussion, particularly if they are accompanied by a short rationale as suggested in Annex G1.

With respect to (2) and (3) above, it was noted that understanding two types of movement, 'Dispersal' and 'Mixture', is important for cetacean management. If samples can be collected from breeding populations, dispersal can be estimated from genetic data using either standard models that assume migration-drift equilibrium or assignment methods that estimate contemporary dispersal and mixture fractions can be estimated using programs developed for evaluating mixed-stock fisheries of salmon and other fish species. However, it does not seem likely that breeding-ground samples will be feasible to obtain in the foreseeable future; no surveys are conducted in the presumed breeding grounds (sub-areas 1-4), and little whaling has ever occurred in that area.

Given this situation, the major alternatives that have been used to date are: (1) comparisons of genetic characteristics in samples separated in space and/or time; and (2) use of a clustering program like STRUCTURE to try to partition the samples into component gene pools. The Committee **endorses** the recommendations for future genetic analyses developed by the *ad hoc* group but noted that there had been insufficient time to discuss the priorities to this work assigned by the *ad* hoc group.

10.2.3 Other

The Committee considered the results of the estimation of trend in bycatch per unit effort (BPUE) of the common minke whale taken incidentally from 'J' stock by set net fisheries along the coasts of Japan (Appendix 9 in Annex G1). It noted that such data could potentially provide useful information on trend but noted a number of concerns with the analysis presented, recognising that the analysis of CPUE (or BPUE) was difficult and great care is needed to be exercised in its interpretation. For example, the Committee noted that any change in reporting regulations could have had an ongoing effect on reporting rate and, therefore, the consistency of the series. The Committee **encourages** further work on standardisation but cautioned that the information content of the BPUE series would inevitably be of limited for use in assessment.

The Committee **agrees** with recommendation of the JARPN-II review (SC/61/Rep1) that *Implementation Simulation Trial* methodology should be used for assessment purposes. Such a framework is intended to incorporate all relevant information and to encompass uncertainties.

10.2.4 Future work

The Committee **agrees** that work on integrating abundance estimates should continue, taking into account the concerns expressed in Item 10.2.1, in particular, issues relating to migration.

The Committee was **pleased** to receive a plan for a Japanese biopsy sampling survey to be conducted in the Sea of Okhotsk in summer 2009 to obtain information on the mixing rate of 'J'/'O' stock minke whales in this area. The Russian Federation had indicated that permission would be given to conduct this survey south of 57ºN and west of 152ºE. The Committee recalled its strong recommendation last year that permission be given for this work to take place and **expresses** its appreciation to the Russian Federation for granting this permission. The Committee **welcomes** the plan and looks forward to receiving the survey report and the results of data analysis.

The Committee did not have time to discuss all aspects associated with taking forward the work on stock structure. It understood that this work would form a key component of the process needed to develop alternative stock structure hypotheses for minke whales in the coastal and oceanic regions of the western North Pacific and assess their relative plausibility. These hypotheses would in turn form the basis for a set of assessments of the minke whale populations in these regions to allow the effect of removals from these populations to be evaluated. The process, including a possible intersessional workshop, and exact terms of reference for this exercise would need to be developed by the Scientific Committee. It was confirmed that all scientists who wish to present analyses of data for consideration provide the relevant datasets through the 'Procedure A' of Data Availability Agreement six months prior to the workshop if it is held.

10.2.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

10.3 Southern Hemisphere humpback whales (SH)

The report of the sub-committee on the assessment of Southern Hemisphere humpback whales is given as Annex H. This subject has been on the Scientific Committee's agenda since 1992, when the Committee recommended that priority be given to the assessments of humpback whales (IWC, 1993c, p.22). The Committee currently recognises seven breeding stocks (BS) in the Southern Hemisphere (labelled A to G - see IWC, 1998b), which are connected to feeding grounds in the Antarctic (Fig. 1). Preliminary population modelling of these stocks was initiated in 2000 (IWC, 2001e) and in 2006 (IWC, 2007c), the Scientific Committee completed the assessment of

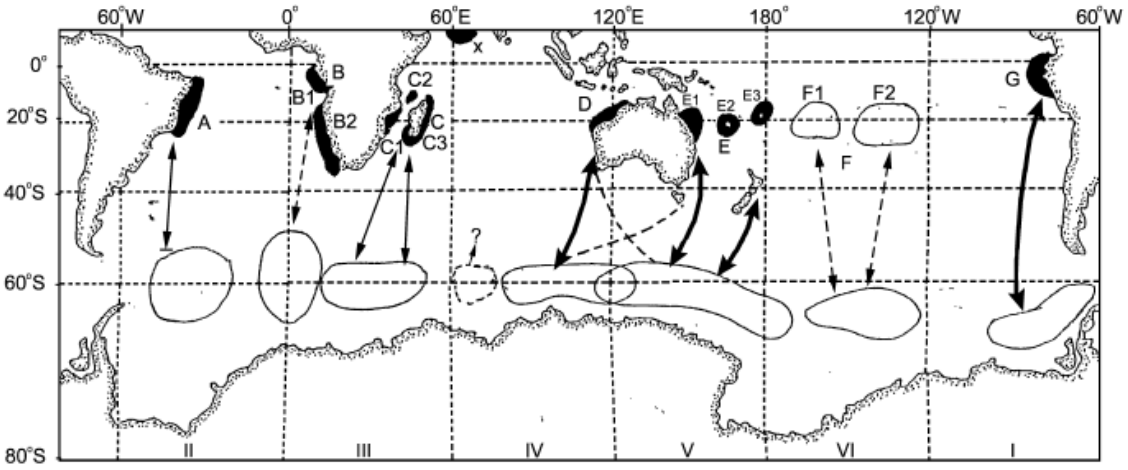

Fig. 7. Southern Hemisphere humpback whales, breeding stocks and feeding grounds.

Table 9

Definitions of conceptual models of interchange for the C1 and C3 sub-stocks

Model	Description and assumptions
Resident Model	Assumes no interchange between stocks on the breeding grounds.
Sabbatical Model	Assumes there is a probability in any year that a C1 sub-stock whale will move to the C3 breeding area off Madagascar. Similarly, a C3 whale may instead move to the C1 breeding ground. This does not affect the situation in the following year, where the whale remains more likely to move from the Antarctic to its home breeding ground. Under this model a whale will visit only one of the two breeding grounds in any one year.
Migrant Model	The is similar to the Sabbatical model, except that if a C1 whale travels to C3 breeding area in one year, it then joins the C3 sub-stock and behaves thereafter as a C3 whale (with the same probability of subsequent migration back to C1).
Tourist Model	This similar to the Resident model, except that in any one year in addition to returning to the C1 breeding area, there is a probability that a C1 sub-stock whale may also visit the C3 breeding area (and similarly for a C3 breeding stock whale).

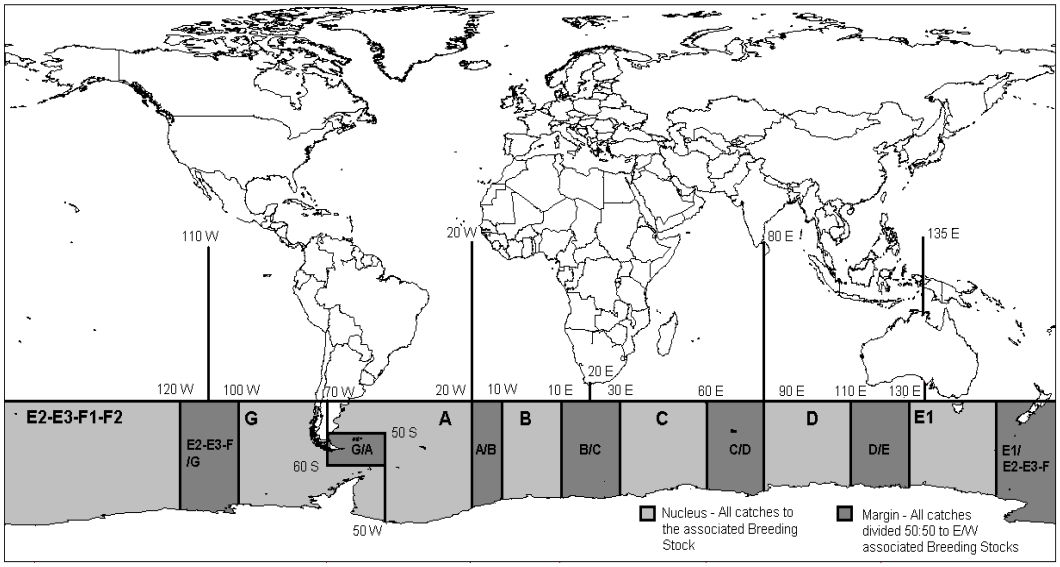

Fig.8. Southern Hemisphere humpback whale catch allocation reference case showing Nucleus and Margin Areas in the feeding grounds associated with breeding stocks A-G.

BSA (eastern South America), BSD (western Australia) and BSG (western South America). Since then, the completion of the assessments of BSB (western Africa) and BSC (eastern Africa) have been considered a priority by the Committee (e.g. IWC, 2008h, p.217; 2009e, p.66).

10.3.1 Report of the Southern Hemisphere Humpback Whale Modelling Assessment Intersessional Workshop.

Last year, the Committee agreed to hold an intersessional Workshop to develop methodologies appropriate for modelling the complexities in mixing and sub-structure associated with BSB and BSC, and BSD, BSE and BSF (IWC, 2009j, p.239).

The Workshop was held in Seattle, USA, between 3 and 6 February 2009 (SC/61/Rep8). The Workshop reviewed information relevant for the assessment of Southern Hemisphere humpback whales available for BSB and BSC, focussing on their use in population models; catch data, estimates of abundance and trends, and information on catch per unit of effort (CPUE) and relative abundance indices were considered. The Workshop gave preference to considering information on BSB and BSC because the completion of their assessments has been given high priority by the Committee (IWC, 2009e).

In discussing catch data, the Workshop had established an intersessional email group to review and clarify delineations of feeding ground catch allocation models. The report of this group (SC/61/SH31) was received and details of the Committee's discussions are found in Annex H, Item 2.2. A summary of the Committee's conclusions is presented under item 10.3.2, below.

The Workshop discussed the use of mark-recapture data and methods to estimate exchange rates between sub-stocks on or near breeding grounds. Four alternative conceptual models were developed: the *Resident*, *Sabbatical, Migrant* and *Tourist* models (Table 9 and see SC/61/Rep8). The Workshop reviewed a Bayesian stock assessment of sub-stocks C1 and C3 implementing these four models and agreed that the modelling framework was adequate with respect to the inclusion of the capture-recapture data. The Workshop also agreed that parallel analysis of the mark recapture data with more standard methods should be carried out to present a comparison with the assessment model outputs.

At last year's meeting, the Committee had recommended that the assessment model performance should be simulation tested in order to determine whether the model provided 'appropriate' results both in circumstances where interchange was taking place in the manner assumed by the model, and also for alternative representations of the underlying interchange process (IWC, 2009e, p.31). The Workshop discussed initial results from operating models which allowed for interchange between sub-stocks C1 and C3 and were used to compare the performance of the Sabbatical and Resident estimators. The Workshop agreed that further testing would be restricted to using the Sabbatical model as the assessment (estimation) model because this had been chosen as the baseline estimator. The Workshop also agreed on: the other models to be used for full simulation testing (SC/61/Rep8, p.14); the outputs to be recorded; and a number of sensitivity cases that could be extended to full simulation testing.

In light of the discussions of the available data, the stock structure and modelling approaches, the Workshop agreed on input data and various sensitivity analyses for the population assessment models and recommended this work to be presented at the annual meeting in Madeira (SC/61/Rep8, pp. 15-16). The Committee **endorses** the recommendations made during the Workshop to advance the assessment of Southern Hemisphere humpback whales.

10.3.2 Report of the Intersessional Email Group on Catch Allocation

The Committee received a report (SC/61/SH31) of the intersessional email group established in SC/61/Rep 8 (item 10.3.1, above) to review and clarify the various catch allocation hypotheses for Southern Hemisphere humpback whales. SC/61/SH31 recognised that five models were used, which include original models developed by the Committee (IWC, 1998b, p.181) and subsequent changes to these models (IWC, 2001e; 2002c; 2007c; In press) and recommended a review of these hypotheses in light of new data. The Committee discussed two possible new catch allocation hypotheses (named Hypotheses 1 and 2 in Appendix 2, Annex H) and **recommends** Hypothesis 1 (Fig. 8) be adopted as a new reference case for the assessment of Southern Hemisphere humpback whales. The Committee also recognised that uncertainties in catch allocation will vary across different stocks and **encourages** the exploration of alternative catch allocation scenarios in the assessment models.

The Committee discussed whether a global assessment of Southern Hemisphere humpback whales was required to reconcile all catches within the catch allocation scenarios and **agrees** that the assessment of Southern Hemisphere humpbacks whales has two objectives:

(1) to assess individual stocks (allocation of catches will not necessarily be additive across all stocks);
(2) to explore a global assessment of all Southern Hemisphere stocks in concert, which accounts for all feeding ground catches.

10.3.3 Breeding Stock C

10.3.3.1 POPULATION STRUCTURE

SC/61/SH8 reported a comparison of songs from whales wintering off Antongil Bay, Madagascar (Southwest Indian Ocean) and Iguela, Gabon (Eastern South Atlantic Ocean) to infer interaction between the BSB and BSC. The occurrence of song phrase types was virtually the same in both sites; these observations constitute the first evidence of song similarity and suggest the occurrence of close acoustic exchange between the two populations. SC/61/SH9 reported an analysis to determine similarity in humpback whale song content between sub-stock C3 and BSD. The co-occurrence of one theme indicated that these stocks overlap at some point during the migratory cycle. However, these populations differ substantially in the amount of overlapping song content when compared with other intra-ocean populations. Discussion of these papers is given in Annex H, item 2.3.2.

The Committee was informed that songs described as humpback whales were recorded during the 2005-6 SOWER in the Southern Oceans and that a subsequent examination of these songs may have been produced by leopard seals (Gedamke and Robinson, in press). The Committee **recommends** that the presence of humpback song among recordings from SOWER be further investigated (SOWER sound recordings are archived at Cornell University, contact person Chris Clark).

The Committee received recent genotypic evidence for migratory connectivity between the four BSB and BSC sub-stocks and the Antarctic (details in Annex H, p 5).

Genotypic matches revealed six connections between breeding sub-stocks C3 and B1 as well as between BSB and BSC to the Antarctic (Table 10).

Table 10

Summary of individual migratory connections between BSB, BSC and the Antarctic from genotype matches.

Breeding sub-stock	Number of genotyped individuals	Approximate location of the match
B1	1404	Antarctic ~55°S, 0°W
B2	168	Antarctic ~57°S, 1°E
C1	140	Antarctic ~61°S, 5°W
C3	1202	Antarctic ~63°S, 59°E
		BSB1
		BSB1

The Committee noted with interest that this work provides the first direct evidence of linkage between the Antarctic and both sub-stocks B2 and C1. In terms of any implications for catch allocation in the assessment models (Annex H, p. 6), the Committee **agrees** that the reference case boundaries are consistent with the available data and therefore should be used as the base case in the population assessment models for BSC.

10.3.3.2 ABUNDANCE ESTIMATION

SC/61/SH7 reported estimates of abundance for sub-stock C3, Madagascar, using identification photographs of flukes and multi-locus microsatellite genotypes collected in Antongil Bay from 2000-2006. Recaptures were generally sparse, and capture probability low. A series of different models was used to estimate abundance including closed and open population models. The primary concerns affecting resultant estimates are: heterogeneity of capture probability introduced by the consistent timing of capture of individuals; the small sample size relative to population size (low probability of capture); the potential for bias due to closure violations in the closed capture models; and the fit of the data to and appropriateness of the Pradel open model.

Detailed discussion of SC/61/SH7 is given on Annex H, p. 6. Concerns were expressed with the model averaging approach of the Pradel model with respect to fixing parameters and it was noted that estimates from open mark-recapture models can be unstable and imprecise, particularly when capture probability is low and there are few recaptures. The Committee **agrees** that a Bayesian formalism of the Pradel model (such as that described in Johnston and Butterworth, 2005) represents a more appropriate means than model averaging for providing abundance estimates across a realistic range of apparent survival and population growth rate (λ) values, since the weighting in such a formulation is more appropriately distributed across the likelihood space.

In view of the concerns raised regarding the use of the Pradel model in an open mark-recapture framework for sub-stock C3, revised estimates of abundance for use in the population assessment models were proposed by the authors of SC/61/SH7: a 'lower bound' estimate (N = 4,610, CV = 0.39), an 'intermediate' estimate (N = 7,406, CV = 0.37), and an 'upper bound' estimate (N = 8,325, CV = 0.37). The Committee **agrees** that the proposed intermediate estimate, which was based on the photo-identification data, was the most appropriate to investigate the sensitivity of mark-recapture data inclusion in assessment models.

10.3.3.3 ASSESSMENT MODELS AND SIMULATION TESTING

10.3.3.3.1 SIMULATION TESTING

SC/61/SH28 developed various operating models that allow interchange between sub-stocks C1 and C3. These are used to assess the performance of the 'Sabbatical' estimator (results are presented in Annex H, Appendix 3). The 90% intervals for the posterior medians from the Sabbatical estimator generally cover the true values from the operating models, although there is a tendency to underestimate r and consequently overestimate K. If the operating model (but not the estimator) is sex-disaggregated, actual abundances for sub-stock C1 can sometimes fall below the 90% intervals for the posterior medians while those for sub-stock C3 can sometimes fall above. An important result is that if the true values of the interchange rate parameters are fixed to be considerably higher ($0.3yr^{-1}$) than values estimated from the actual data, the estimates provided by the estimator are also higher. Fixing these interchange rate parameters to be higher leads to pre-exploitation and current estimates of abundance lower than those corresponding to the lower rates of exchange estimated from the data.

In discussion of the results of additional scenarios identified (Annex H, Item 2.3.3.1), the Committee noted that the Sabbatical model is capable of detecting large exchange rates (although the estimates are still fairly imprecise) and the performance of the estimator is no worse when there is an asymmetry in the values for the exchange rates. In addition, there are no major biases evident for current population size and depletion. Given the greater amount of data for sub-stock C1 than for sub-stock C3, models outputs are less reliably estimated for the latter. The Committee noted the value of evaluating the posterior intervals for each simulation as well as the posterior medians. The Committee also noted that increasing the quality of some the data (Scenario 4, Annex H, Appendix 3) resulted in distributions of posterior medians closer to the true values. This was not the case for the interchange rates, which was expected given that the mark-recapture sample sizes had not been increased. The Committee noted that further simulations could be conducted to test if the model's ability to estimate interchange rates improves markedly with much larger mark recapture sample sizes.

In conclusion, the Committee thanked Johnston and Allison for producing a considerable amount of information in a short time, and **agrees** that the results of the simulations were sufficient to support the use of the assessment method for the C1 and C3 sub-stocks.

10.3.3.3.2 ASSESSMENT MODELS

SC/61/SH27 presented Bayesian stock assessment results for sub-stock C1 and sub-stock C3 using models which allow for interchange on the breeding grounds as well as mixing on the feeding grounds. The four exchange models shown in Table 9 were explored. Results were also presented for most of the sensitivity tests specified in SC/61/Rep8. The availability of photo-identification data allows the estimation of interchange rates. The estimates

of interchange rates were generally low with posterior median estimates all below 6%/year, and estimated population trajectories were fairly similar for all the models considered. With a single exception, current (2006) posterior median population sizes relative to pre-exploitation levels were all estimated to exceed 80% for sub-stock C1 and 90% for sub-stock C3.

The Committee **welcomes** this work and noted the great effort and collaborative contribution of all groups involved in the assessment. The Committee also notes that results are relatively consistent, suggesting that the assessment model is robust to the sensitivity tests that have been performed. It was suggested that Bayes factors (and also posterior model averages) would be informative additions to the summaries presented (e.g. SC/61/SH27, Table 7). The lower 90% PIs of the BSC3 abundance estimates predicted by the assessment models in SC/61/SH27 were all noted to be greater than the lower bound estimate from mark recapture models suggested by the authors of SC/61/SH7. The Committee **concludes** that the impact of using an independent mark-recapture estimate should be included in the sensitivity tests (see also item 10.3.3.2 above).

The Committee developed a base-case model and a set of sensitivity tests to capture uncertainty surrounding the catches, current abundance and trend information.

Base-case analysis and sensitivity tests

The base analysis and the sensitivity tests are summarised in Table 11.

Results of the base-case analysis and the five sensitivity tests are shown in detail in Fig 3 of Appendix 4, Annex H. Fig. 9 compares the time-trajectories of population size for the six analyses and the posterior medians for the 2006 depletion level and population sizes in 2006 are summarised in Table 12.

Table 11

Specifications of the base-case and sensitivity tests.

Model	Base-case	Sensitivity tests**
Model structure	The Sabbatical model since individual movements between stocks have been documented	The Resident model to allow comparisons with the sensitivity test in which the mark-recapture data are ignored and the estimate of 7,406 whales included in the assessment.
Abundance estimates	Estimated within model	An independent estimate of sub-stock C3 population size (i.e. removing the C3 photo-identification mark-recapture data from the assessment and including an estimate of 7,406 (CV 0.37) from SH/61/SH7 instead). The aim was to evaluate the robustness of the model to the *way* the mark-recapture data are included in the assessment (not different abundance estimates *per se*). Accordingly the sensitivity test was based on an intermediate case represented by a closed population model for 2004-2006 for the photo-identification data (item 10.3.3.2). This test was based on the Resident model because the exclusion of the mark-recapture data meant that exchange parameters cannot be estimated.
Catches	Reference catch scenario noting the caveats raised in 10.3.2.	(a) a higher struck but lost rate (1.3) for catches made between 1900-1916 (breeding and feeding ground)*; (b) a 'maximum' catch case scenario (100% of feeding grounds catches for 10-60E, 50% of 60-90E) as sensitivity inputs.
Trend data	No aircraft SPUE data, in line with conventional Scientific Committee practice	
Prior for r	The priors for both stocks were set to U[0, 0.106]; the previous use of the posterior for *r* for BSA was dropped as that prior is currently under review.	

* The rate, developed from North Atlantic data, may be unreasonably high for the region, but the impact of this was of interest to explore
** As a sensitivity test, density-dependence was assumed to act on total stock abundance. This is one of the most extreme cases in SC/61/SH27.

Table 12

Summary of median N_{2006}/K posterior values and 90% probability intervals [in brackets] for C1 and C3 for the new reference case models and various sensitivities.

	C1 N_{2006}/K	C3 N_{2006}/K	C1 N_{2006}	C3 N_{2006}
New sabbatical reference case	0.834 [0.507; 0.966]	0.962 [0.484; 1.000]	7064 [5639-8617]	8638 [6434-12316]
Sensitivity 1 – 'strike and loss'	0.765 [0.534; 0.918]	0.939 [0.483; 1.000]	7738 [6179-9179]	8424 [6415-12060]
Sensitivity 2 – 'maximum' catch series	0.803 [0.434; 0.959]	0.817 [0.409; 1.000]	7039 [5661-8736]	8961 [6660-12300]
Sensitivity 3 – new resident model	0.821 [0.590; 0.934]	0.979 [0.493; 1.000]	7149 [6186-8255]	9140 [6842-12587]
Sensitivity 4 – new resident model but replace C3 capture-recapture with abundance	0.826 [0.582; 0.942]	0.839 [0.380; 1.000]	7241 [6177-2184]	7875 [4359-14428]
Sensitivity 5 – update of Test3a (density dependence)	0.811 [0.432; 1.327]	0.65 [0.380, 2.588]	7767 [5777-9928]	8358 [5740-11869]

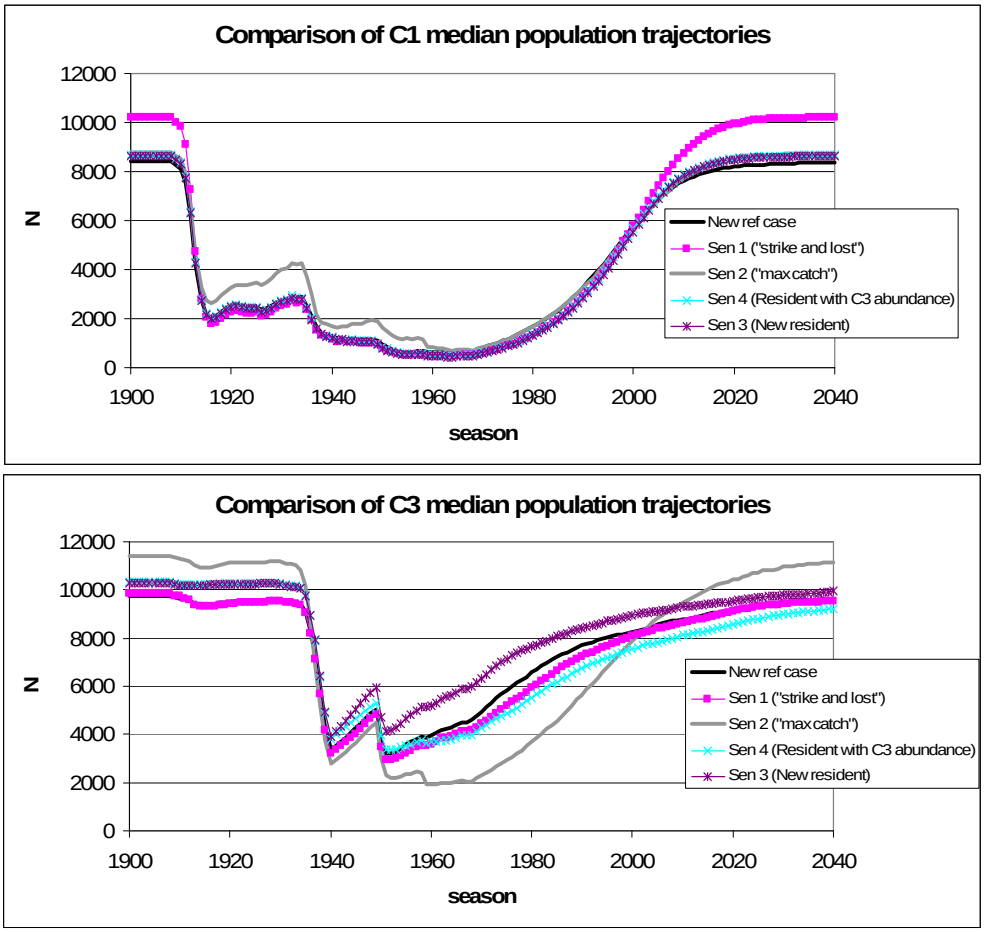

Fig. 9. Comparative plots of Breeding Stocks C1 and C3 median population trajectories for the new reference case and the various sensitivities.

The Committee noted that the posterior distribution for the interchange parameter (α) in the base-case assessment model (median 2-5%; Annex H, Appendix 4, Table 2) is almost consistent with the absence of interchange between sub-stocks (lower 95% PIs >= 1%), while the upper PI is also low in both directions (upper 95% PIs <17%). It was noted that the upper bound on interchange was much higher (38%) when calculated in a multi-state mark-recapture framework (Appendix III IWC, 2008a) than when estimated within the assessment model. Higher precision in estimates of interchange rates are obtained by the assessment model occur because the framework of the model uses more data and imposes population dynamic constraints. The Committee noted that the uncertainty associated with the interchange parameter remained one of the largest sources of uncertainty in the assessment. The Committee **agrees** that despite the poor precision, the degree of exchange between sub-stocks is indicated by these data to be low, given the ability of the model framework to recover higher values of exchange in the simulation trials. It was suggested that additional surveys of unsampled regions in BSC may improve precision of the interchange parameter in the future.

The median estimates for N_{2006}/K in Table 12 are slightly less than those in SC/61/SH27, primarily as a result of omitting aerial SPUE data for the C1 sub-stock and changing the prior for *r* for sub-stock C3 from an informative to non-informative form. The posteriors for *r* for sub-stock C1 were relatively robust to the sensitivities explored (median range = 7.6-8.8%), while these posteriors were more sensitive for sub-stock C3 (median range = 1.7-6.3%). The density dependence sensitivity test led to the greatest change to the posterior median *r* for sub-stock C3, implying that the results for sub-stock C3 are not robust to structural changes in the population dynamics model, in contrast to sub-stock C1. This suggests that the current available data are not informative about *r* for sub-stock C3.

In conclusion, the Committee noted that the base case and sensitivities in Table 12 reflected posterior median estimates for the current status (N_{2006}/K) of both sub-stocks, which ranged from 76-83% for sub-stock C1 and 65-98% for sub-stock C3 (Table 12). It **commends** these to the Commission. In presenting these estimates, attention is also drawn to the uncertainties associated with them as shown in Table 12. As would be expected given that fewer abundance-related data are available for sub-stock C3, the associated probability intervals for its status are wider than for sub-stock C1.

The Committee **agrees** that this brought its assessment of BSC to a close and thanked Zerbini, Allison, Best, Butterworth, Cerchio, Findlay, Johnston and Rosenbaum for their hard work.

10.3.4 Breeding Stock B

10.3.4.1 POPULATION STRUCTURE

SC/60/SH6 presented an exploration of temporal population structure in humpback whales in west coast of

Africa (B1 and B2 sub-stocks). The results showed significant differentiation based on haplotype frequencies (F_{ST}) and molecular distances (Φ_{ST}) between sub-stock B1 and B2; similar results were obtained with the microsatellite data. Significant results were obtained only for F_{ST} in the temporal analysis, where west South Africa seasons were significantly different from seasons in Gabon. Significant differentiation at the haplotype level was found for both sexes and at the nucleotide level only for females. Genotype matches (n=10) showed some degree of connectivity between Gabon and western South Africa. Findings suggested that while significant differences between sub-stock B1 and sub-stock B2 exist, some animals move between the two regions. A higher degree of resolution is needed to help to elucidate population-level differences and connectivity between animals from sub-stocks B1 and B2.

The Committee **welcomes** this work and noted that it represents important progress in clarifying the population structure of a relatively poorly understood stock.

10.3.4.2 ASSESSMENT MODELS

Johnston and Butterworth (2008) reported updated Bayesian stock assessment results for humpback breeding sub-stock B1, which take into account recently advised capture-recapture data. These results suggest that this population is now within the range of 65-90% of its pre-exploitation size in terms of posterior median estimates. However, the authors noted that alternative options for inputs to this assessment are possible, and need to be discussed by the Committee. In discussion it was clarified that the IDCR/SOWER estimates over 20°W-10°E and south of 60°S, included as trend data, are rather uninformative to the assessment model. It was further noted that the posterior distribution for the growth rate parameter resulting from the assessment of BSA should no longer be used as an input prior in future modelling of BSB until the estimated trend for that stock is updated (see Item 2.3.3).

The Committee noted that in the last few years, most of its work focused on the assessment of BSC and that there were insufficient time to thoroughly review information for the assessment of BSB and its sub-stocks B1 and B2. The Committee **agrees** that a review of the available data at next year's meeting is necessary to determine whether an assessment can be carried out on both breeding sub-stocks. The Committee also **agrees** that if it is concluded that such sub-division is not possible, then the assessment of BSB should be completed next year as a single-stock assessment, recognising that data may be too limited to permit a more detailed exploration of sub-stock status.

10.3.5 Other Breeding Stocks

The Committee received a number of papers with new information on other Southern Hemisphere humpback whale breeding stocks. Details of the discussions of these papers are presented in Item 2.5, Annex H.

10.3.5.1 BREEDING STOCK D

SC/61/SH23 presented a description and analysis of data from a combined aerial and land-based survey of northward-migrating humpback whales off Western Australia in 2008. The abundance of northward-migrating (NM) whales was estimated to be 21,750 (95% CI =17,550-43,000). This is based on an estimate of relative abundance of surface-available whales of 11,850 (95% CI = 9,550-23,450), and an estimated $g(0)$ of 0.54 (±0.21).

The Committee welcomed this paper as it represents important progress towards an assessment of BSD and highlighted the methodological advances presented for estimating the variance of the relative density estimates. The Committee **accepts** the NM abundance estimate (21,750, 95% CI = 17,550-43,000) and **agrees** that it should be used as the best estimate in any future assessments of this stock. The authors also noted that they plan to revisit existing survey data from BSD in order to explore new approaches for an analysis of trend. The Committee **recommends** further work to evaluate trends of humpback whales migrating through this area to (and perhaps from) their current breeding grounds.

10.3.5.2 BREEDING STOCK E

The Committee received three papers with new information from BSE. SC/61/SH10 presents results from a multi-year photo-identification sampling and capture-recapture analysis from vessel based surveys conducted between 1999 and 2005 during the annual northern migration of humpback whales off Byron Bay on the east coast of Australia (sub-stock E1). The analysis provides a population estimate of 7,390 (95% CI=4,040-10,739) for the number of humpback whales that migrated north past Byron Bay in 2005. This estimate is consistent with other capture-recapture and land based estimates for sub-stock E1 and supports the growing body of data that indicate a high rate of increase for this population of humpback whales.

The Committee welcomed this paper and noted that this estimate is comparable to that of Noad *et al.* (2008; 9,683, 95%CI 8,556–10,959).

SC/61/SH17 presented satellite tracking data from 16 sub-stock E1 humpback whales tagged in October/November 2008 near Eden, NSW, Australia. Entire migration routes from SE Australia to feeding grounds close to the Antarctic were obtained for eight whales of which all but one remained in Area V (148°E to 178°W) throughout the life of their tag. The other migrated SW from Tasmania and moved to 101°E (Area IV). This suggests substantial mixing of the BSD and sub-stock E1 on the feeding grounds. The study also showed that several whales suspended their migration and spent days to weeks, presumably feeding in areas of high productivity in temperate lower latitude regions (NE Tasmania and SW New Zealand). The Committee **commends** the authors on their successful and important work. Discussions of this document are detailed in Annex H, p. 14.

SC/61/SH25 summarises work to examine migratory patterns of east Australian humpback whales through photo-identification over the past 25 years (a catalogue of 4,196 unique individuals). Findings suggest complex patterns of migratory movement that may require reassessment of current definitions of breeding stocks. The low rate of both within season and across season interchanges reported along the east coast of Australia support the notion that not all whales are travelling along a north-south corridor and that considerable east-west deviation is occurring. SC/61/SH25 concluded that

matching photo-identification data from the entire east Australian coast to Oceania catalogues is critical to determining the degree of mixing that is occurring between these regions. The Committee noted that while exhaustive comparison among all holdings would be of interest, it is not practical due to the number of photo comparisons that would be necessary to achieve this. Therefore the Committee **recommends** strategic area-to-area comparison of Southern Hemisphere catalogues to address specific questions of interest.

10.3.5.3 BREEDING STOCK F

SC/61/SH13, SH14 and SH15 reports on work of the South Pacific Whale Research Consortium (SPRWC). SC/61/SH15 reports on the annual meeting of the South Pacific Whale Research Consortium (SPWRC), detailing the results of fieldwork and analysis conducted during 2008 in Oceania. SC/61/SH13 describes a comparison of individual fluke photographs between French Polynesia (sub-stock F2) and the Antarctic Peninsula and Strait of Magellan. The absence of matches suggests that the Antarctic Peninsula is not the primary migratory destination of whales from the French Polynesia breeding sub-stock (F2). SC/61/SH14 reports on estimates of abundance for humpback whales in French Polynesia using photo-identification capture-recapture analysis from 1999 to 2007. Estimates ranged from 564 (CV=0.90) to 2,046 (CV 0.16).

The Committee acknowledged the progress of the work of the SPWRC and **encourages** its continuation. The research will be relevant to upcoming comprehensive assessment of BSE and BSF.

10.3.5.4 BREEDING STOCK G

The Committee welcomed new information from BSG humpback whales. SC/61/SH1 estimated the genetic diversity of Ecuadorian humpback whales (BSG) using mtDNA sequences collected between 2002 and 2007, which was compared with diversity within and between Colombia, the Magellan Strait, and the Antarctic Peninsula. Significant differentiation was found only with the Magellan Strait ($p<0.0001$). When data were stratified by sex and year, significant differences were found at both the haplotype and nucleotide level between females in 2006 and in 2007 ($p<0.01$) and between females in 2006 and males in 2007 ($p<0.05$). The pooled dataset analysis suggests panmixia within BSG, but stratified data indicate some level of heterogeneity, possibly due to differential female migrating behaviour. Such heterogeneity would be also responsible for the skewed sex proportion obtained (2.5 males:1 female).

SC/61/SH18 compared catalogues of photo-identified humpback whales in the Eastern and Southeastern Pacific region between 1991 and 2008. The entire dataset included 1,387 individuals: 1,289 from Ecuador and 98 from Costa Rica-Panama, with four inter-year matches between these areas. These data confirm that the wintering area for BSG extends approximately 3,000km along the coast of South America, from north of Peru to Costa Rica.

Capella *et al.* (2008) compared individual humpback whales photo-identified off northwestern Isla de Chiloé, the Patagonian and Fuegian fjords and in the Strait of Magellan. Four matches provided the first evidence of direct connections of individual humpback whales along the coast of southern Chile. To date no matches have been found between these areas and the Antarctic Peninsula giving rise to the possibility that humpback whales found near shore in southern Chile have separate migratory destinations.

The Committee noted that the studies mentioned above represent good progress in detailing the migratory connections of whales from BSG, which are consistent with previous research (Acevedo *et al.*, 2007).

SC/61/SH30 investigates the presence of humpback whales in the Pacific waters of the Galapagos Islands and their subsequent migration destination. Data were inconclusive with respect to the year-round presence of humpback whales off the Galapagos. SC/61/SH2 described the distribution and seasonal occurrence of humpback whale cow-calf (CC) pairs and cow-calf pairs with at least one escort (CE) from June to October in Ecuador from 2001 to 2008. CC groups were distributed in significantly shallower waters than CE groups. First CE groups were recorded 20 days after the first CC groups while the peak frequency of the former was five days earlier than the latter suggesting a segregation of CC groups in the first days after birthing.

10.3.6 Antarctic Humpback Whale Catalogue

The interim report of the Antarctic Humpback Whale Catalogue (AHWC) was presented in SC/61/SH11. During the contract period, 407 photo-identification images representing 260 individual humpback whales from Antarctic and other oceans in the Southern Hemisphere were catalogued. Photographic comparison yielded 16 previously known individuals. The current total number of catalogued whales identified by fluke, right dorsal fin/flank and left dorsal fin/flank photographs is 3,069, 410 and 405 respectively. Matches included re-sightings between Panama and the Antarctic Peninsula (n=6), Panama and western South American breeding areas (n=5) and between Ecuador and Antarctic Peninsula (n=2). Within-region re-sightings were identified in the Antarctic Peninsula (n=5) and American Samoa (n=1). The collection is internationally collaborative, with photographic contributions from 250 researchers and opportunistic sources.

The Committee **welcomes** this report, noting that this is important work for the assessment of humpback whales and **recommends** its continuation.

10.3.7 Future Work

SC/61/SH29 fits a sex- and age-structured BALEEN II population model to population abundance and trend data for BSC1, as well as photo-identification capture-recapture data for both BSC1 and BSC3 humpback whale breeding sub-stocks. The model is of the 'Resident' type (no interchange between breeding grounds), but with mixing on the feeding grounds. Uniform selectivity on the 1+ population is assumed for both regions. A particular aim of this model is to address whether length distribution differences between the two regions reflect different levels of past exploitation. Comparison of model predictions and observed length distribution data for both regions indicate a greater proportion of larger males than anticipated in the

BSC3 catches, and the reverse effect for both males and females in the BSC1 catches (a greater proportion of smaller animals than anticipated). In broader terms, these results point to the importance of investigating the implications of using more complex sex- and age-structured population models for assessing the status of Southern Hemisphere humpback whales.

Discussions of this paper are presented in Annex H, p. 14. The Committee **agrees** that it would be useful to explore the length-at-catch data further at a generic level for Southern Hemisphere stocks, but felt that it was a lesser priority for next year. However the Committee **welcomes** submissions which could clarify issues in regards to sex-segregation on breeding grounds at next year's meeting.

10.3.8 Work Plan

The Committee **recommends** that existing data be analysed by next year in the following order of priority, with those undertaking the work indicated in parenthesis:

(1) photograph catalogue matching between Gabon and West South Africa (Collins, Barendse);

(2) analyse and genotype Antarctic samples from IDCR/SOWER 2006/2007 received in March 2009 (n=83 from an area south of 40°S 5°W-30°E) to inform about migratory connections, stock mixing and connections with nuclear versus margin areas (Loo and Rosenbaum);

(3) collection of additional biopsy samples and photo-identification data in Western Africa (Rosenbaum and Best);

(4) genotype matching between Gabon and West South Africa updated by samples collected in (3) (Carvalho and Rosenbaum);

(5) photograph catalogue matching between Gabon, west South Africa and the Antarctic Area II/III (College of the Atlantic catalogue) (Collins, Barendse);

(6) explore uncertainty in catch records for early 1900s (Best, Findlay, Allison);

(7) explore genetic information informative to the degree of A/B and B/C mixing in the newly defined margin areas (10-30°E, 60-80°E) (Loo and Rosenbaum);

(8) photographic catalogue comparison between C1 and B2 (Findlay and Barendse);

(9) explore utility of IDCR/SOWER 2005/2006 (north of 60°S and between 10-20°E) and 2006/2007 (north of 60°S and between 0-5°E) for estimating feeding ground abundance of BSB (Findlay);

(10) estimate abundance for B2 (Best, Butterworth, Rosenbaum, Cerchio); and

(11) compare photo-identification data to investigate interchange between BSA and BSB (Collins, Barendse, Engel).

The Committee also **recommends** the following work be undertaken to prepare for the assessment of BSD, BSE and BSF starting at the 2010 Annual Meeting:

(1) evaluation of trends and absolute numbers of humpback whales migrating through Shark Bay (BSD) to (and perhaps from) their current breeding grounds (Hedley, see discussion in SC/61/SH23);

(2) estimation of abundance in Oceania (sub-stocks E2, E3, F) (Jackson, Steel, Constantine);

Item (13) above is another item with financial implications. A proposal to conduct this work is presented in Annex H, Appendix 8.

10.3.9 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

10.4 Continue assessment of Southern Hemisphere blue whales

The report of the sub-committee working on the assessment of Southern Hemisphere blue whales is given in Annex H. In 2002, the Committee recommended that the assessment of blue whales started in 2005, after the completion of the IDCR/SOWER review (IWC, 2003a, p.41). In 2008, the Scientific Committee completed a circumpolar assessment of Antarctic blue whales (IWC, 2009j) and recommended that area-specific analysis be examined to evaluate whether separate assessments can be done for each IWC Management Area (IWC, 2009j). The Committee **endorses** its previous recommendation that area-specific analysis (Rademeyer *et al.*, 2003) be examined by Branch, Butterworth and Rademeyer to evaluate whether it would be worth conducting separate assessments for each of the IWC Management Areas.

The Committee also recommended gathering data relevant for the assessment of non-Antarctic blue whales.

10.4.1 New Information

The Committee received a number of papers with new information on Southern Hemisphere blue whales.

SC/61/SH3 addressed a Committee's recommendation from last year that an analysis of blue whale photo-identification data from JARPA surveys be completed for comparison with the SOWER catalogue maintained by Olson. The paper summarised information from surveys in Antarctic Areas IIIE, IV, V and VIW from 1992/93 to 2008/09. The catalogue held by the Institute of Cetacean Research contains 476 pictures. A preliminary matching exercise within the feeding grounds resulted in a single match. Analyses of photographs collected during the JARPA/JARPA II have the potential to contribute to better understand movement patterns of blue whales in the feeding grounds. This information can be optimised if these photographs are examined in conjunction with photographs from other surveys and regions. Pictures of blue whales from JARPA/JARPA II will be provided to the IWC catalogue (through the IWC Secretariat) and research collaboration can be conducted following the IWC data access Procedure B.

The Committee acknowledges the authors for this detailed response to a previous recommendation. The Committee **recommends** that in future reports, photo-identification data presented are sub-divided into left-side and right-side

categories for better judgment of sample sizes. The Committee also **encourages** a comparison of the JARPA/JARPA II and other blue whale catalogues through the appropriate data availability procedure.

SC/61/SH19 describes a summary of progress with archiving and analysis of blue whale photographs collected during annual IWC IDCR/SOWER surveys between 1987-1988 and 2008-2009. Over 22,000 photographs have been obtained from all IWC Management Areas over 20 Antarctic cruises. A total of 207 individual whales were identified (including 157 individuals from Area III). Cross-referencing of photographs between and within years yielded four multi-year re-sights in Area III (one over a 12 year interval) and 21 within-season re-sights. Within-season re-sights for 2005-2006 (Area III), 2006-2007 (Area III) and 2008-2009 (Area IV) were 11%, 17% and 20% respectively, suggesting a degree of within-season residency.

The possibility of double-counting blue whales on IDCR/SOWER cruises was discussed, in view of the substantial movements of blue whales across the Antarctic implied by the re-sighting times and distances described in SC/61/SH19 and SC/61/SH3. It was noted that double-counting is minimised by the IDCR survey design and is not expected to upwardly bias abundance estimates obtained by these surveys. Further discussion of SC/61/SH19 is found in Annex H, p. 15.

SC/61/SH26 used passive acoustic monitoring to evaluate whale occurrence in the Southern Indian Ocean near Crozet Island. Acoustic analysis revealed calls of several species/subspecies/populations in the region in 2003-2004. Discussion of this paper is given in Annex H. The Committee **welcomes** the presentation of this work and **recommends** its continuation. The Committee **agrees** that collection of biopsy samples in this region would also be useful to clarify population structure. The Committee also **agrees** that the continuation of this project would be a useful contribution for a French component of the Southern Ocean Research Partnership (see Item 19) to pursue in continuous acoustic monitoring and the deployment of additional recording devices.

The Committee received a number of papers about blue whales in Chile. SC/61/SH22 presented an update of the 2009 field research season of the Alfaguara Project on blue whales off northwestern Isla de Chiloe, where land and boat-based studies were conducted and sighting and photo-identification data as well as biopsy samples were collected. SC/61/SH21 presented abundance estimates of blue whales off southern Chile from line transect aerial surveys conducted in 2007 (N = 96, CV = 0.65) and 2009 (N = 110, CV = 0.38) with the support from the Chilean Navy. Detailed discussion SC/61/SH21 is given in Annex H, p. 19. The Committee **recommends** that the relatively small numbers of sightings recorded in each survey year could be pooled to obtain a more robust estimate of detection probability and that left-truncation should be explored in order to account for lack of visibility in the area beneath the observer.

SC/61/SH32 presented a reanalysis of data collected during the 1997/98 SOWER survey off Chile (18°30'S to 38°S). A model-based abundance estimate for the survey region, taking into account spatial bias in trackline placement, was 267 (95% CI = 214-332). SC/61/SH33 presented a summary of a new line transect survey of pygmy blue whales in coastal waters of Chile in February and March 2009. A preliminary abundance estimation of 232 individuals (CV=0.68) was provided. Discussion of these papers are presented in Annex H, p. 17. The Committee noted that a previous recommendation to Montecinos *et al.* (2008) to provide a full report of the boat-based data and calibrations (IWC, 2009e) has not been addressed in SC/61/SH33 and **recommends** the original recommendation to be fully addressed. The Committee welcomed the information on blue whale abundance and density from the coast of Chile and noted that given the relatively low estimates, these likely correspond to a fraction of the total population. Therefore, the Committee **reiterates** its recommendation from last year (IWC, 2009j) that attempts to derive absolute abundance estimates of blue whales in this region be made in order to provide information required for the assessment of this population.

The Committee welcomes a summary of the progress on the Southern Hemisphere blue whale catalogue (SHBWC) and noted it represents an impressive amount of work which will be helpful with other photo-identification efforts for blue whales in the Southern Hemisphere. The Committee **recommends** the continuation of this important work as it will provide useful and relevant information for future assessment of blue whales.

10.4.2 Work Plan

10.4.2.1 ANTARCTIC BLUE WHALES

See previous section.

10.4.2.2 PYGMY BLUE WHALES

The Committee **endorses** its recommendation from last year that the estimates of natural mortality for pygmy blue whales (based on age data from whales caught throughout the entire Indian Ocean) be analyzed with a simple age-structured model that would include estimating separate selectivities for the Japanese and Soviet fleets operating in the region (IWC, 2009j).

At last year's meeting the Committee also recognised that to undertake assessments it is necessary to have acceptable abundance estimates and it had recommended that abundance estimates be developed and identified two areas of special interest, Western Australia and the coast of Chile. During this meeting, the Committee welcomed a number of estimates of abundance obtained with line transect surveys. The Committee noted that these estimates probably do not correspond to the total stock size and **recommends** that surveys be designed and that alternative methods (e.g. mark-recapture estimates) be considered to estimate total population size. The Committee also established an intersessional e-mail group to coordinate among researchers in Western Australia, Chile, and possibly other areas in order to provide mark-recapture estimates of abundance of blue whales at next year's meeting.

10.5 Western North Pacific stock of gray whales

The Scientific Committee has expressed concern over the critically endangered western gray whale on a number of

occasions (e.g. (IWC, 2007c, pp. 35-6) as has the Commission (IWC, 2005a; 2006a), since holding a workshop in 2002 (IWC, 2004f).

10.5.1 New scientific information

This was a primary topic for discussion this year. A considerable amount of information was presented, and this is discussed in Annex F, item 4.1.1. Only a brief summary of that extensive work is given here.

SC/61/BRG24 reported the results of field studies, during 2004-08, on the distribution and abundance of benthic prey distribution patterns on two feeding grounds off the Northeast coast of Sakhalin Island: the shallow Piltun feeding area off Piltun Bay and the deeper offshore feeding areas, and SC/61/BRG25 provided results of vessel-based transect surveys and shore-based surveys performed in the summer-autumn season of 2008 in the shelf waters of northeast Sakhalin, within the framework of the Russian programme of western gray whale monitoring.

In discussion, it was noted that industrial activities including pile-driving as part of pile installation, and a seismic survey occurred during parts of the study period. However, it was not clear if, or how, these activities might have affected the behaviour or distribution of the observed animals.

SC/61/BRG26 provided a summary of 2008 photo-ID studies conducted in the two Sakhalin feeding areas and in Olga Bay, located on the southeast coast of the Kamchatka Peninsula. The 2002-08 catalogue of photo-identified western gray whales off Sakhalin Island currently includes 165 fully identified, individual whales. Over the past few decades, researchers have become aware of the presence of gray whales in the coastal waters off southeast Kamchatka during summer-autumn and the early winter months. Photo-ID studies conducted off Kamchatka in 2004 and 2006-08 substantiate these observations. Results from the 2008 photo-ID effort show that 97 individuals from the Sakhalin catalogue were seen only off Sakhalin, 24 were seen only off Kamchatka and one was seen at both locations; thus, a total of 122 whales from the Sakhalin catalogue were observed in 2008. For the first time, one cow-calf pair was recorded in the shallow waters of Olga Bay in 2008. Previously the mother had been recorded off Sakhalin in 2002-06 and in Olga Bay in 2007; she also had been seen with calf off Sakhalin in 2003.

SC/61/BRG8 reviewed the findings up to 2008 from the ongoing long-term collaborative Russia-US research programme on western gray whales summering off northeastern Sakhalin Island, Russia. Photo-identification research conducted in the near shore feeding area off Sakhalin Island in 2008 resulted in the identification of 45 whales, including three calves. Of the 42 non-calves identified, all (100%) had sightings in previous years. One new reproductive female was recorded in 2008, resulting in a minimum of 25 reproductive females observed since 1995. When results from 2008 are combined with data from 1994-2007, a catalogue of 172 photo-identified individuals has been compiled. Not all of these 172 whales (including the 25 reproductive females) can be assumed to be alive, however. Overall, the pattern of whales photo-identified in 2008 was quite different from previous years in that: (1) 45 is the lowest number of whales identified since 1997 when the research programme was started; (2) three is the lowest number of calves observed since 2000; and (3) never before have no new non-calves have been identified in a given year. These findings are of concern with regards to the status of the population but are presently poorly understood.

The Committee noted the discussions of possible links between the eastern and western gray whale populations (see discussions of SC/61/BRG22 and 30 in Annex F). Recommendations for future work to clarify this included: satellite tagging of western gray whales off Sakhalin Island and Kamchatka; photo-identification comparisons of western gray whale catalogues with those maintained for eastern gray whales; genetic sampling of animals feeding in areas potentially used by both eastern and western animals, to be started as soon as practical in collaboration with scientists from Russian and Japanese research institutes and scientists from other interested countries; and genetic analysis of samples (including historic bone or baleen) obtained from animals entrapped, stranded, or sighted in areas other than Sakhalin and Kamchatka (e.g. Japan). It was agreed to form an intersessional working group (convenor Donovan, Q31) to review the contribution genetic studies can make to western gray whale conservation including objectives, sampling programme and analyses. The Committee **agrees** that a review of genetic studies on western and eastern gray whales should be submitted at the 2010 Annual Meeting.

The Scientific Committee has established a co-ordination group with respect to western gray whale telemetry, in particular to ensure that any programme meets the scientific, conservation and welfare standards set by the IWC Scientific Committee and the IUCN Western Gray Whale Advisory Panel (WGWAP). The report from that group (SC/61/BRG31), outlined a satellite tagging research programme to obtain vital information on the migration route(s) and wintering ground(s) of western gray whales, to enable the development of essential mitigation measures. The following summarises the extensive general safeguards developed by the IWC Scientific Committee and the WGWAP (the full details are given in SC/61/BRG1):

(1) the work should be carried out by experienced investigators using tested techniques following the guidelines used by the Society for Marine Mammalogy with regard to the treatment of marine mammals in field research; (2) tag design and deployment methodology should be of best-practice standard, including: (a) tag length being the minimum possible to achieve a pre-determined attachment duration; and (b) use of sterile techniques to minimise infection; (3) no more than 12 tags be deployed on known males in good body condition and identified in 'real time' (i.e. in the field before tagging is attempted, by the recognised expert in identification in the field) from previous photo-id and genetic studies; (4) field protocols to minimise risks and limit the time spent with individuals should be developed and presented for review by the co-ordination group in advance of fieldwork; (5) follow-up work on the potential effects of tagging should

be a key part of any programme, and in particular every effort should be made to resight tagged whales during the period of the study and subsequently; and (6) tracking data should be available to the IWC in as near 'real time' as possible.

One member, whilst acknowledging the conservation value and urgency of the research expressed his concern that the tagging would take place before what he believed to be a successful study monitoring impacts on feeding eastern gray whales. He also believed that undertaking photo-id to confirm identification of the animal prior to tagging was important. The tagging programme is discussed further under the conservation advice section below. In the general discussions, the Committee also **recognises** the value of tagging whales off Kamchatka in the future to provide additional information on the stock affinities of these whales (eastern or western), their migratory paths and possible additional feeding areas in order to better inform conservation and management strategies. A detailed proposal for such work, taking account of the 2010 programme off Sakhalin, would be welcomed by the Committee for review.

The Committee also **concurs** with the view of the co-ordination group (and the IUCN range wide workshop, see below) of the value of testing new and emerging tags that are potentially less invasive and/or may have longer duration on eastern gray whales as soon as possible (including in the 2009 field season). In doing so, it **stresses** that this should not further delay efforts to tag western gray whales with existing (proven) tags. A candidate population for such testing would be the well-studied Pacific coast feeding aggregation off Washington and Oregon, USA and British Columbia, Canada, in which inter- and intra-annual resightings of the same individuals are frequent, making follow up studies possible. Such techniques, once tested and proven, may then be candidates for use in future tagging studies on western gray whales.

In this context, was noted that researchers of the southern feeding aggregations of the eastern North Pacific gray whales have permits to conduct satellite tagging studies, but lack funds to conduct the study. In consideration of the direct relevance of understanding and improving the efficacy of tagging gray whales on their feeding grounds, the Committee **recommends** that every effort be made to obtain immediate funding for this tagging study.

The Committee **stresses** the importance of ensuring that all necessary permits for telemetry work on gray whales are applied for in a timely fashion and **requests** relevant national authorities to facilitate the authorisation of permits.

As a conclusion to the discussions of new information and an introduction to the discussions of conservation and management advice, Larsen presented the report of the Western Gray Whale Range Wide Workshop held by IUCN in September 2008 in Tokyo, Japan (IUCN, 2009). This represents the most comprehensive recent overview of knowledge and conservation issues related to western gray whales. The workshop was organised as a step towards development of a comprehensive, range wide strategy, as anticipated by the IWC Ulsan workshop in 2002 (IWC, 2004d) and the IUCN International Scientific Review Panel in 2005 (Reeves *et al.*, 2005). Most attention focussed on areas of the western gray whales' range outside the Sakhalin shelf area given the extensive work of the Western Gray Whale Advisory Panel WGWAP on that region (Annex F, Appendix 3). The workshop was attended by 26 scientists, including from all the presumed range states except the Democratic People's Republic of Korea. In the following summary, only new information will be highlighted.

The report provides a review of western gray whale population biology including population structure, distribution, feeding, natural mortality, abundance and trends. New here is the considerable amount of information on western gray whales at Kamchatka and on the links between the known and suspected feeding areas. The Workshop identified major information gaps with regard to the population biology of western gray whales and the need for improved information on:

(a) migration routes and timing, including movements of the animals within a season and between feeding areas;

(b) population status in addition to the current estimates of abundance and trend;

(c) calving history of individual females in relation to their health status, which is probably affected by environmental factors, both natural and anthropogenic;

(d) health status from necropsy of stranded or bycaught animals.

The workshop identified and quantified to the extent possible actual and potential threats to the population including both direct and indirect human-caused mortality as well as changes in environmental conditions. New information on direct human-caused mortality includes results on the magnitude of anthropogenic interactions as inferred from the types and incidence of scars on western gray whales, and information on an initial evaluation of the magnitude of the threat of ship strikes on western gray whales in Japanese waters. New information was also received on examination of body condition of western gray whales in relation to environmental change in the North Pacific. The Workshop identified major information gaps with regard to actual and potential threats to the western gray whale population (in addition to those identified above) and the need for improved information on:

(a) where and when the occurrence of western gray whales coincides with a high density of threat factors;

(b) vessel activity, fishing and other anthropogenic factors that could put gray whales at risk in China, Korea and Russia;

(c) effects (preferably dose-based) of noise on gray whales as well as the thresholds of responsiveness;

(d) the 'skinny whale' phenomenon; and

(e) potentially harmful activities in areas where gray whales are present obtained in a timely manner.

The workshop report also deals with threat elimination and mitigation. Prioritisation of actual and potential threats

identified is given in Annex F, table 1. Highest priority is given to mitigating entrapment in set nets, entanglement in other types of fishing gear and noise in feeding areas.

Discussion of actual and potential mitigation measures centred primarily on fishing-related mortality. The workshop agreed that in general:

- mitigation through prevention is preferable to mitigation through disentanglement, so in the case of set nets, the goal should be to prevent whales from entering in the first place;
- disentanglement teams should consists of trained individuals who have access to specially designed equipment;
- because a single wrap of line can kill a whale, it is wrong to assume that releasing a whale with 'only a little gear left on it' can be considered a successful rescue;

The workshop was pleased to learn that three rescue (response) teams had been established in the Republic of Korea and that these teams are designated to release any marine animals, including gray whales, either live-stranded or accidentally caught in fishing gear. The workshop identified the need for a better basis for assessing the nature and degree to which chemical contaminants other than oil represent a threat to western gray whales as a major information gap with regard to threat elimination and mitigation (in addition to those identified above).

The primary objective of the range wide workshop was to work towards a conservation plan. The report discusses the structure and components of such a range wide conservation plan. The workshop agreed that such a plan should be developed under the auspices of the IUCN Global Marine Programme following the guidelines provided by Donovan *et al.* (2008) and as outlined in Annex D of the workshop report. The initial draft of the plan will:

(1) include a clear explanation of why the conservation plan is needed and a statement of its goals and objectives;

(2) incorporate assistance from the relevant programme(s) within IUCN with respect to the 'legal framework' portion of the plan;

(3) accompany any references to 'hunting' by a clear explanation (possibly in the form of footnotes) of the legal status, recognising that all range states, with the possible exception of the Democratic People's Republic of Korea have complete prohibitions against the direct, intentional taking of western gray whales;

(4) include examples of mitigation measures taken elsewhere in the world to protect whales (regardless of species) from the same or similar threats; and

(5) include a separate section, in addition to specific actions, devoted to public awareness and education.

10.5.2 Conservation advice

As it had done last year, the Committee **acknowledges** the important work of the IUCN WGWAP and **welcomes** this year's update on its activities (Annex F, Appendix 3).

The Committee **welcomes** the report of the IUCN range wide workshop and thanked Larsen and IUCN for their hard work in ensuring that this happened; it **agrees** that the workshop represented an important updating of the 2002 IWC workshop and formed a strong basis for conservation and management action. The Committee **endorses** the report and its recommendations and the full recommendations are given in Appendix 4 to Annex F.

In particular, the Committee **endorses** the development of a 'Conservation Plan for Western North Pacific Gray Whales' following the process outlined in Donovan *et al.* (2008) and in Annex D of IUCN (2009), which was the overarching recommendation of the workshop. This is in accord with the Committee's discussions of conservation plans last year (IWC, 2009e). Donovan reported on the current status of the plan. The core of the plan is to reduce anthropogenic mortality towards zero as soon as possible. This **reiterates** the view of the Scientific Committee for a number of years of the **urgent need to reduce anthropogenic mortality to zero.** An initial drafting group (including scientists from several range states) has been established and considerable work is underway (one drafting meeting has been held) although the draft is not yet ready for circulation. The recommendations of the range wide workshop will form the basis of draft 'actions' to be included in the plan that will be developed over the coming year and submitted to IWC for consideration. Involvement of stakeholders in the development and implementation of the plan is a key component of the work.

The Committee then considered the main recommendations and conclusions of the workshop report. These cover three broad areas: status and monitoring, threats and improved mitigation, and improved information outside the feeding grounds.

With respect to status and monitoring the Committee **endorses** the following research recommendations that:

(1) research effort off Sakhalin Island (via photo-ID and biopsy), in support of annual population assessment through modelling, must be continued as the highest-priority monitoring tool for this population. The subcommittee expressed concern that no biopsy samples were collected in 2008;

(2) photo-identification effort be continued or expanded in other areas where western gray whales are known to occur, such as off Kamchatka and Magadan (the Committee also **encourages** that a biopsy component be added to the photo-identification work in these areas);

(3) the importance of continuing efforts to identify additional feeding areas of western gray whales;

(4) all photographs from Kamchatka be compared to the Sakhalin catalogues maintained by the Institute of Marine Biology (IBM) and the Russia-US programme; and it was also requested that all gender

information be made available to all Western Gray Whale researchers; and

(5) in accordance with previous recommendations of the WGWAP and the IWC Scientific Committee, joint analyses of the Russia-US and IBM catalogues are undertaken and that the photographs from Kamchatka and other parts of the population's range be included in any such joint analyses and notes.

A primary recommendation related to threats and mitigation was the need for satellite telemetry work. Given the extensive discussion that has occurred within the IWC Scientific Committee and elsewhere regarding this recommendation, the background and rationale is presented here.

A good spatial and temporal understanding of the migratory routes, breeding areas and movements of western gray whales is essential if effective conservation measures are to be developed and implemented to protect them from anthropogenic threats throughout their range, particularly entanglement and entrapment in fishing gear, vessel traffic and industrial activities. At present, there is a severe shortage of such information. The Workshop stresses that the most efficient (and probably only) way to achieve the necessary knowledge is to undertake a carefully planned satellite tagging programme. A successful programme will provide essential insights on threats (e.g. what they are, their spatiotemporal character and severity), reveal new information about the biology and behaviour of the animals to allow the development of effective mitigation measures, and better inform research and conservation planning.

In short, satellite tagging of western gray whales will address the following critical objectives:

(1) Further identification of feeding habitats of western gray whales. This would (a) lead to photographic identifications of whales in feeding areas other than Sakhalin and Kamchatka, allowing improved population assessment, and (b) point to additional areas in need of protection from harmful human activities.

(2) Identification of migratory timing and routes between summer feeding and winter breeding areas to improve assessment of threats along the migration routes and identify where mitigation is most critically needed.

(3) Identification of the winter breeding area(s) so that threats there can be identified and mitigated.

In making the recommendation below the Committee reiterated the importance it had attached to the extensive cost-benefit reviews of telemetry studies that have been undertaken in recent years (by the Scientific Committee, the WGWAP, the review commissioned by the US Marine Mammal Commission, the Range Wide Workshop) in addition to its discussions this year with respect to how telemetry can contribute to the conservation of this critically endangered population versus the potential risks of tagging to individual western gray whales. It **concurs** with the view that initiation of the satellite-tagging programme should not be further delayed, and **recommends** that every effort be made to attempt tagging on the Sakhalin feeding ground at the end of the 2010 field season. It further **reiterates** that every safeguard will be undertaken to minimise risks to the health of individual animals and to the population's recovery as summarised above in the discussion of SC/61/BRG31 and in Appendix 2 and that this will be supervised by the co-ordination group established previously. If these criteria are not met to the satisfaction of that group then the effort will not proceed in 2010. In this context the Committee **refers** to its previous discussions on this subject and **endorses** the recommendations therein (IWC, 2007c; Martien *et al.*, In review).The Committee also noted its earlier discussions of the value of telemetry studies off Kamchatka as soon as 2011 and the testing of new and emerging technology on eastern gray whales and encouraged the development of plans for such work to be undertaken. The Committee also **requests** national authorities to facilitate the granting of permits for telemetry work recommended by the IWC Scientific Committee.

In terms of taking more immediate action the Committee **endorses** the recommendations related to the release of entrapped/entangled whales (see Appendix 4 of Annex F) summarised below:

- that every effort be made to release entrapped animals as expeditiously as possible and in this context it **encourages** relevant authorities to develop carefully considered incentive schemes to encourage live release of gray whales, free of fishing gear;
- **encourages** the appropriate Japanese authorities to continue a campaign to educate all set-net fishing cooperatives concerning (a) the critically endangered status of western gray whales, (b) the historical role of set nets in bycatches of gray whales and (c) the need to make every effort to release any entrapped or entangled western gray whale.
- **encourages** authorising agencies to identify appropriate individuals who can make up a rapid-response team to assist fishermen in the event that a badly entangled gray whale is found and specialised assistance is needed to release it alive and **encourages** communication with experienced response teams elsewhere in the world.
- **encourages** appropriate authorities in the other range states (e.g., Russia, Democratic People's Republic of Korea, Republic of Korea and China) to initiate educational campaigns specifically targeted at fishermen who use the types of fishing gear that could entrap or entangle western gray whales.

Should carcases be discovered, the Committee **recommends** that facilitation of necropsies be conducted as a priority in all range states, involving all relevant qualified individuals and organisations In this regard, the Committee **welcomes** the initiative of IUCN to develop a detailed necropsy protocol, taking due account of experience elsewhere in the world (e.g. with North Atlantic right whales), and distributed widely to maximise the amount of data and information obtained from dead western gray whales.

The Committee **recommends** that reports of any necropsies that occur are provided to the Annual Meetings of the Scientific Committee.

The Committee noted that almost all of the new information on western gray whales in recent years has come from the feeding grounds near Sakhalin Island. It therefore **endorses** the workshop's recommendation that arrangements for detecting, reporting and investigating occurrences of gray whales, for example through stranding and sighting networks, be enhanced in all range states and particularly in China. This should be accompanied by efforts to improve the capacity and ability of researchers in the range states to investigate and validate reports of gray whales, e.g. through photography or tissue sampling. It **reiterates** previous Scientific Committee recommendations that any tissue samples should be made available for genotype matching with the biopsy archive of the Russia-US programme.

Recognising the difficulty of detecting individuals away from the known concentrations on the feeding grounds, and given that the total number of animals is so small and information on breeding grounds and migration is so poor, the Committee **agrees** that high priority be given to developing accurate and effective public awareness campaigns in the range states, involving use of *inter alia* the internet, newspapers, radio and, if possible, television. It **encourages** IUCN and the IWC to assist relevant authorities in each of the range states in this regard.

10.6 Southern Hemisphere right whales

In reviewing recent work as described in the following sections, the Committee **recommends** the continuation of current long-term studies on southern right whales off eastern South America, South Africa, and Australia/New Zealand, particularly as they should provide information on population status in relation to carrying capacity and annual breeding success in relation to climate change.

10.6.1 Australian and New Zealand Area

Last year, the Committee reviewed the results of a 15-year series of annual surveys off southern Western Australia, from which increase rates had been obtained of 6.94% (95% CI 3.37-10.63) for all animals and 8.10% (95% CI 4.48, 11.83) for cow/calf pairs (Bannister 2008). Those results had excluded data from the final year in the series, 2007, where the counts had been very low and were regarded as outliers. The 2008 survey had resulted in the highest counts recorded, with calculated annual increase rates, 1993-2008, of 6.38% (95% CI 2.88, 10.00) for all animals and 6.61 (95% CI 1.98, 11.54) for cow/calf pairs. The low figure for 2007 had been included in the trend estimation. As a conservative best estimate, the trend for all animals, 1993-2008, of 6.38% (95% CI 2.88, 10.00), was preferred.

10.6.2 South African Area

Funding had been received to allow at least another two annual aerial surveys to take place off South Africa. Images from past surveys had been scanned and entered into an electronic data base incorporating the Hiby/Lovell matching system, and quality control checks undertaken. The priority was now to bring the matching of recent surveys up to date. Field counts (uncorrected for duplicates) in the 2008 survey totalled 350 cow-calf pairs, 418 unaccompanied adults and 11 juveniles.

10.6.3 South American area

SC/61/BRG15 analysed the distribution patterns of right whales wintering along the Santa Catarina coast, Brazil, while SC61/BRG18 reported unusual mortality events of southern right whales off Península Valdés, Argentina. Since 2003, when the Southern Right Whale Health Monitoring Program was established, 291 right whale strandings have been recorded, with peaks in 2005 (47), 2007 (83) and 2008 (100). Most (90%) of these strandings were calves.

In the discussion it was pointed out that because of the long-term nature of the monitoring of this population, it could prove an excellent candidate for modelling the effects of unusual mortality events on whale populations in general.

Kelp gulls at Península Valdés, Argentina eat the living skin and blubber of southern right whales, so that the whales spend less time resting and more time in higher-energy behaviour fleeing from the attacks (SC/61/BRG19).

The databases developed by research projects in Argentina and Brazil are long, and have been highlighted as very relevant to monitor the population dynamics and health of the species. For this reason, and given the situation described above, the Committee **strongly recommends** the uninterrupted continuation of the monitoring surveys of the population off the east coast of South America.

10.6.4 Report of intersessional working group on an updated assessment of southern right whales

The Committee noted that at the SORP meeting in March 2009 (Item 19), several steering group members met and suggested that each research group should work on assessments in their region. The Committee **agrees** that it should review the results at its next meeting, with a view to holding an assessment as soon as possible thereafter, possibly in 2011. The intersessional correspondence group established last year should continue its work (Q8).

10.7 Other stocks of right whales and small stocks of bowhead whales

10.7.1 North Atlantic right whales

SC/61/BRG11 provided recent information on North Atlantic right whales for the period November 2007-April 2009, including on-going research and national management actions. A shared photographic catalogue was used to produce an estimate of population size of 415 for 2007. This was the number of unique, catalogued individuals that had been seen alive between 2001 and 2007. A total of 39 calves have already been documented in 2009. This represents the largest annual calf count on record, and mothers in 2009 had previously given birth 3.9 years ago on average. A total of six right whale mortalities were documented during the report period. Additionally, there were 10 new entanglement cases and five previous entanglement cases that had not yet been resolved.

Waring *et al*. (2009) provided the most recent US government stock assessment of the North Atlantic right whale. Photo-identification data indicated that a minimum of 345 individuals were alive in 2005, based on individuals seen alive in 2005 or both before 2005 and after that year. An estimated crude growth rate of about 1.9% was presented for the period 1993-2007.

In discussion it was clarified that the estimates of population size in SC/61/BRG11 and Waring *et al*. (2009) are not directly comparable. Rather, they are different types of estimates, calculated over different time periods and for different purposes.

While the Committee **remains concerned** regarding the status of this population and the continued anthropogenic mortality that threatens its recovery, it noted that the relatively high calf counts and the positive growth rates in recent years are encouraging. The Committee also **commends** the recent actions taken to lower the possibility of ship collisions, including movement of shipping lanes in the USA and Canada, the establishment of an 'Area To Be Avoided' in Roseway Basin, and speed restrictions on vessels in areas of the eastern coast of the USA. The Committee also commends the progress made towards reducing risk of entanglements by sinking 'ground line' in fixed gear fisheries, and **urges** the continuation of the management efforts. The Committee **repeats its previous recommendations on this population** that it is a **matter of absolute urgency** that every effort be made to reduce anthropogenic mortality to zero.

10.7.2 North Pacific right whales

SC/61/BRG16 summarised a multi-year study of North Pacific right whales in the Bering Sea, conducted by the U.S. National Marine Mammal Laboratory. A short field season in 2007 was followed by more extensive work in the summer of 2008, including both vessel and aerial surveys. One right whale and 3 humpbacks were satellite tagged during the cruise. In total, 9-11 individual right whales were photographically identified. Five whales seen in 2008 were also previously photographed in the Bering Sea in 1996-2002 and in 2004.

The Committee expresses **concern** about this probably very small population, and encourages that mark-recapture estimates of abundance for Northeast Pacific right whales are made available next year from both genetic and photo-identification data.

10.7.3 Small stocks of bowhead whales

Ivashchenko and Clapham (2009) reviewed knowledge concerning the endangered population of bowhead whales in the Okhotsk Sea (OS), about which relatively little is known. This is an update of the report presented last year (SC/60/BRG35). The authors reviewed existing information about this stock, including much previously untranslated material published in Russian. Whaling for OS bowhead whales began in either 1846 or 1847, was pursued intensively for two decades, and continued sporadically until about 1913. Catches resumed in 1967 when the USSR began killing bowhead whales illegally, although the number of whales taken remains unknown. Estimates of the pre-exploitation population size have ranged from 3,000 to 20,000 whales. Dedicated surveys and other research are required to better assess the status and conservation needs of the OS stock.

SC/61/BRG2 summarised reported sightings of bowhead whales which have taken place in the Svalbard area between 1940 and 2008. The data provided are based on a database of incidental sightings held at the Institute of Marine Research and records of sightings at the Norwegian Polar Institute. The paper summarises 41 observations made during 1940-2008, of which only three were made prior to 1980.

Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

10.8 SOWER CRUISES

10.8.1 General review of 2008/09 IWC/SOWER cruise

The planning meeting for the 2008/09 IWC/SOWER cruise was held in Japan in September 2008 (SC/61/Rep7). The meeting agreed that the highest priority should be given to work on investigating changes in Antarctic minke whale density with respect to ice recession. It was also agreed that a combination of line transect survey and collection of individual identification data (biopsy/mark-recapture) would be carried out. Other objectives included continuation of research on blue, humpback and southern right whales as in previous years.

The cruise was conducted in Area IV aboard the Japanese Research Vessel, *Shonan Maru* No.2 (SC/61/IA19). AMSR-E satellite ice images indicated a paucity of pack ice which led to the slight modification of the research area. A total of 1,441n.miles was covered during four repeat surveys which extended from the pack ice edge to a common northern boundary, and in two survey modes (SS-II mode and BT-Option II mode). The total number of minke whales sighted during the entire coverage of the research area was 49 groups (56 animals). Biopsy samples (4) and individual identification photographs (15) were collected. No substantial southward recession of the ice edge was observed during the survey period. Thus, the objective of observing patterns of whale distribution in relation to ice recession was not possible. Seven groups, comprising 17 Antarctic blue whales were sighted, with biopsy samples from 6 blue whales and identification photos of 12 individuals. Acoustic recordings were conducted at a total of 25 stations using sonobuoys and sounds attributed to Antarctic blue whales were recorded. Humpback whales were the most frequently sighted species with 373 groups comprising 682 animals observed. Biopsy samples were collected from 23 humpback whales and photo-ID images were obtained of 74 whales. By number of animals, killer whales were the second most frequently sighted species in the research area with a total of 255 animals observed (21 groups) with Types A, B and C seen. There was only one opportunity for a trial approach to test the feasibility of approaching minke whales close enough for potential deployment of telemetric devices, and the outcome was unsuccessful. Considerable research effort was also achieved on the transits.

The Committee **thanks** the Government of Japan for once again generously providing the vessel and crew for the SOWER programme. Appreciation was also expressed for the work of all involved, including the steering committee, cruise leader, researchers and crew.

It was noted that there were no sightings of right whales during the cruise. Ensor suggested that the distribution of right whales may be further to the east based on sightings from previous cruises, although one had been seen in the Prydz Bay area (further west). One possible explanation suggested for the low number of minke whale sightings was the survey was observing the more northerly distribution of the population; this was inferred from the many small minke whales. During the cruise, there were considerable discrepancies encountered between the ice conditions observed from the survey vessel and AMSR-E satellite data. Collection of biopsy samples and satellite telemetry trial approaches to minke whales proved difficult and it was noted that more time would be need to collect sufficient samples for mark-recapture type analyses. The small animals encountered and poor water colour made it difficult to slowly approach whales for telemetry trial attachments and collection of biopsy samples. Approaches to larger animals in larger groups may be easier, but overall it was felt that conditions during the 2008/09 were not unusual.

10.8.2 Update on analyses of some previous SOWER cruises

On the last three SOWER cruises, experiments were conducted that used photogrammetric systems to measure angles and distances to sightings and to document observer's search patterns. SC/61/IA13 suggested there was little bias in angle estimation and a root mean squared error of 4.9°. These errors are similar to other studies. During the Buckland-Turnock (BT) mode, observers were instructed to search within the sector 60° on either side of the trackline. Results showed that observers spent 80% of their time searching within 34° of the trackline. This indicated a slightly wider search area than indicated by a similar experiment on the 1983/84 IDCR survey. Additional data on search patterns of observers include Kasamatsu (1986) and Doi *et al.* (1974; 1980; 1982)

The Committee **encourages** further data collection and analysis of angle measurement error and scanning patterns of observers.

SC/61/IA12 summarised the data collected on minke and humpback whales in IO mode and BT-option 2 mode during the 2007/08 SOWER cruise. This cruise investigates the feasibility and utility of these two methods for future cruises. It was also the first cruise in the series to re-survey the same area in the same season to investigate temporal changes in the spatial distribution of whale species. SC/61/IA18 presented updated analyses of BT mode experiments conducted on the IWC\SOWER surveys in 2005/06-2007/08. One reason that these experiments were suggested was to provide an independent comparison of g(0) for the topman (Platform A).

These analyses are important for interpreting the results of the CPII and CPIII analyses. SC/61/IA18 can be used to assist in understanding the differences between the results from the OK and SPLINTR methods (see Item 10.1), while SC/61/IA13 could be used as a potential indicator of responsive movement and could be incorporated in simulated datasets. The Committee **encourages** further analyses of the SOWER experimental data.

10.8.3 Results from other Antarctic cruises

Following a successful pilot study in 2006 the German research vessel *Polarstern* conducted a cetacean sighting survey using helicopters in December 2008 (SC/61/IA11). Two transects were covered starting at 57° S 00°40' E and going to Atka Bay (70° 30' S 07°58' W). A key objective was to survey the distribution and abundance of minke whales in the pack-ice. A total of 24 sightings of 28 minke whales was recorded with a maximum group size of 3. (5 southern bottlenose whales and 1 killer whale were also seen within the ice.)

The Committee **welcomes** these efforts to survey minke whales in sea ice habitat. It notes that this survey demonstrated the value of helicopter surveys of sea ice habitat. The ability of helicopters to fly slowly also offers opportunities to confirm species and school size and to measure lengths which might be able to provide information on the distribution of the age/lengths of animals in and outside the ice.

A pilot aerial survey (fixed wing) for Antarctic minke whales was conducted by the Australian Antarctic Division in sea ice in Vincennes Bay, East Antarctica, in December 2008 (SC/61/IA3). Around 76 Antarctic minke whales were observed, in 53 sightings, with group size ranging from 1 to 4.

The Committee notes that it appeared from AMSR-E data that the area was free of sea ice, but ice was still observed from the aircraft. This discrepancy points to a limitation in scale of the AMSR-E sea ice data. The survey confirmed the suitability of the CASA-212 aircraft for such surveys. A limitation of the preliminary abundance analysis in SC/60/IA3 was the assumptions about the availability of minke whales at the surface that are required to estimate g(0). Currently more data are needed to refine these assumptions and so telemetry studies are planned.

10.8.4 Recommendations for 2009/10 cruise and short-term objectives

10.8.4.1 2009/10 SOWER CRUISE

Owing to changes in vessel availability, the Japanese Government is offering the 61.9m *Kaiko-Maru* (860 tons) instead of the *Shonan Maru* no. 2 that was used in previous cruises. The vessel has been used as a dedicated sighting vessel in the JARPA II programme since 2006/7 but does not possess a certificate allowing it to enter international ports (except in an emergency). This had several implications for the proposed cruise which have not as yet been fully resolved.

The *Kaiko-Maru* is available for 80 days, departing Japan on 17 December 2009 and returning to Japan on 6 March 2010, with about 30 days available from Antarctic research.

After discussing several possibilities, the Committee **recommends** that as a first priority, the IWC/SOWER

2009/10 cruise should take advantage of the planned Australian aerial survey and collaborate with them to continue the IWC's investigation of the distribution of minke whales in relation to sea ice. The Committee also **recommends** that, if this becomes impractical for logistical reasons, an alternative plan would be to collect biopsy samples and photo-identification images from humpback whales in Area IV to assist in elucidating the degree of mixing of breeding stocks D and E on the Antarctic feeding grounds. This will contribute directly to the ongoing comprehensive assessment of southern humpback whales. Two possible study areas that were suggested were potential stock-mixing areas or areas where sample coverage from previous cruises was low (60-110°E and 130-150°E). The choice between these was left to a planning meeting, where all available data on the distribution of available photos and samples, and the logistic for the vessel would be considered.

The Committee **recommends** final plans for the 2009/10 cruise be completed at the Tokyo Planning Meeting (convened by Kato) during 16-18 September 2009. The SOWER steering group comprises of Kato (Convenor), Bannister, Best, Bravington, Brownell, Donovan, Ensor, Gales, Hedley, Kelly, Matsuoka.

10.8.5 Future of the SOWER programme

The Committee notes that the proposed 2009/10 cruise may represent the last in the SOWER-Circumpolar series of cruises. Commencing in 1978/79 as part of its International Decade of Cetacean Research (IDCR), this programme has been organised annually under the auspices of the IWC. In the intervening 32 years the cruise programme has involved between 1 and 4 ships each year, for a total of 4,112 vessel-days (or 11¼ vessel-years) and has covered an estimated 216,000 n.miles in the area south of 60°S. In the process, the Antarctic continent has been circumnavigated 3 times and 43,000 sightings of cetaceans made, including notably 25,333 of minke whales and 400 of blue whales. Estimates of abundance have been obtained not only for the Antarctic minke whale, the prime objective of the programme, but also for almost every other cetacean occurring in higher latitudes, including several smaller species that had never been assessed previously. The first circumpolar survey took place when commercial whaling was still in progress, and 2,748 minke whales were tagged with Discovery marks and 95 recovered, including one 24 years later: this continues to be the only source of data on the summer movements of Antarctic minke whales. From the second circumpolar series onwards, some 1,500 biopsies have been collected, over 3,000 whales photographed for individual identification and many thousands of hours of acoustic recordings made. The programme has also stimulated the development of different approaches to modelling sighting data. Without the generous provision of vessels by the Government of Japan (and initially by the Soviet Union) and the financial and other support of the IWC, the success of this programme would never have been possible. It has been truly international in nature, with over 200 scientists from 15 member nations participating, and cooperative cruises in lower latitudes have been conducted off Australia, Brazil, Chile, Madagascar, Peru and South Africa. All the data collected on these cruises have been submitted to the IWC Secretariat and made available through its DESS data base to interested scientists from any member nation. Although the programme may now be coming to an end, the IWC Scientific Committee will doubtless continue to mine the wealth of information it has accumulated on southern cetaceans for many years to come. It is hoped that reviews of many of the achievements of IDCR/SOWER will be included in the Special Issue of *JCRM* that is planned for the near future.

The Committee recognised the extensive amount of information that has been collected during the 30 years of the IWC/IDCR/SOWER cruises on a wide variety of cetacean species. To acknowledge this achievement, the Committee **reiterates the recommendation** that an intersessional working group be convened to develop plans to commemorate these cruises by considering to further update the IWC webpage to include more information about the cruises and creating a special volume of the JCRM reviewing the extensive scientific work undertaken over the 30 years. The working group will be convened by Bannister and Donovan. The work on the web page pas already begun with the addition of a large number of photographs and reports of recent cruises. Eventually, all reports will be available as they are digitised.

10.9 North Pacific survey programme

A proposal and preliminary plan for a mid- to long-term research programme involving sighting surveys to provide information for cetacean stock management in the North Pacific (NP) sponsored by the Government of Japan was presented. The first research cruise in the series was planned for July-August 2010 and proposed research to be undertaken included: standard line transect sightings survey, biopsy skin sampling and photo-identification studies and satellite telemetry. The preliminary schedule suggested a planning component to be held in conjunction with the 2009-10 IWC-SOWER logistics meeting in mid-late September 2009.

The Government of Japan pledged the same level of support for this North Pacific research as it had generously provided to the recent annual SOWER cruises with regard to budget, vessel, and duration of the cruises. It was noted that the development of the framework for North Pacific research could be considered at various levels or a combination of levels: a Japanese national programme; a joint Japan-IWC programme; or an IWC programme similar to the ongoing IWC-SOWER programme. The last would have the advantage of an integrated approach which could involve collaboration with other relevant international research efforts and could maximise research outcomes towards understanding the status, stocks and the role of whales within the North Pacific ecosystem.

The Committee **welcomes** this initiative from Japan and **agrees** the value of a large-scale, middle-long term integrated research programme in the North Pacific and **strongly encourages** this in the context of international collaboration under IWC auspices. Given its scale and importance to the work of the Committee, considerable detailed planning is necessary. The Committee **recommends** that the planning process should start with a

review of the current discussions of North Pacific issues within the Committee and a careful examination of available information and identification of gaps in knowledge. It was recognised that there was insufficient time to ensure appropriate design and planning prior to the first cruise due to take place next year. It was suggested that it might be valuable to hold an intersessional meeting to establish a broad outline of objectives and sub-objectives and to evaluate what resources are needed to best achieve these aims. Attention was drawn to the similarity of this design process with that of the ACCOBAMS Mediterranean sighting surveys (Cañadas *et al.*, 2006; Cañadas *et al.*, 2008) and the recent Southern Ocean Research Partnership (SORP) workshop (reported in SC/61/017) to develop coordinated, long-term research on the large whale species managed by the IWC in the Southern Hemisphere.

In conclusion, the following points were identified for consideration in the planning of the programme: (1) the value of large scale, long-term research to the work of the Committee; (2) agreement on working towards specifying objectives for an IWC/international research programme within which the Japanese cruise would/could fit; (3) the need to collate and review issues of importance to the Committee that could be addressed by such a programme; (4) the need for collation of information from interested range states; (5) agreement that an intersessional workshop would probably be required next year to discuss and specify objectives and begin to specify the programme; and (6) issues to be discussed include the value of a large-scale synoptic approach as well as long-term, smaller scale approaches.

The Committee established an intersessional group (Convenor Kato, see Q15). Terms of reference of the steering group are:

(1) review the Committee's issues in the North Pacific and circulate a paper before the next Annual Meeting;
(2) review the past and ongoing survey activities and available data in range states from completed pro forma;
(3) consider possible line transect survey plan and additional data collection (e.g. photo ID and biopsy) for 2010 season; and
(4) prepare proposal for intersessional workshop (between SC/62 and SC/63) on future surveys beyond 2010.

To initiate and review progress of the intersessional work, an informal intersessional meeting will be held after the SOWER Tokyo planning meeting in September 2009. Clapham, Matsuoka and Miyashita agreed to prepare a summary table of existing research efforts in the region for the informal intersessional meeting.

10.10 Other

10.10.1 Initiate planning of in-depth assessment of North Pacific sei whales

In preparation for a future in-depth assessment of North Pacific sei whales, the Committee reviewed available data on abundance, distribution, catch history, stock structure and biological parameters of North Pacific sei whales. Since last year the following studies were reviewed: (SC/61/Rep1); a new genetic study (Kanda *et al.*, 2009); abundance estimates for the JARPN II area (Hakamada *et al.*, 2009); and spatial modelling that extrapolated the abundance beyond the surveyed area (Hakamada, 2009). Extensive surveys on the west coast of the USA resulted in very few sei whale sightings (Barlow and Forney, 2007), although, before 1970, sei whales use to be a common species in the catch. The Committee emphasises the importance of accounting for negative information (survey effort resulting in zero sightings or too few to estimate abundance), especially when using spatial modelling to extrapolate densities. The Committee noted the absence of recent surveys offshore of the central and eastern North Pacific, and emphases the importance of collecting new data in these areas. However, it considered that work on the in-depth assessment should proceed in parallel with new data collection. While current abundance is the most important data need, it is also important that historical abundance data be analysed.

Allison reported on progress with compiling a catch history. Further data on the North Pacific Soviet catches were unlikely to become available, and a complete reconstruction of these catches would not be possible, but reasonable inferences of the likely range of these catches could be made.

The Committee **agrees** that the first phase of the in-depth assessment should focus on abundance and distribution (past and present), stock structure, and catch history (including the separation of the North Pacific sei and Bryde's whale catches by Japan and Russia). The Committee **agrees** to defer the topic of biological parameters to a later stage, because there are no recent analyses although data have been collected in the JARPN II program).

There is little information on the stock structure relationships between sei whales on the eastern and western sides of the Pacific Ocean and there are only few eastern Pacific available samples. Thus, the Committee **recommends** any available samples from the eastern side of the Pacific be analysed to explore the stock structure.

The Committee **recommends** that the in-depth assessment could start at the 2010 Annual Meeting if the tasks in the work plan in Annex G, Appendix 4 are completed. This includes the following tasks: inventory of existing data holdings; approximate quantification of the negative information from US and Canadian abundance surveys; genetic analyses on available Northeast Pacific sei whale samples; a preliminary review of historical abundance and distribution data; and compilation of a catch series (including upper and lower values if appropriate).

10.10.2 Southern Hemisphere fin whales

SC/61/SH16 describes 3 distinct regional differences in fin whale song recorded in and near the Southern Ocean. These region specific song types are confirmed by the presence of distinct, seasonal bands of energy in multiple year recordings from the different locations. Differences in fin whale song types may be useful in defining distinct stocks or population structuring within fin whales in the Southern Ocean. Discussion of this document is given in

Annex H, item 4. The Committee **recommends** that collaboration of the authors with the French SORP study (item 10.4 above) be pursued in order to obtain more data with which to explore these findings.

11 STOCK DEFINITION

This agenda item was established in 2000, and has been handled since then by a Working Group; see IWC (1999d, p.83) for the original Terms of Reference. The term 'stock' has been used with different meanings in different contexts at different times, both within IWC and in other management and conservation contexts. These multiple meanings have sometimes hindered the Committee's ability to provide management advice. The Working Group was set up to clarify the issue of 'stocks' in a management context, to create a bridge between IWC and the expertise of the wider population genetics community, to develop software that evaluates the utility of various population genetic analyses for management (TOSSM[8]; see Item 11.2) and to develop guidelines for preparation and analysis of genetic data within an IWC context. This is of fundamental importance to the Committee's discussions on assessments, and the development of management advice. The Report of the Working Group is given as Annex I.

11.1 Statistical and genetic issues related to stock definition

11.1.1 Guidelines on DNA Data Quality

In recent years, the Scientific Committee has engaged in several in-depth discussions centred on the genetic data that form part of the delineation of stock structure hypotheses, for example in the bowhead whale *Implementation Review* (IWC, 2007f, pp.142-46). The Committee's experiences have underlined that a clear understanding of the reliability of each genetic dataset is essential for correct interpretation in terms of stock structure, and have re-emphasised the importance of developing suitable quality protocols for genetic data used in providing management advice (IWC, 2009k, p.248). There are associated issues in terms of the Data Availability Agreement (IWC, 2004e), and these would be greatly aided by having a protocol for the use of genetic data that includes both guidelines and suggestions for minimum standards. Last year, the Committee endorsed a general set of guidelines (IWC, 2009k, pp.252-56), and moreover strongly recommended adherence to them for studies done to provide stock structure advice in a management context. The guidelines are expected to evolve in future. The complexity of the issues means that the current guidelines lack any numerical reference points, and the Committee has encouraged suggestions for such reference points where appropriate, via an intersessional email group. There were no proposals for consideration in 2009, but the intersessional email group will continue (Q19) and the Committee looks forward to updating the guidelines accordingly in the 2010 meeting.

[8] TOSSM = Testing Of Spatial Structure Models.

11.1.2 Guidelines on analysis methods

In parallel with the development of data quality guidelines, the Committee is developing guidelines for some of the more common types of statistical analyses of genetic data that are employed in IWC management contexts. These will update and considerably expand the initial attempt made during the 2nd TOSSM workshop (IWC, 2007a). As with the data quality guidelines, the analysis guidelines are expected to evolve in coming years. The document is intended to be of value both to geneticists and to management scientists.

This year, the Committee **agrees** the initial structure for the analysis guidelines document (for details, see Annex I, Appendix 2, which is based on SC/61/SD1 and subsequent discussion). To set the context, the document will start with an example: a simple description of a real IWC management conundrum involving alternative stock structure scenarios. It **agreed** that WNP Bryde's whales would be a suitable first example, since the situation is not so complicated as to obscure the generic points. An initial draft of this example is given in Annex I, Appendix 3.

The analysis guidelines themselves will address five main categories, with numerous sub-categories each addressed by a 1-2 page description, with comments on domain of applicability, pitfalls, and appropriate interpretation. The main categories will be:

(1) Species ID and delimitation.

(2) Analysis of diversity within populations.

(3) Estimation of population size (census, effective, and historical).

(4) Analysis of stock structure, ie diversity across populations, including discussion of particular algorithms/software.

(5) Generic issues in analysis (e.g. multiple testing, MCMC issues, influence of selection, interpretation of negative results).

The document will end by returning to the original example. It will first consider what might be possible given an ideal sampling scheme, then how best to proceed with the kind of samples available now, and then whether there are implications for further data collection as well as analysis. The document will work through the analytical steps that might usefully be taken, and will point out some that should not be. In future iterations of the document, other IWC examples will be included, since these may require different approaches to analysis. Examples include cases where breeding ground samples are available and cases where sampling occurs on coastal migration routes.

While the genetic analyses considered by the Committee have mainly concerned guideline category 4 (which is also the focus of the introductory example), all five categories are of importance to the Committee, and it should be possible to make progress on several fronts simultaneously.

To facilitate development of the analysis guidelines, a separate intersessional email group has been established (see Q17). Individual members of the Committee have been identified to address particular sub-categories.

Sections of particular relevance to Western North Pacific Minke *Implementation Simulation Trials* will be identified and it is hoped to have an initial draft ready for these by 1 Oct 2009, so that the sections can be reviewed amongst the email group and then circulated to those involved in relevant intersessional workshops. A draft paper with most sections addressed should then be available at the 2010 Annual Meeting.

11.1.3 Relationship between biological populations and management stocks

The Committee has repeatedly noted that the stock-related demographic parameters of relevance to management (e.g. mixing proportions, *per capita* dispersal rates per year) are quite different to the genetic differentiation parameters typically considered in studies of population genetics (e.g. F_{st}, absolute numbers of migrants per generation). Particularly in the context of guidelines meant for geneticists outside the IWC as well as for the IWC itself, it is important to try to bridge the gap between concepts. In particular, it is important to give population geneticists an idea of the level of genetic differentiation that the Committee is interested in detecting, and to clarify why it is not possible to provide a single definitive value for all situations. To this end, the Committee this year considered a simple hypothetical example in which two breeding populations are linked by dispersal, the catch level is proportional to the combined abundance, but all the catch is taken from Population 1. In this example, it is possible that Population 1 will become over-exploited. Whether this actually occurs depends on several parameters: the overall catch rate, the MSYR, the proportion of the total pre-exploitation abundance coming from Population 1 and the dispersal rates (see Annex I, Figure 1 and Appendix 3). Given the abundances and the overall catch rate, it is possible to calculate a threshold dispersal rate above which over-exploitation will not occur, based only on population dynamic considerations. For management purposes, the 'one stock or two stocks' question corresponds to whether the true dispersal rate is above or below the threshold, regardless of whether the biological reality is two breeding populations or just one. Further, it is possible to translate the threshold dispersal into the population genetic parameters mN_e and F_{ST} or similar. Although the translation relies on simplistic assumptions and is only approximate, it is straightforward, and provides a basis for considering the power of various genetic methods. For example, if the threshold F_{ST} turns out to be exceedingly low, then assignment methods may have very low power and close-kin methods might be the only option to distinguish between alternative stock structure hypotheses.

The example in Annex I Appendix 3 could be adapted to other situations of management interest, e.g. with mixing of populations on the catch areas, and that this might be useful in informing future considerations of population genetic methods, and in 'tuning' such methods for testing in TOSSM (see 11.2). The example emphasises that there is no single threshold of genetic differentiation that can define a 'stock' for management, but that the threshold depends on population parameters and catch/by-catch patterns.

11.2 Progress on the TOSSM project

The general aim of the TOSSM project is to facilitate comparative performance testing of population structure methods intended for use in conservation planning (Martien *et al.*, In press). From an IWC perspective, the TOSSM software package, written in R, allows evaluation of methods for detecting genetic structure, in terms of how successfully they can be used to set spatial boundaries for management. Following intersessional work this year, the basic TOSSM framework is now complete. The software is freely available to all as a fully-documented R package on CRAN (*http://www.cran.r-project.org*), and a paper describing TOSSM has been accepted in *Molecular Ecology Resources*. A paper describing the results of some of the testing that has already happened (e.g. of STRUCTURE - see IWC, 2008i, p.227; Martien *et al.*, 2007) is in preparation. Maintenance and development of TOSSM rests with Karen Martien at SWFSC USA, and the developers are happy to help those wishing to use or extend TOSSM to explore genetic methods in a management context, whether in the IWC or beyond.

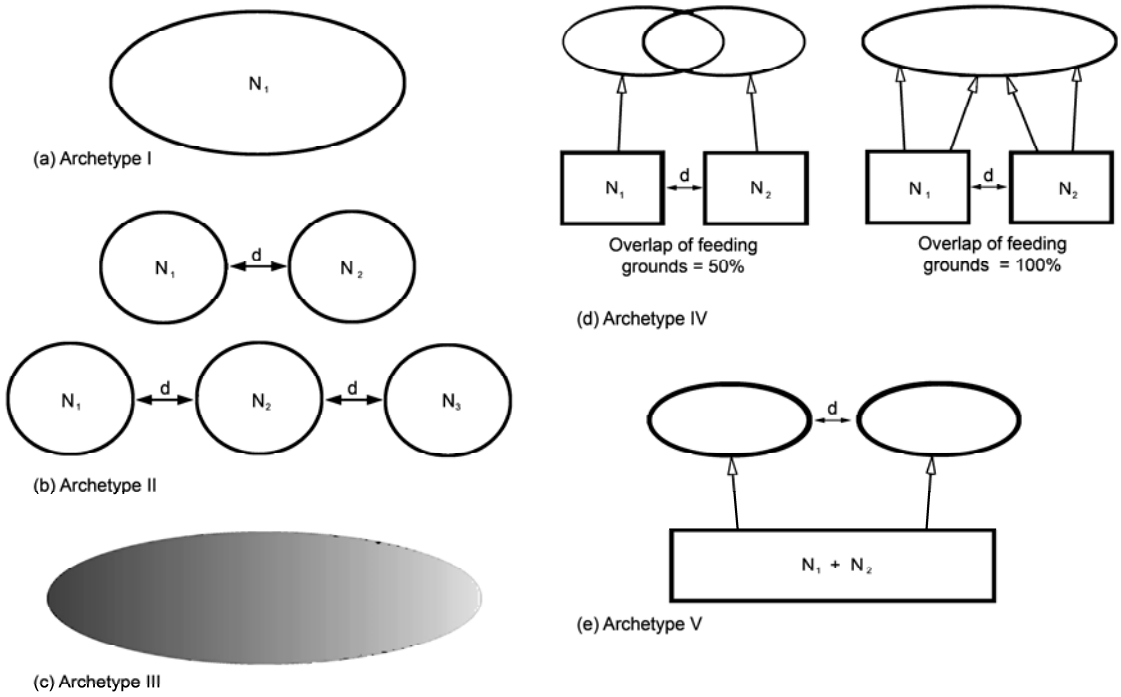

Fig 10. (a) Archetype I. Panmixia. (b) Archetype II. Stepping-stone. There can be either 2 or 3 populations. Dispersal occurs only between adjacent populations. (c) Archetype III. Diffusion-type isolation-by-distance. (d) Archetype IV. Two discrete breeding grounds with feeding grounds that overlap partially or completely. Ovals indicate feeding grounds while rectangles depict breeding grounds. Open-ended arrows indicate migratory routes while closed arrows indicate dispersal. (e) Archetype V. A single breeding stock with two separate feeding grounds. Animals follow their mothers to the feeding ground and exhibit strong feeding ground fidelity. Ovals indicate feeding grounds while rectangles depict breeding grounds. Open-ended arrows indicate migratory routes while closed arrows indicate dispersal due to females occasionally changing feeding grounds.

There are two steps to using TOSSM: developing a reference dataset for a particular biological scenario, and testing a population genetic method on one particular reference dataset. The former is much more time-consuming. Reference datasets covering three of the five Archetypes originally proposed for TOSSM are now available: Archetype I (single stock), II (two stocks with dispersal), and IV (dispersal + mixing) is complete.

The Committee recalled that a number of methods have already been tested with TOSSM , but to date only for the simplest Archetypes I and II. This year, the Working Group considered those stock structure hypotheses for large cetaceans that are currently being considered by the Committee in the light of the TOSSM archetypes. Archetype IV is most common, often with some elements of Archetype V. The Committee **encourages** those involved in largely-Archetype IV cases (e.g. some aspects of Western North Pacific minkes) to consider whether TOSSM can be used to evaluate the power of e.g. STRUCTURE, noting that this had already been considered in Martien *et al.* (2007) for Archetypes I and II. It may or may not prove necessary to develop further reference datasets for specific stock structure hypotheses such as for Western North Pacific common minke whales.

Although Archetype IV/V cases may be the present primary focus of the Committee the isolation-by-distance model of Archetype III remains relevant (also for small cetaceans); development of a reference dataset for this Archetype and testing of methods on it would be useful. Development of further reference datasets rests with individual developers; software is available from the TOSSM website, and guidance from Martien.

No new results on tests of population genetic methods under TOSSM were presented this year.

11.3 Criteria for unit-to-conserve

The term 'unit-to-conserve' has been used in the Committee to avoid some of the terminological conflicts associated with the term 'stock'. There have been no recent specific proposals in an IWC context. Nevertheless, the experience gained through TOSSM and through discussions of statistical population genetics have certainly assisted discussions with the Committee. Although no papers on this topic were discussed this year, the discussion on relationship between biological populations and management stocks this year under Item 11.1 is certainly relevant, and the Committee **encourages** examples along similar lines being presented at the 2010 Annual Meeting.

11.4 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

12 ENVIRONMENTAL CONCERNS

The Commission and the Scientific Committee have increasingly taken an interest in the possible environmental threats to cetaceans. In 1993, the Commission adopted Resolutions on research on the environment and whale stocks and on the preservation of

the marine environment (IWC, 1994a; 1994b). A number of resolutions on this topic have been passed subsequently (IWC, 1996; 1997a; 1998a; 1999b; 1999c; 2001b). As a result, the Scientific Committee formalised its work on environmental threats in 1997 by establishing a standing working group that has met every year since then. Its report this year is given as Annex K.

12.1 Review report from the second Climate Change Workshop

In 1993, the Commission requested that the Scientific Committee convene a special workshop on the effects of global change on cetaceans (IWC, 1993b), resulting in the first Climate Change Workshop held in 1996. The Workshop Report (IWC, 1997b) concluded that a considerable amount of fundamental research was needed to support predictions of the effects of climate change on cetaceans, and recommended that the Scientific Committee and Commission consider ways to facilitate such research. In 2007, the Scientific Committee proposed that a second Workshop on Cetaceans and Climate Change be convened, with the primary aim to determine how climate change is or may already be affecting cetaceans and how best to determine these effects. Funding was approved at the 2008 Commission meeting.

The second Workshop was held at the University of Siena Italy from 21-25 February 2009 (SC/61/Rep4). The terms of reference for the Workshop were to bring together and enhance collaborations among experts in cetacean biology, modelling, marine ecosystems and climate change, as well as to review the current understanding and to improve conservation outcomes for cetaceans under recent climate change scenarios: (1) identifying existing long-term cetacean environmental datasets that can be analysed and included in models in relation to climate change variables; (2) determining patterns that may be attributable to climate change via analyses of these datasets; (3) modelling mechanisms to consider cause and effect relationships, provide predictions and identify data gaps that, if filled, would improve our understanding of the effects of climate change on cetaceans; and (4) providing timely advice related to cetacean research, conservation and management via peer reviewed publications.

The Workshop made a number of recommendations and the Committee **endorses** these below.

The Committee **recommends** that IWC member countries and relevant organisations: (1) take the potential effects of climate change on cetaceans seriously and include these considerations in relevant climate-related and conservation management initiatives, including implementation of emission controls; and (2) support the research recommendations given in SC/61/Rep4.

With respect to the strengths and limitations of existing modelling approaches, and in regard to analytical needs, the Workshop had recommended that: (1) some priority be accorded to developing models that can integrate the demographic and spatial consequences of climate change; (2) effort be allocated to exploring the value of developing ecosystem models that begin with baleen whale dynamics rather than building bottom-up ecosystem models; (3) the scenarios used in the *Implementation Simulation Trials* for the RMP and the *Evaluation Trials* for the AWMP should be re-evaluated in light of discussions at the Workshop and additional trials which consider climate impacts added if necessary. Specifically, it was noted that for the first time variability in sea-ice cover, an environmental 'icon' of climate change, was used in an assessment of the eastern stock of North Pacific gray whales (SC/61/AWMP2) prepared to evaluate the performance of the *Gray Whale SLA*; (4) where possible, further correlative studies should be undertaken in order to improve the conceptual understanding of population processes, and hence enable the development of a set of testable hypotheses; (5) the predictions and levels of uncertainty with respect to the many IPCC modelling exercises need to be carefully reviewed with respect to choosing the most appropriate for incorporation into modelling exercises with respect to cetaceans; and (6) telemetry studies should be used and resultant cetacean movement patterns evaluated via multivariate analysis using a range of environmental variables, with the results of these analyses used as basis for developing hypotheses regarding the mechanisms which influence animal movements. The Committee **endorses** these recommendations, noting that they are being taken into account by the sub-committees dealing with the relevant topics (RMP, AWMP, EM).

With regard to the Southern Ocean, the Committee **endorses** a number of specific Workshop recommendations for future work, including: (1) further investigation of the IDCR/SOWER datasets (and others) to investigate possible changes in killer whale abundance, given their unique role as predators of other whale species; (2) further investigation of the use of autonomous bottom mounted acoustic recorders to obtain long-term datasets for fin and blue whales; (3) continued investigation and analysis of individual identification data for blue whales (genetic and photographic) for potential mark-recapture studies; (4) resolution of the controversy over the interpretation of whaling data to infer long-term changes in sea-ice (de la Mare, 2009); (5) further efforts (e.g. telemetric) to examine the movements and feeding ecology of Antarctic minke whales in winter; (6) further studies into the interactions between large whales and the overall productivity of the marine ecosystem.

The Committee **recommends** that every effort be made by researchers to participate in co-operative studies that can address matters of important conservation concerns, including the potential effect of climate change. In particular, it **recommends** that (1) the established photo-identification catalogues of humpback whales be investigated with respect to the estimation of demographic parameters; and (2) collection of photo-identification data be continued to allow hypotheses regarding the causes of changes in population growth rate, including environmental change, to be investigated.

With respect to Southern Ocean studies, Best stressed the possible value of direct studies of nutrition in studying effects of environmental variation, including (1) examining historical trends in oil production from commercial whaling and (2) biopsy sampling of blubber to establish current nutrition levels and trophic relationships. He also doubted that given the size of current southern

humpback whale populations and the small number of inter-year recaptures with existing photo-identification efforts that the proposed recommendation would be an efficient way of obtaining information on demographic parameters in the short term.

Following on from the Workshop, the Committee again **emphasises** the great value of long-term datasets and **recommends** that funding be provided to ensure their continuation. In particular, the Committee **recommends** emphasis on cetacean studies which allow comparisons between contrasting regions where data on a wide range of ecosystem components are available. Regionally comparative studies on southern right whales and humpback whales from Eastern Antarctica, the Antarctic Peninsula and South Georgia are likely to be particularly informative, and their continued development and implementation is recommended. Although timing of events in other taxa such as pinnipeds has not shown clear relationships with climate, the Committee **recommends** that where data exist, these should be examined with respect to timing of arrival on and departure from the breeding grounds particularly with respect to different components of the population. The Committee also **recommends** further investigation of data from the multi-disciplinary cruises where cetacean data have been collected (including CCAMLR 2000, SO-GLOBEC and BROKE surveys).

The Workshop noted the ongoing work within the Scientific Committee with respect to trends in abundance of Antarctic minke whales in different regions of the Southern Ocean (analysis of the IDCR/SOWER data) and the examination of possible links to environmental factors such as sea-ice extent was noted. Recent application of aerial surveys to the measurement of minke whale densities in sea-ice (see Item 10.1) has the potential to further inform these analyses; and the Committee **reiterates** that this work should continue (Annex K, Item 6.5.2). The Committee also **recommends** the coordination of methods and seasonal timing of such surveys if comparisons between regions are to be possible. Although the Southern Ocean Working Group from the workshop was unable to develop specific research recommendations in the time available, the Committee recommends that the development of detailed recommendations should be developed in tandem with the SORP programme (see Item 19).

With regard to the Arctic, the Committee **endorses** the Workshop recommendations that work continue on development of the three outlined studies (A) Single Species-Regional Contrast; (B) Trophic Comparison; and (C) Distribution Shift (defined in Annex K, item 6.4.2). This work must be undertaken before specific recommendations on analytical methods and modelling can be made. The recommended studies are based upon extant databases of 10-40 years, which then provides a 20-50 year timeline for investigation and modelling of climate-related events. The Committee **encourages** continued development of detailed analytical and modelling plans, under the general guidelines set forth in SC/61/Rep 4for each of the three outlined studies.

The Committee noted and commends the Sundarbans case study on small cetaceans (Annex K, Item 6.4.3) and strongly **encourages** future conservation efforts with respect to anticipated effects of altered hydrologic regimes, sea level rise and other climate-related impacts in combination with other anthropogenic factors in this area and with respect to the development of MPAs.

The Workshop also considered a range of hypotheses that might be investigated for small cetaceans. These have been referred to the sub-committee on Small Cetaceans, as well as the suggested indicator species and research situations, with the aim of identifying specific research projects.

With respect to the Commission itself (including the Conservation Committee and the Aboriginal Whaling Sub-Committee), the Committee notes in particular the recommendations made under Item 8.1 in SC/61/Rep4 that relate to collaboration with institutions outside the IWC. As the Scientific Committee has stressed on many prior occasions, work on the possible effects of climate change and indeed all work related to ecosystem modelling (and the necessary datasets) is not something that can be accomplished by the IWC in isolation. The Committee believes that collaboration among international groups should be strongly encouraged, not only to further IWC efforts in cetacean conservation and management but also because cetaceans are potentially good indicator species. Clearly, there is a need for international and multi-disciplinary efforts and the Committee recommends that collaborative work with other relevant bodies (e.g. ACCOBAMS, CCAMLR, SO-GLOBEC, Arctic Council, and others) continues and is expanded. In most cases this needs to be at a greater level of involvement than simply an exchange of observers at meetings. An ongoing dialogue with the IUCN on the development of sensitivity indicators was also recommended.

The Committee **requests** that the Commission **urges** policy makers, regulators, and others involved in cetacean management to consider tertiary effects of climate change (e.g. consequences of the opening up of previously closed areas to shipping) (SC/61/E8) via appropriate risk assessment approach and **recommends** that management plans are devised to address these impacts in addition to primary and secondary impacts. It is important that these effects on cetacean populations are considered in policy decisions regarding adaptation to climate change.

The Committee thanked the sponsors of the workshop, including Australia, Germany, the UK, the USA, Humane Society International and the Whale and Dolphin Conservation Society.

12.2 Review progress in planning for the POLLUTION 2000+ Phase II

The IWC-Pollution 2000+ programme was initiated to investigate pollutant cause-effect relationships in cetaceans, and arose from a workshop chemical pollution and cetaceans held in Bergen, Norway in 1995 (Reijnders *et al.*, 1999). Following the Bergen workshop, a planning meeting was held in 1997 (Aguilar *et al.*, 1999a) and a workshop was held in 1999 (Aguilar *et al.*, 1999b), where Phase I of the POLLUTION 2000+ programme was

launched. Phase I had two objectives: (1) to select and examine biomarkers for exposure to and/or effects of PCBs, and (2) to validate/calibrate sampling and analytical techniques. The results of Phase I were reviewed at the POLLUTION 2000+ Phase II Workshop in Barcelona in April 2007, where a general framework for POLLUTION 2000+ Phase II was outlined (IWC, 2008b). Discussion for Phase II studies since that time has determined the need to (1) produce a framework for modelling the effect of pollutants on cetacean populations; (2) identify cetacean populations to be studied under Phase II, and (3) develop a protocol for validating biopsy samples and applying this protocol to any large whale species selected.

Data obtained from POLLUTION 2000+ Phase I, as well as from other contaminant studies over the past 15 years, have provided a broader foundation from which to evaluate the state of the science and plan for future pollutant studies for cetaceans. The Committee **reiterates** the findings of the POLLUTION 2000+ Phase II Workshop and **recommends** that a strong modelling effort using a tiered risk assessment paradigm should form the foundation of further studies. In addition, further development of appropriate endpoints for cetaceans (including the use of biomarkers to determine contaminant exposure and effects, appropriate study populations, and appropriate modelling) are needed.

The Committee **proposes** the following modified goals for the Phase II programme: (1) develop an integrated modelling and risk assessment framework to assess cause-effect relationships between pollutants and cetaceans at the population level, building on the progress made during Phase I and on recent research, using modification of a tiered risk assessment paradigm; (2) extend the work to new species and contaminants as appropriate; and (3) validate further biopsy sampling techniques for use in addressing issues related to pollution, including legacy contaminants and new contaminants of concern and associated indicators of exposure or effects. The Committee **endorses** the proposal for an intersessional Workshop to forward this work (Annex K, Appendix 2). In addition, an intersessional work group (communicating through intersessional email and conference calls) will be established to develop the validation plan for biopsy techniques.

12.3 Receive the State of the Cetacean Environment Report, SOCER

The SOCER aims to provide Commissioners and Scientific Committee members with a non-technical summary of events, developments and conditions in the marine environment relevant to cetaceans. The report is compiled annually, in response to IWC (2001b), with a focus on one pre-selected region each year plus a Global section. SC/61/E1 is the eighth SOCER, and is focused on the North and South Pacific, last covered in 2004.

Based on a thorough search of the scientific literature from 2007-present, the 2009 edition of SOCER (Annex K; Appendix 3) consists of succinct entries on: (1) the Pacific; (2) global events; (3) a glossary of terms used in the report (species names, ecological terms, pollutant types); and (4) a set of tables providing an overview of specific pollutant levels in cetaceans. Next year's SOCER will be devoted to the Arctic region.

12.4 Review report from Cetacean Emerging And Resurging Disease (CERD) working group

A workshop on infectious and non-infectious diseases of marine mammals and impact on cetaceans was held in 2007 (IWC, 2008k). The workshop focused on three topics: (1) harmful algal blooms (HABs); (2) infectious diseases in marine mammals; and (3) modelling and risk assessment approaches for understanding the impacts of toxins and diseases on cetaceans. Participants at the workshop recognised that HABs are now common throughout the world and there is a need for increased research and standardisation of reporting on cetacean health. To that end, the Committee recommended establishing a Cetacean Emerging and Resurging Diseases (CERD) Working Group to (1) summarise available information on cetacean pathogens, HABs and disease; and (2) organise a review of cetacean skin diseases, with emphasis on South America. The second objective was met via a pre-meeting workshop in Santiago, Chile in May 2008 (IWC, 2008n).

The Cetacean Emerging and Resurging Disease (CERD) Working Group (WG) reviewed their recent work and upcoming plans. The Committee **recommends** that the following tasks be completed in time for next year's annual meeting: (1) continue to expand the intersessional email group and CERD membership by inviting participation of additional national experts and field/discipline specialists; (2) develop standardised lesion descriptions, characteristics, and classifications for a few major skin lesions in mysticetes and develop case definitions for a few specific skin diseases of known etiology; (3) identify regional experts who will be willing to provide the information and complete the first round of diagnostic laboratories by region, ocean basin or country; (4) participate in the 'prioritisation of pathogens of concern' work that is being undertaken by the U.S. Working Group on Marine Mammal Unusual Mortality Events; (5) expand the emergency response steering committee; (6) enhance capacities and communications between stranding networks. In addition, consideration will begin in 2011, after some of these tasks have been completed to the creation of a CERD website.

12.5 Other habitat related issues

An update was presented on the 31 May 2008 mass stranding of 100 to 200 melon-headed whales in a complex inter-tidal lagoon off the northwestern coast of Madagascar. Hydrocarbon industry exploration activities were reported to have been occurring in the waters near to this mass stranding event. Following an operational/rescue phase, additional information gathering and data synthesis were completed to investigate the causality of the mass stranding. Efforts are now underway to proceed with the independent scientific review process that will complete the scientific evaluation into the potential causes of the mass stranding event.

SC/61/O20 highlighted the relevant scientific aspects of the first International Conference on Marine Mammal

Protected Areas held in April, 2009 in Hawaii, USA. Much of the conference was focused on management, education and enforcement issues. However, scientific topics included research survey techniques from MMPAs around the world, some using inexpensive platforms of opportunity and others developing innovative new technological methods. In addition, approaches to understanding and mitigating common threats (e.g., sound, entanglement, and ship strike) were presented. Finally, workshops were held to discuss criteria for determining and mapping critical habitat. Relevant recommendations and initiatives from the conference were listed (Annex K, Item 10.6), including the announcement that France will host the next conference in late 2011.

12.5.1 Review any new information on anthropogenic noise and cetaceans

The possible impacts of anthropogenic sound on the marine environment creates unique challenges for virtually all conservation and management agencies. The considerable scientific uncertainties regarding the nature and magnitude of actual impacts have been the focus of numerous scientific review panels and workshops. In the SWG, a special session on underwater sound was held in 2004 (IWC, 2005e), followed by a pre-meeting focused on effects of sound from seismic surveys in 2006 (IWC, 2007g). The item is retained on the SWG agenda each year as a means to update the Commission on new information.

SC/61/E10 presented information on a model that quantifies acoustic masking of individuals and populations of baleen whales as a result of anthropogenic sound sources. Results of masking were presented for singing fin, singing humpback, singing bowhead and calling right whales, where the primary sound source was shipping noise and a secondary consideration was sound from a seismic airgun array. Model results indicated that different species experience very different levels of masking as a result of their species-specific bioacoustical adaptations and behaviours. In addition, the results support the concept of a marine acoustic ecology and the notion that individuals, and thus populations, incur a cost when there are changes to their acoustic habitats.

SC/61/E15 and SC/61/E16 presented information about chronic stress in marine mammals. The physiological stress response is activated immediately upon the perception of a threat by the animal - releasing adrenalin and noradrenalin - and causes numerous physiological and biochemical changes, including increases in heart rate and respiratory changes. Stress (acute and chronic) has been linked to numerous disease states in mammals, including marine mammals. Due to the potential of stress in critically altering life history parameters (e.g. disease susceptibility, reproductive rates, mortality rates), the authors of SC/61/E16 suggested that the Committee highlight research on the importance of chronic stress. A workshop on the cumulative impacts of underwater noise, including chronic stress, will be held later this year (details are listed in SC/61/E15).

SC/61/E19 reported concerns about increases in offshore ambient noise due to commercial shipping that have resulted in the work program of the International Maritime Organization to develop technical guidelines to reduce shipping noise. At frequencies below 300Hz, the underwater noise signature from large vessels will be dominated by propeller cavitation. Based on the distribution of source levels across merchant fleets reported in SC/61/E19, the noisiest 10% of vessels may contribute between around 48% and 88% of the total sea area ensonified by shipping noise. Thus noise reduction targets could most easily be achieved by targeting measures at a relatively small percentage of the noisiest vessels. Reductions in overall ambient noise achieved through quieting the noisiest vessels may also assist whales in avoiding collisions with quieter vessels and thus contribute to a reduction in ship strike mortality.

An intersessional correspondence group under Suydam was established on anthropogenic sound (Q26; Annex K, Item 11.3) to elaborate this agenda item for next year's meeting. The focus will be on the impacts of long-term chronic exposure to high levels of anthropogenic sound, primarily from shipping.

12.5.2 Review available new information on marine renewable energy and cetaceans

Anthropogenic sound (especially from pile driving) associated with the rapid development of offshore wind farms has been discussed in the SWG since 2003. A review of issues associated with sound from renewable energy was provided in 2007 (Dolman *et al.*, 2007) and was the focus of a European workshop (Evans, 2008). The item is retained on the SWG agenda each year as a means to update the Commission on new information.

In SC/61/E6 and SC/61/E7, information was provided on marine renewable energy developments. In addition to wind power generators, wave and tidal (both tidal stream and tidal range) generators are now being developed, tested and installed (SC/61/E6 provides an introduction the range of devices being developed and the technology involved and SC/61/E7 looks at their locations and stage of development including energy capacity and the year that the operation started). As wave and tidal devices are still relatively new, little is known about their potential impact on wildlife. SC/61/E6 identified potential problems including underwater and surface noise, contamination of the local environment, entrapment, entanglement or collision and electrical and electromagnetic disturbance to marine life.

Given the increasingly widespread nature of such developments and the swiftness with which they are now being deployed, the Committee **recommends** that further research should be conducted into the impacts of marine renewable technologies.

12.6 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

13 ECOSYSTEM MODELLING

The ecosystem modelling working group was established in 2007 (IWC, 2008j). It is tasked with informing the Scientific Committee on relevant aspects of the nature and

extent of the ecological relationships between whales and the ecosystems in which they live. This advice is important for the work of several other sub-committees and can span a broad range of issues. These include the physical and biological components of the environment that influence cetacean behaviour, possible consequences for whales of major environmental change such as that driven by climate processes and potential ecological relationships between whales and fisheries activities. The interest of the Commission in such work has been expressed in a number of resolutions (e.g. IWC, 1999a; IWC, 2001b; 2002a). Each year the working group focuses on reviewing progress in the development of relevant ecosystem models as well as reviewing the technical aspects of the input data used in the models. A major additional task at this year's meeting was to review the report from the joint CCAMLR-IWC workshop (SC/61/Rep2) which specifically addressed the prioritisation of research relevant to both CCAMLR and the IWC to improve our ability to understand the relationships between Antarctic krill and their predators (including whales). The report of the Working Group is given as Annex K1.

13.1 Review report from joint CCAMLR-IWC workshop

A joint CCAMLR-IWC Workshop to review input data for Antarctic marine ecosystem models (SC/61/Rep2) was held at the CCAMLR headquarters in Hobart, Australia in August 2008. The workshop reviewed the input data that are currently available for such models in order to understand what is needed to reduce uncertainties and errors in their use.

Overall, the workshop made substantial progress toward providing a standardised approach to the use of data for modelling Southern Ocean ecosystems. The workshop recognised the importance of appropriate, coordinated, long-term data series of key features of the environment and the predators and their prey. It was noted that major parts of the Southern Ocean ecosystem remain poorly defined (e.g. squid, flighted birds, and salps), and understanding the influence of these knowledge gaps on ecosystem models that focus on the more data-rich components remains a challenge. Improvements in parameterisation in CCAMLR and IWC models, which were in part facilitated by the workshop, are expected to inform ecological relationships between whales, their prey, their predators and other parts of their ecosystem, as well as informing models for the sustainable management of krill.

The Committee welcomed this report and **endorses** the workshop recommendations. It thanked the Joint Steering Group, the participants in the expert groups, the CCAMLR Secretariat for hosting the meeting and the IWC Secretariat for assisting with the coordination of the meeting and in the production of the report.

A key outcome of the workshop was a recommendation that the expert groups should complete their work. The Committee **recommends** that these papers should be published as soon as possible - and where practical by the 2010 Annual Meeting.

13.2 Review of progress in the development of ecosystem models

Four closely related papers dealing with cetacean *vs* fisheries interactions in the Caribbean and Northwest African ecosystems (Gerber *et al.*, 2009; Morissette *et al.*, 2009a; Morissette *et al.*, 2009b; Morissette *et al.*, 2009c) were presented. Under the wide range of uncertainty assumptions, the authors noted that model results consistently indicated that: (1) cetaceans consume less than fisheries take and are feeding on different prey species; (2) the overlap between cetaceans and fisheries is lower than in other areas; (3) the overall trophic impact of cetaceans is minimal compared to that of fisheries; and (4) the simulated eradication of baleen whales in both ecosystems did not lead to any appreciable increase of commercial fish biomass.

In discussion, some concerns were raised about the assumptions made on the input data; in particular, the scaling down from global models of cetacean distribution and densities to more local scales, lack of ground truthing of these estimates and assumptions on homogeneity of spatial feeding patters. The authors acknowledged that it has been necessary to make a wide range of assumptions, but that extensive sensitivity analyses had been conducted using simulations within the models, and that the results were robust to these uncertainties. They further noted that, while the cetacean component of the model lacks local data, other parts of the model are based appropriately scaled local data. The Committee **agrees** that it was difficult to fully evaluate the outcome of the models as some critical components of model parameterisation were not available in the presented papers. The authors agreed to incorporate these details in the papers as they were submitted for publication. The Committee noted that the papers presented represented a substantial body of work and looked forward to further developments in this area. Such discussions make an important contribution to ecological modelling work involving cetaceans.

Corkeron (2008) compared two sets of modelling approaches applied to the North Atlantic; one which examined interactions between three fish species and common minke whales (Schweder, 2006; Schweder *et al.*, 1998; Schweder *et al.*, 2000) and another which focused on interactions within and between the three fish populations, fisheries and climate. The first models resulted in unrealistic model outputs when harp seals were added (Aldrin and Schweder, 2005) while the second modelled key processes of the system successfully (Cury *et al.*, 2008; Hjermann *et al.*, 2007; Hjermann *et al.*, 2004a; Hjermann *et al.*, 2004b; 2004c). The paper concluded that current problems with models with a cetacean-focused top-down approach, and the slow development of models derived from lethal sampling programmes, could be resolved by applying new, broader modelling frameworks that include bottom-up processes. In discussion, the Committee was informed that the NAMMCO Scientific Committee proposed applying and comparing four different modelling approaches in the Northeast Atlantic, including the work of Hjermann and Morissette.

Corkeron (2009) questioned the use of lethally acquired fore-stomach samples, coupled with acoustic and trawl

surveys for prey, as an unsophisticated and inefficient approach to investigating the foraging ecology of *Balaenoptera* spp. The paper contended that non-lethal foraging ecology studies, using far fewer resources, and producing more definitive information on the ecosystem role of baleen whales, were more appropriate. In discussion, there was a range of views of the relevance of whale stomach content analysis for ecosystem models, including questions of the degree to which particular models are sensitive to this input and their importance in estimated functional feeding responses. There were also a range of views on issues of interpretation and ground-truthing foraging data acquired from non-lethal telemetry and data-logging methods. There were some suggestions that stomach content data could be used for this. It was noted that NAMMCO has recommended studies to compare non-lethal chemical methods for examining diet with stomach contents data (see also the discussion under Item 17.1.1).

13.3 Review of data relevant to parameter estimation and ecological interactions

SC/61/JR2 presented a re-calculation of different models used to estimate whale consumption rates that were presented at the expert panel review of JARPN II (IWC/61/Rep1). Daily consumption estimates derived from different models varied widely: mature female common minke (45-148kg), sei (102-491kg) and Bryde's whales (132-577 kg). In discussion, a number of computational and methodological concerns were raised with these estimates, in particular, it was noted that the estimated variances of the consumption estimates were considerably lower than the variances of the abundance estimates, some average daily consumption estimates were unrealistically high, and difficulties of uncertainty associated with spatial and seasonal extrapolations of consumption. The author noted the limited time available to undertake these re-calculations and agreed to provide a further analysis at next year's meeting. The issue of whether or not there was a need for additional stomach content samples to resolve uncertainties in consumption estimates was also discussed. The Committee **agrees** that until the computational issues are resolved it is not in a position to consider the estimates presented in SC/61/JR2.

It was noted that issues of sample size and uncertainty are common to both lethal and non-lethal techniques and there is a need for all types of methodologies to examine the benefits of increasing sample sizes in terms of reducing the variance of final estimates.

13.4 Review of other papers

SC/61/EM1 uses Bayesian estimates of mutation rate and coalescence times among loci, to estimate the long-term population size of Antarctic minke whales prior to whaling to be 670,000 individuals (95% CI: 374,000-1,150,000). The authors concluded that competitive release, assumed by the krill-surplus hypothesis, is not necessary to explain the current abundance of Antarctic minke whales and that the use of stock assessment, modelling, and genetic data could be a powerful way to test alternative hypotheses and improve biological plausibility of model outputs. In discussion, it was noted that some estimates of scale of increase of Antarctic minke whales had not been corrected for detection probability, and that this might explain some apparent inconsistencies with SC/61/EM1 where estimate range could then cover the increase in minke whale abundance suggested by recent population modelling studies (Mori and Butterworth, 2006a; Mori and Butterworth, 2006b). The Committee **agrees** that some caution is needed in using genetic methods to make inferences on absolute numbers, but that there was scope for integration of genetic studies, population and ecosystem models and such studies were encouraged. It was noted that the Working Group on Stock Definition is developing draft guidelines for appropriate analysis and interpretation of genetically determined long term population size estimates and will discuss this at next years meeting.

13.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

14 SMALL CETACEANS

The Committee has been discussing issues related to small cetaceans since the mid-1970s (IWC, 1976). Despite the differences of views over competency (IWC, 1993a), the Commission has agreed that the Committee should continue to consider this item (IWC, 1995d). The report of the sub-committee on small cetaceans is given as Annex L.

14.1 Review taxonomy, population structure and status of common dolphins

The priority topic for the Committee this year was the review of the taxonomy, population structure and status of common dolphins. Currently, the genus *Delphinus* comprises two species and four subspecies: the short-beaked common dolphin *Delphinus delphis delphis*, distributed in continental shelf and pelagic waters of the Atlantic and Pacific Oceans, the Black Sea short-beaked common dolphin, *D. delphis ponticus*, Gray's common dolphin (long-beaked form), *D. capensis capensis*, distributed in nearshore tropical and temperate waters of the Pacific and South Atlantic Oceans, and the Indian long-beaked common dolphin, *D. capensis tropicalis,* which occurs in the Indian Ocean.

14.1.1 Taxonomy

Natoli *et al.* (2006) assessed genetic diversity over a broad geographic range, including among long- and short-beaked morphotypes, and tested alternative hypotheses about the relationship between geographic distance, morphotype and population genetic structure using 9 microsatellite loci. The primary interpretations were that: population structure exists in the Atlantic on a relatively broad geographic scale; (2) the long-beaked and short-beaked morphotypes were not supported as reciprocally monophyletic lineages; and (3) it appeared as though the morphotype could result from local selection, independent of phylogenetic background within the broader *Delphinus* lineage.

SC/61/SM11 revisited the worldwide phylogeography using sequences of the mtDNA cytochrome *b* gene. The study included 279 samples from the Atlantic, Pacific and Indian Oceans, including populations described as short-

beaked, long-beaked and the very long-beaked '*tropicalis*' form. Individuals were grouped into putative populations according to their morphology and geographic origin. Nucleotide and haplotype diversity values were high for most putative populations. There was significant genetic differentiation between most putative populations, with the long-beaked population from the NE Pacific and the '*tropicalis*' population from the Indian Ocean being the most differentiated.

Despite this differentiation, the resulting haplotype network indicated the existence of four genetic clusters that do not correspond to taxonomy or geographical origin of the individuals. Therefore, common dolphins may constitute one widely distributed 'super-species', with some differentiated, locally adapted populations perhaps in the process of speciation. Preliminary results with microsatellite DNA markers also seem to support the existence of differentiated populations in the different oceans. This study further illustrates the difficulties of delineating taxonomic units in common dolphins using a genealogical perspective, because processes such as incomplete lineage sorting and hybridisation may be confounding population history.

A new paradigm may be needed, perhaps along the lines suggested in SC/61/SM11 that common dolphins represent a single, widely distributed 'super-species', with numerous partially isolated populations, some of which exhibit a high degree of local adaptation and may be in the process of speciation. The Committee **agrees** that the existing morphological 'bins' are not supported by genetic 'binning'. It was emphasised that in referring to the various morphological types, care should be taken to avoid expressions such as 'Northwest Pacific *capensis*-type' and instead the various populations should be denoted in less committal terms such as 'long-beaked form in the North west Pacific' and the Committee has attempted to do (also in Annex L).

The Committee also **agrees** that the single-gene approach is inadequate for resolving species of *Delphinus*. The next level should be to investigate the processes that have led to the observed global patterns of morphology and phylogeography of common dolphins. This will require additional especially nuclear markers. The Committee thanked the authors for bringing this paper to the meeting, and **encourages** the continuation of this work to further elucidate the taxonomic issues.

14.1.2 Population structure

A number of papers were received dealing with population structure and were discussed on a regional basis. Only short summaries are given here. Detailed results and discussions can be found in Annex L.

Pacific Ocean

NORTH PACIFIC

Chivers *et al.* (2008) presented genetic evidence for population structure of short-beaked common dolphins in the eastern North Pacific (ENP), currently managed in U.S. waters as a single stock referred to as the CA/OR/WA stock that includes all animals off California, Oregon and Washington out to 300 n.miles from shore. Additional genetic analysis suggests at least four demographically isolated populations (DIPs) within the CA/OR/WA, each apparently adapted to particular ocean conditions. The Committee noted stock boundary revisions will be needed to improve conservation and management for this form in the ENP.

Hoelzel reported preliminary results of analyses on a finer geographic scale in the Gulf of California (GC) and along the Pacific coast of Baja California and southern California. An initial analysis showed differentiation between the short-beaked and long-beaked forms. However, there was also differentiation across the Baja California peninsula, and among northern and southern samples both along the outer coast and within the GC. Furthermore, this held for comparisons both within and between the putative species.

SOUTH PACIFIC

Population structure was also detected in common dolphins from New Zealand (SC/61/SM20). A comparison of New Zealand animals with eight different populations including long- and short-beaked morphotypes found that the NZ animals exhibited high genetic variability (gene diversity = 0.991, nucleotide diversity = 0.018). In total, 65 haplotypes were identified, three of which were shared with short-beaked forms from the eastern North Atlantic, Argentina and the North Pacific. An additional three haplotypes were shared with long-beaked forms in the North Pacific and South Africa. The NZ animals showed significant genetic differentiation when compared with all others except short-beaked animals in the North Pacific. Intrapopulation structure between regions in New Zealand; coastal, Hauraki Gulf and oceanic was also detected, but only between Hauraki Gulf individuals and the other putative populations, and not between coastal and oceanic groups (Stockin *et al.*, 2008). The Committee **encourages** continued analysis in this area, using nuclear markers.

Population structure in common dolphins was also detected within Australian waters. Bilgmann *et al.* (2008) found significant differentiation between the animals in South Australia (eastern Great Australian Bight and Spencer Gulf) and those in southeastern Tasmania. No significant differentiation was found within South Australia. Common dolphins occur along the Australian coast to the east and north of the sampling area and the Committee **encourages** the authors to extend their sampling programme into waters along the coast of Victoria.

CONCLUSION

In general, on-going analyses suggest more population structure in the Pacific Ocean than previously recognised, which may lead to a re-evaluation of stock boundaries with potential conservation implications. However, genetic analyses are absent from other regions, and it is suggested that this work be prioritised, especially in areas where there is known bycatch, to help with the assessment of status and the evaluation of impact of bycatch.

Atlantic Ocean

MEDITERRANEAN AND BLACK SEA

The study by Natoli *et al.* (2008) showed genetic differentiation between the eastern and western sites within the Mediterranean using microsatellites, and for

mtDNA, also between the Alboran Sea and sites in Portugal and Galicia. A coalescent method indicated a comparatively low rate of migration between the Mediterranean and the Black Sea, although the Black Sea sample was small. Major results from this analysis showed (a) the existence of fine-scaled structure between the eastern and western basins within the Mediterranean Sea and (b) a need for further sampling and study to assess the possibility of further structure in the central portion of the Sea.

NORTH ATLANTIC

Mirimin *et al.* (2009) examined population structure in the North Atlantic and detected structure in short-beaked common dolphins between the two main regions (wNA and eNA) suggesting at least two genetically distinct populations in this ocean basin. Results from this study support the hypothesis of a single stock in the waters off the south-western coast of Ireland/western English Channel and a single stock off the US Atlantic coast. However, the authors noted that due to the opportunistic nature of sampling, and the fact that large parts of the known range in the North Atlantic remain unsampled, including along the mid-Atlantic ridge, other genetically distinct populations may exist.

SC/61/SM27 provided results of a follow-on study examining population structure in the NE Atlantic; no significant genetic structure was found among all sampled areas. Although the study included a large dataset of 152 individuals, the high levels of genetic variability found at both nuclear and mtDNA control region markers suggest that larger sample sizes are required to obtain more realistic population-wide estimates of gene frequencies. The authors concluded that as more samples are collected each year, genetic structure should be re-assessed using the larger dataset and testing different classes of markers.

Freitas presented preliminary results from genetic data analyses for common dolphins from the Azores and Madeira. Mitochondrial and nuclear DNA revealed no genetic structure between the archipelagos, between groups of islands or in relation to habitat features. Tests for sex-biased dispersal did not support the hypothesis of higher gene flow in males than females.

Hoelzel presented preliminary results of an ongoing investigation of putative populations along the coast of Portugal. The results of analysis using neutral microsatellite DNA loci were compared to results obtained using markers potentially linked to loci under selection. A matrix incorporating Fst values based on the 'neutral' loci (n=11) was compared with results from analysis using the 'selected' loci (n=4) and only the latter showed significant signs of population structure, suggesting structure within animals inhabiting Portuguese waters. Although recognising that the results were preliminary, the Committee **encourages** that this work continue and that these loci are used in wider scale geographic analysis in order to improve understanding of population structure in the NE Atlantic.

The use of ecological tracers (stomach content data, fatty acid composition of blubber, carbon and nitrogen isotopic ratios in muscle, cadmium in liver, and cadmium in kidney) to determine structure in the NE Atlantic was examined in SC/61/SM33. From these indicators, and particularly from those tracers with an integration time of close to a lifetime (cadmium in kidney), it was hypothesised that animals from oceanic habitats, animals from northern neritic habitats (north of the English Channel) and animals from southern neritic habitats (south of the Channel) could be considered as fairly distinct demographic sub-units, although in discussion questions were raised about the sample size and some of the suggested links presented in the analysis. It was also noted that it might be helpful if a suite of organic contaminants had been included in the array of ecological tracers investigated in this study.

CONCLUSION

In general discussion, the lack of sampling in offshore areas was noted, especially further north along the mid-Atlantic ridge and, the Committee **agrees** that there is a need for studies that incorporate animals from offshore (i.e. off-shelf) waters (e.g. via biopsy sampling there) and for further analyses using additional genetic markers.

Overall conclusion

No additional information was presented to the Committee in relation to stock structure. Notwithstanding the complexity in taxonomy, it was noted that within the Pacific, stock structure appears to be complex, with evidence of population separation over relatively small areas in the NE Pacific and elsewhere, possibly requiring a reassessment of stocks. In contrast, in the North Atlantic, apart from differences detected between the Black Sea and Mediterranean, within the Mediterranean, and between the western North Atlantic and eastern North Atlantic, little or no genetic differentiation has been detected over large geographical areas on either side of the North Atlantic. The Committee noted that lack of detection of genetic structure does not necessarily mean that structure does not exist and it **encourages** additional sampling in areas that have not previously been sampled, in addition to the use of additional markers, including the use of markers not under selection and ecological markers.

14.1.3 Abundance and distribution

Information on abundance and distribution was presented in a number of papers and the results on abundance estimates are summarised in Table 1 of Annex L.

Atlantic Ocean

NORTHEAST ATLANTIC

A number of surveys have been have been carried out in the northeast Atlantic to estimate abundance of cetaceans. These surveys were carried out at different spatial and temporal scales and the published estimates are briefly discussed here, with more detail given on new estimates. The abundance estimate for common dolphins during the major SCANS II survey, carried out over the continental waters in July 2005 was about 64,400 (CV of 0.46). The majority of common dolphins was sighted around the coasts of Spain, Portugal and France, in the Celtic Sea and off the west coast of Ireland. SC/61/SM6 provided information on abundance and distribution of common dolphins generated during the follow up CODA survey in July 2007 that encompassed an area from northern Spain to northern Scotland, in the deeper waters off the

continental shelf, approximately 200n.miles from the coast. Abundance was calculated for both common and common/striped dolphins combined using design-based methodology as well as density surface modelling. For common dolphins alone the abundance estimate for the model-based method was some 116,700 (CV 33.7%) and for common and striped dolphins, combined, it was some 259,600 (CV 36.9%). Common dolphins showed a clear preference for the Bay of Biscay. Combining the CODA estimates with the SCANS II estimates results in an overall estimate of about 185,200 (CV 27.2%) common dolphins (estimate of SCANS based on design-based estimate and CODA on model-based estimate). The Committee **welcomes** this work and also **encourages** a re-analysis of the combined SCANS II and CODA data, using density surface modelling.

Cañadas *et al.* (2004) highlighted the issue of vessel attraction by common dolphins. Using data collected during a double-platform, line transect cetacean survey in the NE Atlantic in 1995 (the NASS survey). They found a strong indication that animals were attracted to the vessel; $g(0)$, the probability that animals on the trackline are seen, was estimated to be 0.796. Density estimates obtained under the assumption that no responsive movement occurred were some six times higher than when it was taken into account. Cañadas *et al.* (2009) used further data to examine the distribution of common dolphins in the NE Atlantic. In a preliminary analysis, the different data sources were combined in a spatial modelling approach including latitude, longitude and depth as explanatory variables. The resulting distribution map showed a gap of common dolphin occurrence on the Mid-Atlantic ridge, which is probably due to poor coverage of this area.

A summary of information on common dolphins in Norwegian waters was also presented (SC/61/SM9). During dedicated surveys conducted since the 1980s, no confirmed sightings of common dolphins have been made and this species can be considered rare in Norwegian waters although strandings and bycatches have been reported along the Norwegian coast. The most northerly sighting was at 72ºN. Although SCANS II found no common dolphins in the North Sea, the Norwegian database included some incidental sightings in the North Sea, indicating occasional or seasonal influxes.

Information on occurrence and relative abundance of common dolphins at three sites along the Portuguese coast was presented in SC/61SM16. Common dolphins were the most commonly sighted species and large groups aggregate along submarine canyons. It was suggested that great depths near shore are suitable habitats for more pelagic species such as common dolphins. More surveys are planned for the coming years.

SC/61/SM35 presented information on the distribution of short-beaked common dolphins observed during the 2007 T-NASS (Trans North Atlantic Sightings Surveys) aerial and vessel surveys. The principle aim of the T-NASS project was to estimate the abundance of cetaceans in the Northern North Atlantic from survey data collected during the summer 2007. The surveys were co-ordinated with the European CODA and the American SNESSA surveys. Off Canada, the distribution of common dolphins ranged from about 56.9° to 42.4°N, being most frequently sighted on the Scotian Shelf and off southern Newfoundland. Most sightings occurred in the mid- and outer-shelf areas, rather than nearshore. Abundance estimates were about 580 for the Newfoundland survey strata and 53,000 for the Scotian shelf strata, resulting in a total uncorrected estimate of some 53,600 (95% CI 35,200 – 81,800) animals. In the northeast Atlantic part of the survey area, where survey conditions were generally poor, common dolphins were not observed by dedicated surveys, even in areas where they had previously been seen (e.g. NASS surveys). It was not possible to derive an abundance estimate from this part of the survey area.

A review of sightings data spanning years from 1963 to 2007, conducted during an ASCOBANS/HELCOM workshop, suggests that common dolphins are distributed all across the NE Atlantic to the mid-Atlantic ridge (Evans and Teilmann, 2009). There is some suggestion of a hiatus between 30-40°W but this may reflect a lack of survey effort in this area. A summary of current knowledge on distribution and habitat preferences of short-beaked common dolphins in the Azores was presented by Silva, with additional information presented in SC/61/SM8. The short-beaked form was present in the Azores year-round, and showed a different spatial distribution to the Atlantic spotted dolphin. Sighting rates were lower in summer than during the rest of the year.

There is some evidence of seasonal movements of common dolphins in the NE Atlantic, with an increase in density of common dolphins in the Celtic Sea, and the western English Channel in the winter (Brereton *et al.*, 2005; De Boer *et al.*, 2008). In contrast, Kiska *et al.* (2007) reported larger aggregations of common dolphins in the northern Bay of Biscay in the summer, when compared to the western English Channel. In Maderia, information on common dolphin distribution and occurrence from shipboard and aerial surveys, opportunistic sightings and stranding records between 2001-2008 showed a clear seasonal pattern in common dolphin occurrence, with the highest densities in winter and spring (SC/61/SM29). Such seasonal shifts may be associated with changes in feeding opportunities.

In general, it was noted that winter surveys were less frequent than summer surveys in the areas of the NE Atlantic, including the Mediterranean, where seasonal movement occurs, and that there appears to be inter-annual variation in movements, possibly related to water circulation patterns and/or shifts in prey distribution.

MEDITERRANEAN

Dolphins in the Mediterranean remain relatively abundant only in the westernmost portion of the basin (Alborán Sea), with sparse sightings records off Algeria and Tunisia, concentrations around the Maltese islands and in parts of the Aegean Sea, and relict groups in the south-eastern Tyrrhenian and eastern Ionian Seas (Bearzi *et al.*, 2003). Otherwise, they are rare or completely absent from Mediterranean areas where information is available. Cañadas and Hammond (2008) presented information on the abundance and habitat preferences of common dolphins in the southwestern Mediterranean. The point estimate of abundance was around 19,400 (95% CI =

15,300 to 22,800). Average density was higher in summer than in winter, and higher in the Western Alborán Sea than in the eastern Gulf of Vera. It was also found that groups with calves and feeding groups preferred more coastal waters, a result that could have important implications for the development of conservation measures for common dolphins in the Mediterranean.

Given current knowledge of population structure, the high numbers of bycatch in previously unsurveyed waters and the concern about the status of common dolphins in the Mediterranean, the Committee **re-iterates** its recommendation in support of a basin-wide survey (Cañadas *et al.*, 2006; Cañadas *et al.*, 2008) that planning and implementation proceed as quickly as possible and that a survey be carried out to estimate abundance of common dolphins in this region.

WESTERN ATLANTIC

Population estimates for the short-beaked form in western North Atlantic are around 121,000 (CV 0.23). Large schools are often seen in waters between 100-2,000m depth. There is a seasonal shift in their distribution being more northern in the summertime and more southern in the winter. Strandings have been reported year round on Cape Cod (SC/61/SM12).

No vessel reactions were documented for common dolphins in this area and thus no correction factor were applied, in contrast to the NE Atlantic. Potential reasons for this lack in observed reaction could be the use of high-powered binoculars (although the same were used in SCANS II & CODA), the survey vessel used, or a general difference in behavioural response. Given the bias in abundance associated with not correcting for responsive movement, the Committee **recommends** that earlier surveys should be examined for this where the data are available and appropriate data should be collected in all areas where surveys are being routinely carried out.

Information on the distribution of common dolphins in the western Atlantic Ocean was presented in Jefferson *et al.* (2009). There were no valid records in the Gulf of Mexico. All valid records in the Caribbean were in shallow (<120m) depths along the coast of Venezuela, suggesting a distributional hiatus with the MW Atlantic. Four putative stocks were proposed: South Brazil Bight Stock (most likely long-beaked form), Brazil-Argentina Stock (most likely short-beaked), Venezuelan Stock (long-beaked form, isolated, past hunting pressure) and Western North Atlantic Stock (short-beaked form). These results are different from what has been the commonly accepted distribution for this genus in the Atlantic. Most areas of distribution coincide with moderate to strong upwelling and common dolphins appear to avoid warm, tropical waters. As the presented paper highlighted, large areas in the western Atlantic Ocean have not been subject to dedicated survey effort. The Committee **recommends** that marine surveys being carried out in this region include small cetacean data collection, to better understand distribution and that attempts be made to obtain abundance estimates.

Tavares *et al.* (2009) presented information on biogeography of common dolphins in the southwestern Atlantic Ocean. Distributional patterns closely associated with areas of high productivity led the authors to suggest at least three stocks in the southwestern Atlantic: one in northern Brazil and two others from southeastern Brazil to central Argentina. Both short and long-beaked forms occur in this area. Information on abundance and distribution of common dolphins, *Delphinus* spp., off northeastern Venezuela was presented in SC/61/SM2. Common dolphins are widely distributed over the entire northeastern basin. Areas of higher densities for *Delphinus* spp. are located on the northeastern coast, which coincides with the focal location of sardine fisheries and the most active upwelling in the areas.

Given the likelihood (based on our current knowledge of distribution patterns) of there being some stock structure in this large region, the Committee **recommends** that work to better inform our understanding of population structure be carried out in this large geographical region, including southern Brazil.

SOUTH AFRICA

SC/61/SM33 presented an assessment of the abundance of long-beaked common dolphins over the continental shelf south of South Africa based on sightings made during a Bryde's whale aerial survey in December 1982 and ship-based survey in January/February 1983, using standard line transect methodology. However, the fact that the aerial survey included tracks parallel to the coast and the extremely small sample sizes raise doubts about the estimates presented.

Pacific Ocean

NORTHEAST PACIFIC

Carretta *et al*. (2008) summarise the most recent estimates of abundance for the short-beaked form of common dolphin off California, Oregon and Washington (USA). The distribution of short-beaked common dolphins throughout this region appears to be variable, due in part to seasonal and inter-annual oceanographic changes. The most recent multi-year average abundance estimate (2001-2005) is some 393,000 (CV=0.18). Carretta *et al*. (2008) also summarises the most recent estimates of abundance for the long-beaked form of common dolphins off California (USA). Since the distribution and abundance of long-beaked common dolphins off California seemingly varies seasonally and inter-annually, a multi-year abundance estimate, based on two ship surveys conducted in 2001 and 2005, is some 15,300 (CV=0.56).

SOUTHWEST PACIFIC

There have been no systematic surveys to address distribution or abundance of common dolphins within New Zealand waters (SC/61/SM20). They occur around much of North Island but sightings in the South Island are limited. While common dolphins have been observed in the Marlborough Sounds and off Westport and Jackson Bay on the west coast, the southerly distribution along the east coast of the South Island appears mostly limited to Banks Peninsula. Common dolphins are also known to strand on the Chatham Islands and are assumed to occur in the Tasman Sea between New Zealand and Australia. Occurrence in coastal waters is considered seasonal in many regions, the exceptions being Hauraki Gulf (north east coast of NI) and off Wellington (southern coast of

NI). In these two regions, common dolphins occur inshore year round.

Conclusion
Large parts of the range of common dolphins have not been covered by surveys and thus abundance estimates are limited (see Table 1). The Committee **recommends** that further studies be conducted at regional and local scales to better quantify abundance and distribution. Quantification of abundance in areas where there is concern over the status of the species (e.g. Mediterranean) or where levels of bycatch are known to be high (e.g. Peru, Korea) should be prioritised. In addition, surveys to better elucidate distribution (and abundance) should be carried out in the southwestern Atlantic and southwestern Pacific, where gaps in distribution have been noted and in the mid-Atlantic, to establish if there is a continuous distribution of this species across the North Atlantic.

14.1.4 Life history
A number of papers dealing with life-history were presented. Dabin *et al.* (2008) found that the numbers of *corpora albicantia* did not increase with age after sexual maturity is reached, suggesting that ovarian scars are not persistent or that their number at any one time results from the ovulation rate and from a healing or regression rate operating concomitantly. The authors consider that these results limit the potential for reconstructing individual reproductive lifetime history in the common dolphin. In discussion, it was noted that additional study should include histological examination, to better examine this issue.

The Committee received a number of papers (SC/61/SM5; SC/61/SM12; (Dabin *et al.*, 2008; Murphy *et al.*, 2009b) on life history parameters for the short-beaked form in the North Atlantic. The results can be summarised as follows: 8-9 years for the average age at attainment of sexual maturity in females; 25-33% for the annual pregnancy rate; 3.8 years calving interval; 363 days gestation period; 93cm average length at birth peak month of conception July with suggestion of reproductive seasonality. Details can be found in Annex L.

The Committee noted the importance of strandings and bycatch schemes in obtaining biological information for small cetaceans, including samples useful for stock structure studies. The Committee **encourages** the continuation of existing strandings and bycatch monitoring programmes that incorporate standardised protocols and **recommends** further colloboration in the establishment of new programmes.

A study to examine the effect of contaminants on reproduction of female common dolphins in the eastern North Atlantic (Pierce *et al.*, 2008) suggested that 40% of the animals examined were above a threshold for adverse effects on the immune system and reproduction in other mammals. However additional analyses on a 'control group' Murphy *et al.* (2009a) suggested that the apparently high contaminant burdens were not inhibiting ovulation, conception or implantation in female common dolphins although the potential effects on foetal survival require further investigation. It also appears that some females may go through a large number of infertile ovulations prior to a successful pregnancy and that although there were non-breeding (ovulating) females in the population, almost all females eventually become pregnant.

14.1.5 Ecology
Little is known about the ecology of western North Atlantic short-beaked common dolphins (SC/61/SM12). The highly significant male bias observed in the sex ratios of the biopsy, stranding and bycatch sample sets (Westgate, 2005) suggests that *Delphinus* display spatial sexual segregation. This was also noted for the NE Atlantic. Seasonal changes in the distribution of western North Atlantic short-beaked common dolphins may be related to changes in the abundance or distribution of their prey but to date little is known about their feeding ecology.

Information on the diet and feeding ecology of the short-beaked common dolphin in the northeast Atlantic was presented in SC/61/SM14. Stomach content analysis (n = 129) revealed that the short-beaked form in this area targets relatively small-sized shoaling fish. (31 fish and 15 cephalopod species were found with fish being numerically the most important prey group (95%)). Differences in prey composition were seen when comparing dolphins from the neritic area, with those bycaught offshore. Information on milk in stomachs suggested that weaning occurs between 3 and 6 months.

Bearzi *et al.* (2003) summarised the sparse information available on feeding ecology of common dolphins in the Mediterranean basin, where they are found in both neritic and pelagic habitat. The diet is diverse but small, shoaling fish (anchovies, sardines and sauries) form an important component. Some data point to prey depletion as the reason for the depletion of common dolphins in the Mediterranean but it is also possible that the distribution of the common dolphin has changed and that animals have moved to the southern part of the Mediterranean.

Stomach contents analysis (n = 53) suggest that the diet of common dolphins in New Zealand comprised a diverse range of fish and cephalopod species, the most prevalent prey identified included arrow squid, jack mackerel and anchovy (SC/61/SM20). The prey composition suggested likely inshore/offshore movements on a diel basis. The Hauraki Gulf was identified as an important feeding area for New Zealand common dolphins. There was some discussion on the impact of vessels on the behaviour of the animal and further studies are **encourages** in this regard.

14.1.6 Habitat degradation
SC/61/SM12 lists potential threats to the habitat of short-beaked common dolphins in the western North Atlantic. Potential threats to habitat include pollution, halogenated contaminants and anthropogenic noise; however, none of these threats have been directly quantified with respect to western North Atlantic short-beaked dolphins. These animals spend considerable time in the waters adjacent to the Gulf Stream. Changes in ocean circulation patterns brought on by global climate change may have impacts on the ecology of western North Atlantic pelagic dolphins including short-beaked dolphins.

Trace elements, polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticide levels were recently examined in tissues collected from stranded and bycaught common dolphins from New Zealand waters (SC/61/SM20, Stockin *et al.* 2007). Organochlorine pesticides dieldrin, hexachlorobenzene (HCB), *o,p'*-DDT and *p,p'*-DDE were present in high concentrations. The mean transmission of ∑DDTs and ICES seven chlorinated biphenyls congeners (ICES 7CBs) between a genetically determined mother-offspring pair was calculated at 46% and 42%, respectively. Concentrations of organochlorine pesticides determined in Stockin *et al.* (2007b) were within similar range to those previously reported for Hector's and bottlenose dolphins from New Zealand waters (Jones *et al.*, 1999).

Common dolphins are the focus of several commercial tour-boats, operating within the North Island of New Zealand, with at least 13 permits currently targeting *Delphinus* in the Bay of Islands, Hauraki Gulf and Bay of Plenty regions (SC61/SM20). During a recent impact assessment in the Hauraki Gulf, foraging and resting bouts were significantly disrupted by boat interactions to a level that raises concern about the sustainability of this impact (Stockin *et al.*, 2007a). Impacts identified were similar to those previously reported (e.g. Lusseau, 2003) for bottlenose dolphins.

14.1.7 Directed takes

Directed takes do not seem to be a general threat to common dolphins. A more serious threat is that of bycatch (see Item 6.7 below).

The Committee recalled the information on large and potentially unsustainable catches of common dolphins off Peru noted in last year's report (IWC, 2009m, p.323). Those catches, both directed and incidental, have continued for many years and there have been no abundance estimates for that region.

Historical sources indicate that common dolphins, locally known as *'toninhas'*, were observed and captured in large numbers along the Portuguese mainland coast during the late 19th and 20th centuries (SC/61/SM17) and Angola in the 20th century (SC/61/SM18). Between 1976 and 1978, research directed at quantifying the numbers of cetaceans in fish markets along the Portuguese shore was conducted and resulted in a total count of 45 cetaceans, most of them small cetaceans (87% short-beaked form of common dolphins).

National fishing books from Angola were consulted in the National Institute of Statistics in Lisbon and data, between 1940 and 1969 was obtained. A total of 25 tons of *'toninhas'* was reported, probably representing between 320 and 650 individuals. Although there is uncertainty about species identification, as several small dolphins occur off Angola, it is evident that a fishing effort focused on small cetaceans occurred in the region. In discussion, the Committee noted the difficulty in determining whether the animals were targets of the fishery or were bycaught, and the difficulty of species identification.

SC/61/SM20 provided an overview of common dolphins previously held in captivity in New Zealand. During the past 44 years, Marineland has held a total of 41 common dolphins, including two stranded individuals, one captive-born and several captured individuals from the Hawkes Bay region. No dolphins are currently held by Marineland and recent proposals by Marineland to capture common dolphins from the wild have not been approved.

14.1.8 Incidental takes

A number of papers presented information on bycatch. An annual observer-based estimate from 2001–2003 in a Spanish demersal pair trawl fishery (targeting blue whiting, and secondarily, mackerel, hake and horse mackerel) was 327 common dolphins (SC/61/SM30). Most capture events involved only one or two individuals, although there were a few isolated capture events that involved up to fifteen individuals.

The EU funded project 'Petracet' (Northridge *et al.*, 2005) aimed to monitor about 5% of annual fishing effort among the main French, Irish, UK, Danish and Dutch pelagic trawl fisheries operating in the Celtic Seas and Bay of Biscay region. Dolphin bycatch was estimated in the pelagic fisheries monitored at around 622 (489 in the bass and 133 in the albacore tuna fishery) animals per year; 96% of these were common dolphins. Other fisheries that were observed were for anchovy, horse mackerel and mackerel. No cetaceans were observed in any of those but it is clear from previous studies that some bycatch might be expected in at least the horse mackerel and mackerel fisheries (Couperus, 1997; Morizur *et al.*, 1996).

Since 2004 EU members states have been obliged to monitor 10% of winter fishing effort (December to March) for pelagic trawling in EU Atlantic waters, and 5% during the rest of the year. More recent observations suggest a possible decline in bycatch rate in the bass and tuna pelagic trawl fisheries. Observations in the French pair trawl fisheries in 2007 included 13 common dolphins caught in 240 observed tows in the bass fishery (some of which may have used bycatch mitigation measures, which complicates interpretation), compared with 75 common dolphins in 285 observed tows in 2003/4, leading to an estimate of 165-243 common dolphins in this fishery in 2007.

In the UK bass pair trawl fishery bycatches peaked at 439 animals (95% CI 379-512) in the winter of 2003/2004 and declined to 84 in 2005/6. Since that season effort has been low, and since December 2006 the majority of tows have been made with acoustic deterrent devices deployed. Despite limited sample size, data collected between December 2006 and December 2008 suggests both no obvious decline in the underlying bycatch rate, and that the acoustic deterrent devices are effective (SC/61/SM37). However, more observations will be needed to quantify the extent of this effect.

Common dolphin bycatch is also known to occur, especially in the winter months, in several other UK fisheries, notably those involving large meshed static nets. Between 2005 and 2008, over 3,000 such UK-based operations have been monitored in the Irish Sea, Celtic Sea and English Channel. A combined estimate from these data yields a provisional total bycatch figure for 2008 of 594 common dolphins (CI: 22-797). The observed bycatch

rate from year to year warrants further investigation, as does the spatial distribution of the bycatch.

The Committee discussed the possibility of extrapolating the bycatch estimates to fisheries taking place in all regions. Although there have been some improvements, it is still difficult to obtain a complete compilation of fishing effort. It was also highlighted that the pelagic trawl fishery is not the only concern. As noted above, the static net fleet also has bycatches of common dolphins (and see SC/61/ProgRepFrance); a focused attention on the set net fishery would be advisable.

SC/61/SM5 presented information on the short-beaked common dolphin in Galicia, NW Spain. Between 1990 and 2007, 1,747 common dolphins stranded along the Galician coastline of which 606 were considered to be 'fresh' enough to see evidence of fisheries interactions. Of these, 41% of the animals (93 females and 153 males) showed evidence of fisheries interactions (CEMMA, unpublished data). The authors noted that common dolphin and fisheries interactions in Galicia appear to greatly exceed the maximum allowable limits recommended by ASCOBANS and the IWC and are most probably unsustainable. However, the Committee noted that gaps in our knowledge of this population and the need for more robust abundance and distribution data, limit our knowledge of the impact of bycatches on common dolphins in the area.

Given that all these fisheries operate in the Northeastern Atlantic, and that, in general, the data are compiled on a country by county basis, the Committee **recommends** a regional effort to compile data of all nations and to include the set net fisheries in the monitoring programme. After taking into account previously high bycatches in some fisheries, that in other fisheries there are seasonal fluctuations in fishing effort and location, the probable movement of animals over a large geographical area, the incomplete sampling of all fishing fleets, and the low observer coverage, the Committee **agrees** that from the information available, a minimum 1,000 common dolphins are taken in fisheries annually in this large geographical region, which is of concern.

Information on the bycatch of short-beaked common dolphins in the western North Atlantic between North Carolina, USA and Nova Scotia, Canada was presented in SC/61/SM12. Short-beaked common dolphin mortalities have been documented in the following US fisheries: Atlantic pelagic drift gillnet, Northeast and Mid-Atlantic gillnet, Northeast and Mid-Atlantic bottom trawl, and Mid-Atlantic mid-water trawl (including pair trawl) fisheries. Short-beaked common dolphins have also been documented to be hooked and released alive in the pelagic longline fishery. On average 415 (CV=0.15) animals were taken annually as incidental bycatch in these fisheries during years/fisheries which had at least some observer coverage. The Atlantic pelagic drift gillnet and Mid-Atlantic bottom trawl fisheries have the highest annual averages: 185 animals (CV=0.03) and 181 animals (CV=0.34), respectively.

Recent fishery mortality and injury for short-beaked common dolphins of the U.S. California, Oregon, Washington stock is given in Carretta *et al*. (2008). Mean annual takes reported are based on 2002-2006 data with an average estimate of 77 (CV=0.38) animals taken annually. A summary of recent fishery mortality and injury for long-beaked common dolphins of the U.S. California stock is also reported in Carretta *et al*. (2008). Mean annual takes of long-beaked common dolphins in this region are based on 2002-2006 data, suggesting an average estimate of 16 (CV=0.46) animals taken annually.

Estimates of bycatch elsewhere in the Pacific are rare. It was noted from the progress reports and the summary table (see Annex L) and from previously reported information that bycatch is reported in some areas, such as Peru and Korea. The Committee **encourages** continued and further observer cover in this large geographical area.

Hamer *et al.* (2008) summarised bycatch of the short-beaked common dolphins in the South Australian Sardine Fishery. An initial observer programme revealed high rates of encirclement and mortality (1.78 and 0.39 dolphins per net-set, respectively) of short-beaked common dolphins. This equated to an estimate of 1,728 encirclements and 377 mortalities across the entire fleet over the same period. A code of practice was subsequently introduced aimed at mitigating operational interactions. A second observer programme revealed a significant reduction in the observed rates of dolphin encirclement (0.22; down 87.3%) and mortality (0.01; down 97.1%) with an estimate of 169 and eight, respectively. The Committee noted that the code of practice seems to work well and also **recommends** an assessment of abundance of these dolphins, along with further work on stock structure in the area (see Item 6.2).

SC/61/SM20 summarises information relating to bycatch of *Delphinus* within New Zealand waters. Between 1998 and 2008, 115 common dolphins were reported as incidental bycatch within New Zealand commercial fisheries. An additional 24 unidentified dolphins, probably *Delphinus*, were also reported by observers during the same period. The main fishery involved was the commercial trawl fishery for jack mackerel, with some bycatch being noted in vessels targeting hoki, skipjack tuna, barracouta, snapper and trevally. Observer effort (based on number of trawls observed) within the jack mackerel fishery ranged from 5- 40% during 1998 to 2008. An extrapolation to fleet level was attempted and it was estimated that *ca* 600 common dolphins were bycaught in this fishery between 1998 and 2008. Results from post-mortem examinations suggest 28% of individuals (n=24) exhibited trauma and lesions indicative of net entanglement. Lesions identified appear to be consistent with those inflicted by set nets.

SM/61/SM33 reported that while 1,074 common dolphins had been taken in shark nets off KwaZula-Natal, South Africa, between 1980 and 2000, annual catches had fallen to an average of 5 individuals since 2006, for a number of reasons, including mitigation measures. No other bycatch estimates were reviewed at this meeting.

Estimating bycatch limits

A modelling approach to define bycatch limits for northeast Atlantic common dolphins was presented in SC/61/SM19. The impact of previous bycatches in this

area, assuming a single stock of common dolphins, was assessed and preliminary bycatch limits that would be expected to achieve a specific conservation objective calculated. The main result of the assessment was that the combination of data and model used was not informative about the main population parameters of interest: population growth rate, maximum population growth rate and carrying capacity. Given the shortcomings of the direct assessment approach, another approach to calculating bycatch limits is a fully simulation-tested procedure that can be expected to achieve conservation objectives in the face of the large uncertainties. The authors developed tunings for two procedures, the US Potential Biological Removal (PBR) and the IWC's *Catch Limit Algorithm* (*CLA*) for common dolphins in the northeast Atlantic. Preliminary bycatch limits ranged from 0.1- 1.1% of the most recent point estimate of abundance depending on the procedure and the tuning to meet specific conservation objectives.

Whether using the *CLA* or PBR (or indeed any other) approach, a key aspect is to be able to decide on the appropriate stock unit. The entire northeastern Atlantic might be considered one such unit, or just that area for which an abundance estimate has been made by SCANS/CODA, or an approach such as that taken in SC/61/SM34, where ecological tracers are used, could help to define appropriate stock units. A particular problem with common dolphins in the northeastern Atlantic is that there are evident (presumably feeding) aggregations during winter on the shelf, which is where much of the bycatch occurs, while each such aggregation could include several putative breeding stocks that separate out during the summer breeding season. It was noted that the best way to address these concerns would be to follow the RMP approach i.e. undertake an in-depth assessment by gathering together the range of opinions on how the population might be structured, then to create scenarios or hypotheses about the population structure, assigning some levels of plausibility to each, and then to run the model to see what the bycatch limits might be required to fulfil the conservation objectives. The advantage of such an approach is that it makes best use of all the available information. Current models are extremely conservative because of the large degree of uncertainty and by including as much of the available information as possible, uncertainty might be reduced.

Finally, it was noted that the development of such an assessment procedure could take a long time, as accumulating the relevant bycatch estimates, stock structure information and abundance time series is slow. Even when data are available, however, the principle impediment is (1) reaching agreement on the appropriate conservation objectives, (2) finding some consensus on the most plausible stock structure scenarios and (3) the likely range of bycatch estimates. In the short term, the more simple PBR approach could be adopted. The Committee **welcomes** the development of this '*CLA*' approach and **encourages** people who have suitable data to contribute to efforts to further develop the method.

14.1.9 Other

van Bressem *et al.* (2006) describes diseases, lesions, traumas and malformations of the skull, head, trunk and appendages as well as the skin of the genital tract from a sample of 930 long beaked common dolphins in Peru collected between 1985 and 2000. The authors conclude that long-beaked common dolphins from the southeastern Pacific are affected by a variety of acquired, congenital, traumatic, infectious and parasitic diseases. Some of these were reported to be severe enough to impair normal vital functions and behaviour. Of all the diseases encountered, morbillivirus, poxvirus and *Brucella* sp. infections, as well as *Crassicauda* sp. infestations appear to have the highest potential for significant adverse impact on population abundance (by increasing natural mortality and/or by negatively affecting reproduction).

14.1.10 Consideration of status

The considerable uncertainty about taxonomy and population structure of common dolphins, combined with a paucity of abundance estimates, made it difficult for the Committee to assess the conservation status of stocks.

Although recent genetic studies suggest that population structure is discernible in the eastern Pacific and around Australia and New Zealand, in most areas, including the northeastern Atlantic, there is little or no genetic evidence of population structure, which makes the description of stock units challenging. The Committee **agrees** that there is currently no general answer as to how to define stocks of common dolphins in most areas, nor any simple way to define units of conservation concern.

One area of conservation concern is the Mediterranean Sea where, particularly in the central and eastern portions of the basin, common dolphins have declined considerably (Bearzi *et al.*, 2003). Although historical directed takes and ongoing bycatch have contributed to this decline, there is reason to believe that other factors such as pollution and prey depletion are also involved (e.g. Bearzi *et al.*, 2008). Re-distribution into other areas may also be a factor in reduced sightings records in parts of the Mediterranean. The Committee noted that systematic survey coverage of large portions of the central and eastern Mediterranean is lacking. In part due to **concern** about the status of common dolphins in the Mediterranean, it **repeats its previous recommendation** that a basin-wide synoptic survey (Cañadas *et al.*, 2006; Cañadas *et al.*, 2008) be carried out as soon as feasible.

The Committee also **draws attention** to the of large and potentially unsustainable catches of common dolphins off Peru noted in last year's report (IWC, 2009m, p.323). Those catches, both directed and incidental, have continued for many years and there have been no abundance estimates for that region. Finally, Committee **expresses concern** about ongoing fishery bycatch of common dolphins in the northeastern Atlantic and in other areas, where stock structure remains unresolved. It also noted that in many areas bycatch is known to occur, but data are poor or lacking and abundance estimations are absent. It **recommends** that efforts continue in these regions to improve understanding of stock structure and obtain better estimates of bycatch, to better assess fisheries impact.

14.2 Progress on previous recommendations

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

14.2.1 Vaquita

The Committee received new information on the critically endangered vaquita. SC/61/SM23 reported on recent survey work addressing abundance and distribution of vaquitas. Estimates of current vaquita abundance are so low that it has become necessary to reconsider the design and methodology of acoustic surveys used to monitor population trends and habitat use in the context of the Vaquita Recovery Plan.

Between mid-September and late November 2008, a survey was performed in the Gulf of California in order to test new acoustic equipment (e.g. T-POD, C-POD and towed hydrophone arrays). More than 1,800 km were travelled and 1,600 hours of acoustic recordings were obtained. Analysis of the data gathered in the autonomous equipment is ongoing. A dedicated workshop will be held during 2009 in order to initiate the actual monitoring scheme.

The Government of Mexico also provided updated information on the latest recovery actions. The Recovery Programme (PACE), operated by the Environment Minister (SEMARNAT) has been applying resources for buy-outs, rent-outs and fishing gear changes since 2007. The enforcement of the refuge polygon is being taken care of by Environment Protection Agency (SEMARNAT-PROFEPA) with dedicated funds. The Fisheries National Commission (CONAPESCA) is assessing all fishing licenses and permits and the National Fisheries Institute (INAPESCA) is testing alternative fishing gears. Finally, a public awareness and environmental education program is being implemented together with the State Government of Baja California. To date, 500 illegal fishing boats have been removed; 246 were bought-out; 161 changed to other fishing gears; and a shrimp farm is being rebuilt, which potentially will result in an additional 180 boats being retired.

The Committee **welcomes** the actions by the Government of Mexico to eliminate bycatches in the refuge polygon and **encourages** continuation of the described efforts to monitor relative abundance and trends. However, until it is demonstrated that the recent rapid decline has been stopped and reversed the Committee **reiterates its extreme concern** about the conservation status of the vaquita. It **strongly recommends** that, if extinction is to be avoided, all gillnets should be removed from the upper Gulf of California immediately, and certainly within the three year schedule, started in 2008. In order to meet this schedule, the Committee **encourages** the international community, including member countries and NGOs, to assist the Government of Mexico in the task.

14.2.2 Harbour porpoise

SC/61/SM36 presented data from an ongoing observer programme in several Norwegian fisheries, to monitor and estimate levels of bycatch in Norwegian gillnet fisheries. 501 porpoises were observed bycaught over a three year period, mostly in ICES Area IIa – northern Norwegian coastal areas. The Committee **welcomes** this information, that it will contribute to the assessment of harbour porpoise status in the region and **encourages** the authors to provide extrapolated estimates of total porpoise bycatch for next year's meeting. Work is underway to obtain additional bycatch information in recreational fisheries from ongoing surveys in Norway.

A summary of new information on abundance and bycatch estimates of harbour porpoises in the southwestern Baltic Sea was presented (Herr *et al.*, 2009; Scheidat *et al.*, 2008). Two populations of harbour porpoises occur in the study area: the highly endangered population of the Baltic Proper (east of the Linham and Darss ridge) and the population of the Inner Danish Waters. Over the last several years, aerial line transect surveys have been conducted and minimum bycatch estimates have been generated using two different approaches: (1) using the proportion of stranded animals known or inferred to have been bycaught; and (2) extrapolating from information obtained through interviews with fishermen. The resulting minimum estimates of bycatch ranged from about 50 to 150 animals. Applying these numbers to the local abundance estimates reveals that bycatch is at least 1% of the abundance estimate and possibly much higher than 1.7%. This is cause for serious concern, particularly considering the possibility of the serious consequences for the critically endangered Baltic proper porpoises.

Inner Danish Waters were surveyed during both the SCANS and SCANS II surveys and point estimates between these two surveys indicated a decline of about 30%. Although not significant due to large confidence intervals, this difference suggests a decline in abundance of harbour porpoises over the last decade. The high bycatch rates observed along the German coast have serious implications for the local stock in the southwestern Baltic and consequently for the population in Inner Danish waters. Additionally, the continuing bycatch pressure is a danger to the already endangered Baltic Proper porpoises. Accurate and seasonal data on bycatch and abundance with a focus on the western Baltic and Inner Danish Waters (not national stocks) are needed to address this issue.

The Committee noted that the estimates of bycatch, based on the number of stranded animals with evidence of bycatch and on interviews are both likely to be underestimates. The Committee **recommends** that more detailed estimates of bycatch should be obtained and **encourages** continued abundance surveys. The Committee **stresses its concern** about the conservation status of both the porpoise population in the Inner Danish Waters and the Baltic proper.

14.2.3 Narwhals and white whales

In 2007 (IWC, 2008l, p.314-15) the Committee reiterated previous recommendations that the stocks of narwhals and white whales in West Greenland should remain a focus of major conservation concern. At that time, the NAMMCO Scientific Committee had also expressed its concern about quotas set for some narwhal stocks and the levels of removals from the West Greenland stock of white whales. At a joint meeting of the NAMMCO Scientific Committee

Working Group on the Population Status of Narwhal and Beluga in the North Atlantic and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga Scientific Working Group in February 2009, new data were presented on stock structure, catches, movements, behaviour, abundance and population dynamics of both species (NAMMCO/JCNB 2009). Some of this information is summarised in the Committee report. The Committee **welcomes** this new information and the information that catches of white whales off West Greenland have been reduced in response to previous advice of the Joint Working Group. The Committee **recommends** that provision of reports from the Joint Working Group and from relevant workshops and meetings (e.g. on monodontid age estimation) under the aegis of either NAMMCO or the JCNB are provided routinely for the Committee's consideration.

14.2.4 Other

The status of killer whales was examined in 2007 (IWC, 2008e) and it was noted that in many areas, abundance estimates were few or absent. SC/61/SM10 presented information on an aerial survey for Antarctic minke whales in east Antarctica in December 2008, in which around 370 killer whales were observed throughout the survey area. Based on their distribution, relatively small size and pale cape, the killer whales sighted were either Type B or Type C, or a combination of the two types. They were seen almost exclusively in less than 20% sea ice concentration, with most in ice-free areas. Most of the killer whales were observed in water less than 750m in depth, with a peak in observations around 500m.

SC/61/SM26 reviewed existing data on the occurrence and diet of Ross Sea killer whales ('type C'), and presented data on numbers observed in the southwestern Ross Sea since 2002. These 'resident' whales appear to feed principally on fish (including Antarctic toothfish). On the basis of sea watches on the outer coast of Ross Island beginning in 2002-03, sighting frequency and average group size began to decrease from 2006-07 and thereafter; prevalence also decreased in nearby McMurdo Sound. Consistent with a decrease in the catch-per-unit-effort of scientific fishing for toothfish in McMurdo Sound, the authors suggest that the change in Ross Sea killer whale numbers is related to a contraction of the toothfish stock, and not to changes in the physical environment.

14.3 Takes of small cetaceans

The report of a recent workshop on assessment of Indo-Pacific bottlenose dolphins, using the population in the Solomon Islands as a case study, concluded that the current quota set by the Solomons government of 100 live dolphins exported per year is higher than the local population of *Tursiops aduncus* is likely able to sustain (Reeves and Brownell, 2009). The first known catches of *Tursiops* at Guadalcanal Island in the Solomons, where the live-capture fishery has been on-going since 2003, took place in 1990. What started as a directed hunt using purse seines to take *Tursiops* for food, later evolved into a fishery for live export. The Committee **expresses its concern** at ongoing and past levels of take of *Tursiops* in the Solomon Islands, noting that permitted levels of catch for export are not supported by scientific evidence.

SC/61/SM15 used interviews and other surveys along the southwestern coast of Madagascar to reveal an ongoing subsistence hunt for small cetaceans. Around 6,500 small cetaceans (mainly humpback, spinner and bottlenose dolphins) had been taken between 1975 and 2000. The hunt has been illegal since 2002 and is now concealed. Coastal surveys revealed a very low encounter rate with coastal species – but considerable diversity among cetacean species with 'deepwater' species present nearshore. Given the low survey effort in this area, the Committee **encourages** additional surveys and noted the illegal catches with concern.

A summary of directed catches and associated quotas for small cetaceans in Japan from 1997-2007 was provided and is included as an appendix to Annex L. A new quota was added in 2007 for 350 Pacific white-sided dolphins. The Committee also noted a recent increase in landings of short-finned pilot whales. Reported takes were generally below the quotas, (e.g. Dall's porpoises) and it is uncertain whether this might be due to reduced market demand or to declining catch rates in relation to effort.

The Committee noted the records of 340 individually reported finless porpoises in SC/61/ProgRepKorea, apparently caught in a trawl fishery in the Korean Strait. It **expresses concern** that this may not be sustainable.

The Committee also **expresses concern** that data on small cetacean bycatch as reported in the national Progress Reports is incomplete, and is likely to give a misleading impression of the scale of bycatch in some countries, particularly since the bycatch table (which appears as part of a separate Annex to the Committee's report) therefore currently only represents a partial picture of the levels of bycatch that have been reported to the Committee.

Rather than request that the Secretariat devotes considerable time to compiling records that have been submitted as text documents, the Committee agrees that it would be more useful for member states to submit small cetacean bycatch records electronically in spreadsheet or database format. Furthermore, the present practice of listing each individual specimen does not allow estimates of total bycatch in a fishery to be presented in a practical way and can also be misleading through the confusion of observed (or inferred) individual bycatches with estimates of total bycatch in a specific fishery obtained through an observer programme.

The Committee therefore **recommends** that:

(1) data on small cetacean bycatch in national Progress Reports should be submitted electronically;

(2) two extra fields should be included to allow extrapolated totals and associated measures of error (CV or CI) to be included in the reports;

(3) the Secretariat is requested, with assistance from the sub-committee, to compile national data together with records provided in meeting documents when preparing the summary small cetacean bycatch table, and that this table should be published as an appendix to the small cetacean sub-committee's report;

(4) (4) electronically submitted data, and any additional data submitted to the Committee, in a simple tabular database that can be interrogated for the work of the Committee as needed; and

(5) a summary table for the printed report should be produced as usual, but this should include records for the past five years for each fishery so that it will be easier to distinguish between absence of bycatches and lack of monitoring.

With respect to (5), only the total numbers of animals reported or estimated need to be reported, by country, by fishery and by year. This will enable the Committee to keep track of situations where bycatches may be reported in a fishery one year, and when no further sampling is undertaken or reported, it may otherwise appear that bycatch has ceased. It will also enable late reporting and correction of bycatch estimates from previous years to be noted more easily. The Committee also **recommends** that member states should try to distinguish between fisheries with no reported bycatch and those for which there is no information.

A revised format for the submission of bycatch data in the annual report is shown in Table 2 of the Annex L, and includes two extra location fields to make identification of the fishery within the FAO fishery inventory easier. Not all member states submit reports of small cetacean bycatch and this should be made clear in the table.

14.4 Other

At the recent IWC workshop on climate change (see Annex K), it was recommended that the Committee on small cetaceans consider a series of hypotheses that link climate to the population trajectories of small cetaceans with the aim of identifying species, areas and research situations that could be informative. It was acknowledged that the ongoing rapid change in global climate has major implications for many species of small cetaceans and therefore that improved understanding of how populations are likely to respond is important. However, given the shortage of time to discuss the matter at this meeting, the Committee agreed to establish an intersessional working group under Simmonds - see Q21, which will work by correspondence (unless funds become available to allow it to meet) to pursue this matter further and report back at next year's SC meeting. This intersessional working group was established, with the following terms of reference:

(i) collate and review existing research, taking into account the approach and recommendations developed by the IWC Climate change workshop;

(ii) identify key studies, species and areas, and opportunities for further research; and

(iii) develop recommendations for future research.

14.5 Work plan

The Committee reviewed its schedule of priority topics which currently includes the following:

(1) Systematics and population structure of *Tursiops*.

(2) Status of ziphiids in the Southern Ocean.

(3) Status of small cetaceans in the eastern tropical Atlantic.

(4) Fishery depredation by small cetaceans.

The Committee noted that although a great deal of research has been completed recently and more is ongoing on the topic of *Tursiops* systematics and population structure, this item should wait for another year or two in the expectation that a clearer picture will emerge, thus allowing a more productive and conclusive discussion at that time.

The Committee **agrees** to add status of ziphiids in the Northern Hemisphere as a new priority topic to be considered at a future meeting, based on concern about the effects of naval sonar, entanglement in some areas and new information on abundance and distribution.

Given possibility that the venue for the next meeting will be Morocco, the Committee **agrees** that the priority topic for next years work should be the status of small cetaceans in the eastern tropical Atlantic. A report from the intersessional working group on climate change will also be considered at next years meeting.

Other matters related to the work plan are discussed under Item 22. Budgetary matters are considered under Item 24.

15 WHALEWATCHING

The report of the sub-committee on whalewatching is given as Annex M. Scientific aspects of whalewatching have been discussed formally within the Committee since a Commission Resolution in 1994 (IWC, 1995c).

15.1 Proposal for a large-scale whalewatching experiment

Lusseau presented a report from the large-scale whalewatching experiment (LaWE) Intersessional Steering Group (Annex M, Appendix 2). This arose out of a workshop held to plan a LaWE in 2009 (IWC, 2008c). The report elaborated on the hypotheses that the LaWE project initiative plans on testing and the research design needed to do so. The main tasks of the group are and will continue to be to:

(1) develop the mechanisms through which LaWE can be implemented, including a rationale for the selection of procedures; initiate data collation;

(2) perform meta-analyses to assess sample sizes required to detect a plausible range of effect sizes; and

(3) to discuss the possibility of using existing IWC procedures to archive and access data of relevance to LaWE.

An advisory group will also continue, representing regional and species expertise (Annex M, item 5, Table 2).

The pursuit of the LaWE was not meant to discourage the conduct of short-term response studies. Until the LaWE is well underway and generating results, such studies remain a valuable tool in providing scientific advice to manage

the development of whalewatching. The first objective of the LaWE is to determine whether the vital rate effects described in recent studies can be observed in other situations. If the hypothesis that there are such vital rate effects is found to be false, it may ultimately mean that short-term response studies will be less important from a management perspective. However, it was noted that testing the vital rate hypothesis will take years; therefore, waiting until that hypothesis is tested to engage in short-term response studies is neither preferable nor desirable.

The Committee **endorses** in principle the approach and hypotheses of the LaWE, understanding that there will be further intersessional work, as summarised in Annex M, Appendix 2.

The Committee considered a summary of actions taken by the US government on Hawaiian spinner dolphins (*Stenella longirostris*), which may be particularly vulnerable to disturbance because of their reliance on limited availability of sheltered waters to rest, socialise and avoid predators. Due to growing concerns of impacts of human activity on spinner dolphins, the U.S. National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) is in the process of developing management plans to reduce the exposure of spinner dolphins to human activity in Hawaiian waters. The project and findings are detailed in Annex M, item 5.

The Committee **commends** the government of the United States for supporting the establishment of control areas to facilitate long-term research and increase understanding of human-spinner dolphin interactions in Hawaii. It **agrees** that the following three recommendations can be applied generally to long-term impact assessment research:

(1) there should be a financial commitment to a longitudinal research programme to detect cumulative effects over time and to determine the effectiveness of management intervention;

(2) a sufficient database must exist prior to the implementation of time/area closures that will serve as 'baseline data' for comparison after the implementation of closures; and

(3) there must be commitment to an adaptive management framework to promote rapid and appropriate translation of research findings into management plans.

15.2 Review whalewatching in Portugal (including Azores and Madeira), Canary Islands and Strait of Gibraltar

Sequeira and colleagues presented a detailed overview of whalewatching in Portugal (including the Azores and Madeira), the Canary Islands and Strait of Gibraltar (Annex M, item 6, Table 1).

The Committee **reiterates** its recommendation of previous years, that in general, to be effective, codes of conduct should be supported by an appropriate legal framework so that they are enforceable and they should be modified, if necessary, as new biological information emerges. The Committee **commends** the Madeira Regional Government for taking recent management measures and **encourages** the Madeira Parliament to approve and implement proposed whalewatching regulations.

Monitoring and enforcement of the industry in the Azores is problematic. Operators pay a licence fee and although it was proposed that a portion of the fee be used for monitoring and enforcement, there is no legal requirement that such funds be directed towards any specific purpose. This is similar to the situation in Madeira, mainland Portugal and many other sites. After discussion, the Committee **recommends** that governments involved in issuing whalewatching permits or licences allocate a certain percentage of the taxes or fees received through the licensing process to monitoring, research programmes, and/or enforcement activities.

15.3 Assess the impact of whalewatching on cetaceans

SC/61/WW1 summarises recent papers on short-term whalewatching impacts: Timmel *et al.* (2008), describes a study on the behaviour of Hawaiian spinner dolphins (*Stenella longirostris*) in the presence of swimmers and vessels; Courbis and Timmel (2008) report on the interaction of spinner dolphins with swimmers and vessels in three Hawaiian Bays; Dans *et al.* (2008), investigated the effect of boat traffic on dusky dolphins (*Lagenorhynchus obscurus*) in Golfo Nuevo, Argentina. Jensen *et al.* (2008) investigated noise impacts of smaller vessels in Koombana Bay, Western Australia (a shallow-water habitat) and Tenerife, Canary Islands, Spain (a deep-water habitat) on bottlenose dolphins (*Tursiops aduncus*) and pilot whales (*Globicephala macrorhynchus*); and Sousa-Lima and Clark (2008) describes the effect of boat traffic on the acoustic behaviour of humpback whales in Abrolhos National Marine Park, Brazil. Summaries are presented in Annex M, item 7.

SC/61/WW2 presents a literature review of the effects of aircraft on cetaceans, as requested by the Committee last year. Würsig *et al.* (1998) noted that 'cryptic' species, such as beaked whales (*Ziphiidae*), and *Kogia* spp., showed a stronger response to the plane than other species and that smaller delphinids also frequently changed their behaviour; Patenaude *et al*. (2002) assessed the short-term behavioural responses of migrating bowhead whales and white whales to a helicopter and a fixed-wing aeroplane in the western Beaufort Sea; Richter *et al*. (2006) studied the reactions of male sperm whales off Kaikoura, New Zealand, to aerial whalewatching from fixed-wing planes and a helicopter; and Smultea *et al*. (2008) recorded reactions of sperm whales from small fixed-winged airplanes conducting surveys. Summaries are presented in Annex M, item 7.

The Committee thanked Parsons for both comprehensive reviews and clarified that these reviews are intended as summaries of research conducted in the field in the past year and are not critiques of methodologies or results. Some members reiterated their concern about aerial whalewatching, particularly that involving helicopters, and the potential disturbance to whales. The Committee **recommends** that a review of the nature and extent of aerial platforms be presented next year and that such

information could be stored in the on-line database for worldwide tracking of commercial whalewatching (Annex M, item 8.1), once developed.

SC/61/WW5 reports on the response of long-finned pilot whales to whalewatching vessels in the Strait of Gibraltar. The authors concluded that: (1) it is necessary to establish a carrying capacity for the number of whalewatching operators in the Strait of Gibraltar and to increase their collaboration to avoid disturbance; (2) that data collection be standardised; and (3) that the existing code of conduct be enforced by a bilateral control body from Spain and Morocco.

In discussion, the difficulties in assigning orientation (to the whalewatching platform) without control data from an independent platform were noted such that conclusions of 'responses' drawn without proper controls must be treated with caution. Some members noted the series of management recommendations with which the authors concluded their paper and expressed concern that the data did not support the suggestions whilst others noted that nevertheless these recommendations remain relevant as a management tool under a precautionary approach until more rigorous studies are undertaken.

SC/61/WW6 describes the impact of unregulated whalewatching activities on a small population of humpback whales breeding in New Caledonia. Between 2005 and 2007, land-based surveys were conducted to collect data on the behaviour of humpback whales in the presence and absence of boats using a theodolite. A multiple linear regression analysis showed that whales significantly increase their dive time and decrease the linearity of their path when boats are present within 1000m of the animals. This short-term behavioural response could induce higher energetic costs and have longer term implications for this population.

In discussion, it was noted that although statistically different effects for dive time and linearity of travel were detected, they were relatively small and these differences may not remain significant with the application of correction factors for multiple comparisons of the same datasets. However, it was also noted that this does not mean the effects are negligible for the animals. The Committee **encourages** researchers to report results in full, even when effects in such studies are found to be small or not statistically significant, in order to facilitate cross-study comparisons and meta-analyses.

Baldock *et al.*(2009) examined whether/how vessel traffic (vessels not seeking interactions with cetaceans) was influencing the foraging behaviour and habitat selection of bottlenose dolphins. Dolphins spent less time foraging when boats were present. The greater the number of boats present, the more likely dolphins were to be displaced at a short-time scale (minutes). However, boat presence did not influence dolphin occupancy at a longer time scale (hours). The effect of boat presence did not change with variation in foraging patch quality. These results were consistent with indirect influences of vessels on the behaviour of dolphin prey; the dolphins appeared to be coping at this site in Scotland. This study shows that it is important to consider alternative paradigms when studying the influence of disturbances on animal behaviour and that seemingly similar impacts can emerge from different processes.

SC/61/SM20 summarised information on the influence of whalewatching on a population of common dolphins in the Hauraki Gulf, New Zealand. This study showed that interactions with dolphin-watching vessels disrupted the foraging and resting behaviour of this population. These effects lead to a significantly altered behavioural budget and therefore raised concerns for potential long-term consequences.

SC61/E16 presented information on chronic stress in marine mammals (summarised in Annex M, item 7). Stress (including synergistic effects of multiple stressors) may alter life history parameters and cetacean demographics. The importance of understanding stress responses in animals is recognised, although measuring impacts in cetaceans remains a challenge. The Committee looks forward to receiving the report of an 'outside' workshop on chronic stress and cumulative impacts of multiple stressors next year. The Committee **notes** the common interests and synergy between the standing working group on environmental concerns and the sub-committee on whalewatching regarding the impacts of chronic noise exposure.

SC/61/BRG27 details research on the distribution of gray whales within Laguna San Ignacio, Mexico between 1978 and 2009. A change in the distribution of the whales within the lagoon was found that suggests that fewer whales are using the interior of the lagoon (closed to eco-tourism and whalewatching) and that the preferred area is closer to the entrance to the open ocean (where whalewatching is permitted). Comparison of these trends with other breeding lagoons is needed to determine if these trends are representative of gray whales occupying the entire winter range or are unique to San Ignacio.

15.4 Review reports of intersessional working groups

15.4.1 Compile information on whalewatching programmes and associated data

SC/61/WW7 described the development of an on-line database for tracking whalewatching operations and associated data collection programs worldwide. The project is summarised in Annex M, item 8.1. The Committee thanked Robbins for her work and **agrees** that the on-line database will be extremely useful. Initial development has focused on vessel-based whalewatching programmes, but may expand to other types of operations. Similarly, the prototype web interface will be in English, but will eventually include other languages. It is also conceivable that specific data may be shared directly at this site, in addition to user summaries of their effort and research.

Robbins commented that additional input would be helpful for ensuring that the database incorporates fields that will ultimately be useful for research. To this end, an intersessional steering group, whose main tasks are to advise on the design of a database of whalewatching activities and associated data, has been established (Annex M, item 5, Table 2; Q29).

15.4.2 Further develop a questionnaire to assess the extent and potential impact of swim-with-whale operations

The Committee noted that Rose (Convenor of the Working Group Q30) will present an update of the item at next year's meeting.

15.5 Other issues

15.5.1 Consider information from platforms of opportunity of potential value to the Scientific Committee

SC/61/WW3 examined whether data collected from a research vessel were comparable with those from a whalewatching boat. The latter were found to oversample juveniles and solitary whales as well as having more samples of whales that engaged in aerial behaviour, deep feeding and social behaviour/milling. The results suggest that whalewatching boats were more likely to spend greater periods of time with younger whales that are more likely to be active. Some methods to compensate for this bias in behavioural studies are summarised in Annex M, item 9.1. The Committee **welcomes** this study and noted its importance to many researchers who use whalewatching boats as platforms for their work.

Stockin *et al.* (2001) was an analysis of North Atlantic common minke whale surfacing data gathered from a whalewatching vessel as a platform of opportunity. Results showed significant daily and monthly changes in minke whale surfacing rates. Surfacing rates in this study were compared with other geographical locations and great variability was noted. The authors commented that the significant variability in minke whale surfacing behaviour noted in this study could affect the sightability of minke whales during sighting surveys and thus abundance estimates. Some concern was expressed that there may be biases in the analyses if respiratory rates could only be obtained from solitary animals and not individual whales in an aggregation. In response, it was stated that measuring surfacing rates in a dense aggregation would be difficult as one could not guarantee the identity of surfacing individuals. However, in the study area, as in Iceland and other areas of interest to the work of the Committee, dense feeding aggregations that would cause such problems are rare. It was noted that the results are somewhat different from previous reviews, e.g. Øien *et al.* (2008) and see discussions in Annex D, item 3 and under Item 6.3.

BC/61/BC3 (discussed above under item 7.3) presented an estimate of bycatch mortality for humpback whales. The author commented that some of the required data can be obtained from whalewatching vessels, and that these platforms provide some of the most reliable eye-witness entanglement reports (see for example Robbins *et al.*, 2007).

15.5.2 Review of whalewatching guidelines and regulations

Carlson noted that the compendium of whalewatching guidelines and regulations around the world is in the process of being updated and will be available on the IWC's website in August.

SC61/WW1 described two studies on whalewatching regulations and mitigation measures. Duprey *et al.* (2008) investigated the effectiveness of a voluntary 'rest period' introduced in 1999 to mitigate the impacts of whalewatching on a population of dusky dolphins in the waters off Kaikoura, New Zealand and Tosi and Ferreira (2009) investigated the behaviour of the estuarine dolphin or costero, *Sotalia guianensis*, within a newly established marine reserve (Rio Grande do Norte, Brazil). Summaries are presented in Annex M, item 9.2.

Higham and Bejder (2008) reviewed a series of developments that evolved while stakeholders worked together to manage tourist interactions at Shark Bay, Western Australia. The positive outcomes that were achieved by designing a rigorous research methodology and publishing results, while working with managers and operators, were highlighted. Such an approach triggered the development of new management strategies that help promote sustainability of the local dolphin watching industry in Shark Bay.

SC/61/WW9 discussed the development of whalewatching in Southern Brazil and conservation implications for southern right whales in an important wintering area. Most groups sighted in this region are mother-calf pairs with an increasing sighting frequency of social groups. The paper presented information designed to evaluate the first 10 years of implementation of whalewatching regulations, and the possible implications for the conservation of right whales. The number of whalewatching cruises has been increasing in Ribanceira/Ibiraquera Bay in the same proportion as the number of whales sighted in this bay during aerial surveys in all years but 2008. The resighting of some females in the area indicates that some individuals have been exposed to boat approaches repeatedly over the decade. Further information is detailed in Annex M, item 9.2. In 2006, area closures were adopted and enforced. Two of the area closures are located in adjacent bays to Ribanceira/Ibiraquera, which may serve as a refuge for right whales targeted by whalewatching in that bay.

The Committee **welcomes** this paper and the progress made in the development of management measures for protecting right whales in this important breeding area. It **recommends** that right whale research in this area, including the monitoring of whalewatching and its potential impacts, be continued to ensure a lack of disruption in a valuable long-term database.

SC/61/WW10 described the process by which six new licences were given to whalewatching companies at Península Valdés, Argentina in 2009, and reports the progress made by the Provincial Government of Chubut and several local institutions and organisations that worked together to improve whalewatching regulations. The paper provides a summarised sequence of the main events related to the local whalewatching industry from its beginning in 1971 that led to the present granting of the new licences (see Annex M, item 9.2). While the licensing program did not reduce the number of boats, the mandated minimum trip length (90 min) and minimum period between cruises (30 min) were designed to reduce exposure to the whales. While mother-calf pairs cannot be approached until September, the presence of other classes

of whales until that month makes the regulation realistic. The Committee **welcomes** this age class restriction. Compliance and enforcement will come from funded officials, while independent researchers will continue to collect data on the movements of boats around whales and the animals' responses.

The Committee **welcomes** these new regulations and **commends** the collaborative approach and joint work accomplished by the Provincial Government of Chubut in cooperation with all stakeholders to grant new whalewatching licences and improve regulations at Peninsula Valdés.

The Chilean Law for the Protection of Cetaceans (Law 20.293) includes several conservation measures for marine mammals (summarised in Annex M, item 9.2). In 2009, the Under-Secretariat of Fisheries established an advisory committee of national authorities and non-governmental organisations to discuss the development of whalewatching regulations. Further details on this process are in Annex M, item 9.2. The Chilean Economic development Agency provided funds to develop activities to promote high-quality whalewatching. Centro de Conservacion Cetacea (CCC), a Chilean NGO, conducted an international seminar in 2009 on responsible whalewatching in a joint initiative of the CCC's blue whale project and the Chilean Economic Development Agency. Main outcomes included an action plan, agreed by all participants, with general guidelines to implement the law for the protection of cetaceans as well as to move towards the development of high-quality, community-based whalewatching.

15.5.3 Review of risk to cetaceans from collisions with whalewatching vessels

SC/61/BC1 summarised available data on collisions of sailing vessels with cetaceans world-wide. None of the collisions involved whalewatching vessels; however, as a number of whalewatching operations use sailing vessels as platforms, it is important that the Committee be aware of this ongoing monitoring effort.

SC/61/ProgRepUSA reported a similar number of vessel collisions with whales off Hawaii in 2008 as in recent years, The types of vessels and classes of whales were also similar to past reports, with some of these collisions with whalewatching vessels, with varying degrees of severity.

The Committee refers to its discussion of the global database on ship strikes. The information collected will help clarify the numbers and severity of the whalewatching strikes, especially in relation to other vessel classes.

15.6 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

16 DNA TESTING

The report of the Working Group on DNA is given as Annex N. This particular agenda item has been considered since 2000 (IWC, 2001c; 2001d; 2001f) in response to a Commission Resolution (IWC, 2000).

16.1 Review genetic methods for species, stock and individual identification

Last year, the Committee noted that for the past several years various techniques to extract and amply DNA from 'difficult' whale samples have been presented and discussed and agreed to review current knowledge at the 2009 meeting (IWC, 2001c, p.60).

SC/61/SD2 reviewed current knowledge of techniques to extract and amplify DNA from 'difficult' whale samples. DNA analysis methods currently used for whale product identification are dependent on extraction and PCR amplification of cetacean nucleic acids, but certain product types and intensive processing may restrict the amount of DNA recovered or degrade the DNA and inhibit amplification. Newly developed methods developed for 'ancient DNA' and human forensic analysis may provide for more robust extraction from and amplification of cetacean tissues.

A flow chart showing various extraction/PCR options for 'difficult' cetacean product types is shown in Appendix 2 of Annex N. The flow chart also showed approximate costs and associated references. The Committee considered that this flow chart appropriately responded the recommendation from last year.

16.2 Second round of sequence assessment for species assignment and plan for future sequence assessment

Last year, the Committee agreed to conduct a second round of *GenBank*[9] sequence assessment for species assignment of baleen whale sequences deposited in *GenBank* in 2007. Specifications for this assessment were similar to those in the first round of sequence assessment (IWC, 2008m, p.339).

SC/61/SD3 showed the results of the second round of sequence assessment in *GenBank*. The phylogenetic methods in *DNA Surveillance*, in conjunction with the Witness for the Whales (WFTW) reference sequence were used to assign species identities to the 499 sequences from baleen whales published in *GenBank* in 2007. Regarding the accuracy of species identification all the sequences were assigned to the same species as that recorded in *GenBank*: 99 bowhead whales (*Balaena mysticetus*), 74 common minke whales (*Balaenoptera acutorostrata*), 115 Antarctic minke whales (B. bonaerensis), 52 Bryde's whale (*B. brydei*), 44 blue whales (*B. musculus*) and 115 humpback whales (*Megaptera novaeagliae*).

SC/61/SD3 also attempted to assign common minke whales to the sub-species recognised by Rice (1998). All the sequences appeared to be of reliable quality. No geographic information was recorded for nearly all the sequences deposited in *GenBank* in 2007.

The Committee noted that there is no consistent method for submitting information on the geographic source of samples in *GenBank* and various authors entered this information in different fields in the database, if at all. It

[9] *GenBank* is an annotated collection of all publicly available DNA sequences (*www.ncbi.nih.gov/genbank*).

was noted that two sequences from dwarf minke whale had been erroneously assigned to North Atlantic common minke whale during the species assignment validation exercise. This was due to large genetic differences reported among dwarf minke whales from different regions of the Southern Hemisphere; some are more closely related to North Atlantic common minke whales (Pastene *et al.*, In press; Pastene *et al.*, 2007) that are not yet represented in the WFTW. To provide a better validation of sample origin, all major geographic regions need to be represented for each species in the reference data sets.

The Committee concluded that the second round of sequence assessment was a useful exercise and confirmed no major issues with species IDs of recently submitted cetacean sequences in *GenBank*. Some disagreements were found during the first round of sequence assessment but these appear to be due to a lag in the taxonomy recognised by *GenBank* or uncertainty in taxonomic distinctions currently under investigation (e.g. the number of species and appropriate names for recently described species of 'Bryde's whales'). All the sequences appeared to be of reliable quality. The Committee recognised the importance of having geographic collection information associated with DNA samples and **recommends** that authors to submit this information to *GenBank* or in associated publications.

As agreed by the Committee in previous years, any anomaly detected in the species identity assessment will be shared with members of the Committee. The original submitter would be notified of the inconsistency and a suggestion made that an amendment be made to the entry. The Committee nominated Pastene to carry out this work intersessionally. A summary of amendments as derived from the results of sequence assessments is shown in IWC (IWC, 2009n, p.347):

23 labeled as *Balaenoptera acutorostrata* in *GenBank* were identified as *B. bonaerensis.*

9 labeled as *B. edeni* in *GenBank* were identified as Kochi and Omurai

10 labeled as *Eubalaena glacialis* in *GenBank* were identified as *E. australis* and *E. japonica.*

It was noted that the Committee has not yet decided on the names for the different species of Bryde's whales and that *B. edeni* is the only name accepted by the Committee to date. It was suggested therefore that with regards to the nine sequences labelled as *B. edeni* no amendments should be made at this stage but that some notification should be made that their taxonomic status is currently under consideration.

Given that the results of the two rounds of sequence assessment exercises have indicated no major problems with the species assignment in *GenBank* the Committee **agrees** that assessments of *GenBank* sequences be conducted less often, and periods of three or five years were suggested. The Committee will decide in 2010 when the next assessment will occur.

The Committee again noted the importance of submission of DNA sequences and related specimen data to the work of the Committee. It **recommends** that upon publication of their work, cetacean researchers submit associated sequences to international databases.

16.3 Collection and archiving of tissue samples from catches and by-catches

The collection of tissue samples in Norway is from the commercial catches of North Atlantic common minke whales from 1997 to 2008. A total of 532 whales were landed in 2008 (see Appendix 3 of Annex N).

The collection of samples in Japan is from scientific whaling in the Antarctic (JARPA II) and North Pacific (JARPN II), bycatches and strandings. The collection includes complete coverage for 2008 throughout the 2008/09 Antarctic season. The Committee was informed that a total of 679 genetic samples of the Antarctic minke whale and one of the fin whale were collected from the 2008/09 austral summer survey of JARPA II. From JARPN II in the western North Pacific (NP) samples stored in 2008 were: NP common minke whale, n=169; NP Bryde's whale, n=50; NP sei whale, n=100; and NP sperm whale, n=3. The samples from bycatch stored in 2008 were: NP common minke whale, n=133; NP humpback whale, n=2; NP fin whale, n=1. Genetic samples were stored for the following stranded whales in 2008: NP common minke whale, n=4; NP sperm whale, n=2; unidentified baleen whale, n=1 (see Appendix 4 of Annex N).

The collection of samples from Iceland in 2008 was from commercial catches. Samples stored in 2008 were: North Atlantic common minke whale, n=36 (see Appendix 5 of Annex N).

The Committee **welcomes** this information from Norway, Japan and Iceland.

16.4 Reference databases and standards for diagnostic registries

Genetic analyses have been completed and data on mtDNA, microsatellites and sex entered in the Norwegian register for years through 2007. Laboratory work is being conducted for samples collected in 2008 (see Appendix 3 of Annex N).

For the Japanese register the genetic analyses based on mtDNA have been completed for North Pacific common minke, Bryde's, sei and sperm whales taken by JARPN II through 2008. Laboratory work on microsatellites for these samples is being conducted. The genetic samples of Antarctic minke and fin whales taken by JARPA II in 2008/09 have not been analyzed yet. For bycatch samples, genetic analyses based on mtDNA have been completed for all samples through 2008. Laboratory work on microsatellites for these samples is being conducted. Work is ongoing for stranded animals in 2008 for both mtDNA and microsatellites (see Appendix 4 of Annex N).

For the Icelandic register genetic analyses (mtDNA and microsatellites) were completed for common minke whales taken by scientific whaling in 2007. Laboratory work of samples taken under commercial whaling in 2007 and 2008 is under way (see Appendix 5 of Annex N).

The Committee **agrees** that the same format should be used for the annual updates of the DNA registries of different countries and that the Norwegian format could be used as a model. Pastene will work intersessionally to design a standardised format in consultation with scientists from the relevant countries.

16.5 Work plan

Issues related to the work plan are dealt with under Item 22; budgetary matters are considered under Item 24.

17 SCIENTIFIC PERMITS

This agenda item was discussed in an evening session to enable all Committee members who wished to do so to attend. A PowerPoint presentation summarising the Report of the Specialist Workshop (SC/61/Rep 1) introduced the item.

17.1 Review of activities under existing permits

17.1.1 Review report from a specialist workshop to evaluate results from JARPN II

17.1.1.1 SUMMARY OF THE SPECIALIST WORKSHOP REPORT

SC/61/Rep1 was the Report of the Workshop held on 25-30 January 2009 to review the first six years of the JARPN II research programme. This was the first review of a special research permit programme under new procedure ('Annex P') developed by the IWC Scientific Committee and approved by the Commission (IWC, 2009o). The meeting was held at the National Research Institute of Fisheries Science (NRIFS) in Yokohama, Japan and involved a panel of 14 scientific reviewers. The primary tasks of the workshop were as follows: (1) to review the scientific work undertaken thus far against the stated objectives of the programme and to review future plans in the context of the likelihood of meeting those objectives, (2) to evaluate the techniques used (lethal and non-lethal), (3) to evaluate the appropriateness of sample sizes for the research and (4) to assess the effects of any catches on the relevant stocks. The Panel focused solely on the scientific merit of the research and did not address the more general questions surrounding lethal sampling in research under scientific permit.

In terms of meeting logistics, the Panel was seated at a round table in one part of the room while the Proponents, when present, were seated in another part of the room. During the morning session of each of the first three days, the Proponents gave a brief overview of their results on a particular main topic and answered questions of clarification from the Panel. The rest of the day was a closed session for Panel discussion and report writing. The report itself was constructed as follows. Under each agenda item there was a statement of the objectives and summary of the results written by the Proponents themselves. This was followed by a section on the Panel's discussion of the papers presented and its conclusions and recommendations.

As noted in SC/61/Rep1, this review was greatly facilitated by the fact that the Proponents of JARPN II had provided extensive documentation of both published and unpublished work well in advance of the meeting, and had been highly responsive to the information needs of the Panel throughout the workshop. The general conclusions of the Panel are provided below, with considerably greater technical detail available in SC/61/Rep1.

17.1.1.1.1 REVIEW OF WORK UNDERTAKEN TO DATE

The Panel recognised that an enormous amount of scientific work has been undertaken during the first six years of the programme. However, it also expressed difficulty in assessing this initial progress against the programme's expressed, long-term objectives. The Panel recommended that long-term programmes should identify and quantify specific, short-term objectives against which progress can be judged. The lack of short-term objectives in this case hindered the Panel's review and was considered a weakness of the programme.

The Panel first focussed on the programme's feeding ecology research and ecosystem modelling, which have the ultimate goal of providing multispecies management advice. The Panel recognised that this is an extremely ambitious task. As has been stated within and outside the IWC, obtaining results sufficiently reliable to inform management advice should not be expected within at least the next few years and could require considerably more time. While progress has been made, the Panel concluded that considerably more work would be required, particularly with respect to parameter estimates for non-cetacean components of the ecosystem as well as analytical and modelling techniques.

With respect to prey consumption and prey preferences of baleen whales, the Panel recognised the high quality of the field and laboratory work undertaken. They concluded that the data have the potential to be of great value to ecosystem modelling in both a generic and quantitative manner. However, when reviewing the analyses presented, the Panel had a number of concerns over these analyses and in addition agreed that the rationale for the sampling areas chosen required fuller justification. The Panel was further concerned that insufficient work has been undertaken to address the full level of uncertainty, at all levels of the modelling process. Thus, although progress has been made, the Panel did not believe that the presented estimates of cetacean consumption rates can be considered reliable until further analyses have been undertaken. Several recommendations were made to improve this element of the work (e.g. see SC/61/Rep1, Item 4.3.2).

With respect to ecosystem modelling, varying degrees of progress have been made using three modelling approaches. The Panel welcomed that work, but agreed with the authors that the modelling is still in the exploratory stage. Like most ecosystem modelling work currently underway, the models are not yet at the stage where they could be used to draw even general conclusions, let alone reliably contribute to management advice. Nevertheless, there has been a substantial and laudable effort, and an encouraging start toward synthesising the data collected during the programme. A number of recommendations were made in that regard (see SC/61/Rep1, Item 4.4.2). The Panel agreed that considerably more emphasis should be placed on the modelling work from now on; in particular, a wider range of models needs to be considered and that, without this further work, the likelihood that the objective of the

programme will be reached in a reasonable timeframe will be minimal. It also stated that the data obtained from sperm whales provided no meaningful input to ecosystem models.

The second broad objective of the programme relates to monitoring environmental pollutants in cetaceans and the marine ecosystem. The Panel concluded that the JARPN II pollutant studies represented a valuable contribution to knowledge in this area and acknowledged the considerable amount of work presented. The ongoing programme has been addressing its objectives, and further work was recommended (see SC/61/Rep1, Item 5.3). The Panel specifically recommended that, where possible, papers should assess the potential risk to cetaceans based on current toxicology data in 'model' species and other wildlife, in terms of the health of the animals and dynamics of the stocks.

The third broad objective of the programme relates to stock structure issues. The Panel acknowledged the large amount of new genetic data collected and the substantial number of analyses undertaken under JARPN II. They concluded that the programme had produced a uniquely large data set for testing stock structure hypotheses in the target species. Analyses conducted to date were considered methodologically sound and comparable to other work within and outside the IWC Scientific Committee framework. The inclusion of morphological and morphometric studies was expected to further improve insight into stock structure, especially for the more weakly differentiated populations studied in JARPN II.

The Panel acknowledged the general difficulties in examining questions of stock structure, particularly for weakly-differentiated populations. However, it identified a number of limitations to the analyses presented and made some detailed suggestions for addressing these (see SC/61/Rep1, Item 6.2). The Panel did not agree with the Proponents that the number of hypotheses had been reduced from those proposed during the *Implementations* for western North Pacific common minke whales and Bryde's whales. However, it considered this one of the possible outcomes, after additional recommended analyses. The Panel agreed that these genetic and other analyses would assist in the formulation/narrowing of hypotheses for use in RMP *Implementation Simulation Trials*.

The Panel welcomed the programme's simultaneous collection of *in situ* sea surface and water column characteristics during whale and prey surveys. It recognised the practical challenges of coordinating these sampling methods on the same ship at the same time. The Panel made a number of recommendations for future work including, in the longer term, that the oceanographic data collected on the cruises and satellite derived data be integrated into future analyses.

The Panel also welcomed the collection of sightings data for non-target species and the analyses of their distribution, along with photo-identification studies. It recommended that future surveys cover a larger area than at present in order to better investigate relationships with oceanographic features and to improve abundance estimates. The Panel also made recommendations with respect to trend analyses and the photo-identification data.

A number of other published research papers were presented to the Panel that were in addition to the primary work of JARPN II. These included information on reproductive biology, physiology, and cetacean phylogeny.

17.1.1.2 RELATIONSHIP OF THE PROGRAMME TO THE IWC AND COMMISSION RESOLUTIONS

The Panel also considered the relationship between the JARPN II research and the IWC. With respect to ecosystem and environmental change research, the Panel agreed that many of the objectives of JARPN II are relevant to Resolutions of the Commission and that, as requested in several resolutions, scientific results have been submitted to the Scientific Committee on a number of relevant issues.

The issue of lethal versus non-lethal research is one that remains controversial within and outside the IWC. A major contributory factor to this is that the issue is not only a scientific question. However, the Panel's expertise was of a scientific nature and its comments were confined to scientific matters. It noted that a full comparison of various lethal and non-lethal techniques would require an analysis of the information content of the estimates obtained using the different approaches, in the context of stated quantitative objectives or sub-objectives. Often the data necessary for comparison were not available to the Panel (see recommendations under SC/61/Rep1, Item 8.2.2) and/or objectives were insufficiently stated or quantified (see SC/61/Rep1, Item 9.2.1). In addition, for a complex multi-disciplinary research programme such as JARPN II, an evaluation of appropriate techniques must include an integrative analysis to ensure maximised efficiency from both a scientific and logistical perspective. The Panel was not in a position to evaluate this in detail without information on the logistical resources required and the appropriateness of the proposed sample sizes (see Section 4.1.3, below). Given these important difficulties and information gaps, the Panel was not in a position to complete this item on its Agenda. However, the Panel did recognise that at present, certain data, primarily stomach content data, are only available via lethal sampling.

The Panel nevertheless made a number of recommendations, including that a full evaluation of the relative merits of lethal and nonlethal techniques be conducted as soon as possible, after other recommended work has been completed. A full evaluation *inter alia* would require information on the following: (1) specified and quantified objectives and sub-objectives (see recommendation under SC/61/Rep1, Item 9.2.1); (2) analysis of the precision of the estimates obtained for the relevant parameters by each of the lethal and non-lethal techniques; (3) evaluation of practicalities of field (and, if relevant, laboratory) techniques in the context of the integrated objectives, sub-objectives and analyses proposed. The ability to fully evaluate and compare non-lethal methods in a quantitative manner is severely limited by a lack of appropriate data. The Panel, while recognising that the comparison between lethal and non-lethal research was not one of the objectives of JARPN II, therefore strongly recommended that Japan consider adding to its research objectives a quantitative comparison of lethal and

non-lethal research techniques, if it decides to continue a lethal sampling programme. Whilst recognising the sensitivities surrounding this issue, the Panel respectfully requested that if lethal sampling programmes occur, the IWC Scientific Committee, together with other appropriate scientific body or bodies, might wish to consider collaborating in the design of a well specified study to fully evaluate lethal and non-lethal techniques.

17.1.1.3 SAMPLE SIZE/DESIGN

The Panel concluded that in order to evaluate the appropriateness of the sample sizes, each of the programme's objectives would have to be better specified, identifying those quantities that need to be estimated to achieve the objectives. For each such quantity, the sources of estimate uncertainty should be identified, including those which are sampling-related and those which are not. The precision of each estimate and its relation to sample size and sampling design should be determined. Such an analysis is a pre-requisite for an evaluation of the appropriateness of the sample size and sampling. Although this issue was briefly addressed by the Proponents in Pastene *et al.* (2009), the Panel concluded that this was not undertaken sufficiently. It concluded that a much more thorough approach was warranted and should be carried out as soon as possible. Until that time, it will not be possible to provide appropriate scientific advice on the appropriateness of the sample sizes. The Panel recognised that a thorough review will be a major undertaking and it provided guidance to the Proponents to assist in this process. The Panel recommended that the development of refined, more quantified sub-objectives should be undertaken as a priority. As noted previously, this lack of such objectives was considered a weakness of the present JARPN II programme and limited the Panel's ability to review future plans adequately.

17.1.1.4 EFFECTS ON THE STATUS OF THE STOCKS

The Panel noted that there was no specific guidance from the IWC Scientific Committee as to the appropriate way to provide advice on effects of scientific permit catches on stocks. Such advice would be valuable for both future expert panel reviews under the 'Annex P' protocol and for the Proponents themselves. As a minimum, the Panel recommended that for comparison, results should also be provided for projections for which research catches are equal to zero, as well as for catches equal to the proposed catches. This is particularly relevant to cases where other anthropogenic mortality occurs (e.g. bycatches), as is the case for western North Pacific minke whales. An expression of performance against possible conservation objectives by Proponents and/or the IWC under various situations would go some way to addressing this (e.g. with respect to rates of increase of populations believed to be below some given percentage of unexploited population size). Although the appropriate lower bound to use for MSYR in RMP trials is currently under review, the current situation is that a value of MSYR(mat) = 1% is accorded medium plausibility by the Scientific Committee. The Panel thus recommended that calculations of the effect of catches should also include results for this value of MSYR. The Panel noted that the choice of MSYR (1+) or (mat) is an ongoing matter being discussed within the IWC Scientific Committee.

The Panel further recommended that in circumstances where *Implementation Simulation Trials* have recently been developed for a species in a region, these provide the best basis for evaluating the effect of catches on stocks. These constitute the Scientific Committee's best appraisal of the range of plausible dynamics for the stocks, having been based on all appropriate population abundance and related data. The Panel noted that this is not the same as using the RMP to provide catch advice.

17.1.1.4.1 COMMON MINKE WHALES

The Panel concluded that the information available did not constitute a sufficient basis to provide advice on the effect of planned JARPN II catches on common minke whale stocks. Use of the *IST*s for projections would be the preferred approach, but the existing *IST*s are now dated.

Given this, the Panel thus recommended that the hypotheses underlying these *IST*s and their conditioning should be reviewed and updated by the Scientific Committee as a matter of urgency, given the extensive new information made available from the JARPN II programme. Such updated *IST*s should form the basis for projections of stock abundance under JARPN II catches, which might reliably inform appraisals of the effect of the JARPN II catches on stocks. Such projections should be carried out both including and excluding JARPN II catches so that the contributions of the JARPN II and incidental catches to any negative trends in abundance can be distinguished. In addition, although not strictly part of a review of JARPN II, the Panel emphasised its concern that the results of some of the HITTER runs involving the depleted J-stock presented by the Proponents revealed a decline in abundance for MSYR(1+) = 2% which became severe for MSYR(1+) = 1%. It noted that the primary source of the anthropogenic removals for J stock is bycatch, not scientific permit catches. This provides further support for the need to complete the in-depth assessment of J-stock as soon as possible, along with a full Implementation Review for western North Pacific minke whales.

17.1.1.4.2 BRYDE'S WHALES

The Panel accepted the assessment of the effects of JARPN II catches on Bryde's whales provided by the Proponents and agreed that this level of take does not pose a problem to the stocks.

17.1.1.4.3 SEI WHALES

The Panel had a number of concerns over the analysis on the effect on sei whale stocks provided by the Proponents. In particular, there was concern over the extrapolation of the abundance estimate outside the survey area to the 180° boundary. In the absence of recent survey data for the whole area, the Panel recommended that the assessment of the effect on stocks be repeated without the extrapolation, based on the JARPN II boundary at 170°E, and using an assumed range for MSYR(mature) of 1-4%, while recognising that this might be considered conservative. The catch series (adjusted in light of the Bryde's whale Implementation approach to the historical problems regarding the species identification of sei and Bryde's whales) should be recomputed for this boundary, although this was not considered essential. The Panel was unable to provide a complete scientific review of the effects of

catches upon western North Pacific sei whales until this additional work is undertaken.

17.1.1.4.4 SPERM WHALES

The Panel concurred that the effect on the stock of the small JARPN II takes is negligible. However, it also severely questioned the scientific value of the programme's small and unrepresentative takes of this species.

17.1.1.5 FURTHER REVIEW

The Panel noted that it had not been able to complete its review and would not be able to do so until a number of its recommendations had been addressed. These revolved around two broad issues:

(1) Sample size/sampling design (including the need to have clearly stated quantitative objectives and sub-objectives and the need to have further quantitative information on both lethal and non-lethal techniques);

(2) Effects of catches on stocks for common North Pacific minke whales (including updating the *Implementation Simulation Trial* structure with respect to stock structure, updating abundance estimates) and sei whales (using an appropriate abundance estimate and stock boundary).

The Panel concluded that the Scientific Committee should consider the most appropriate way to ensure that this review is completed. The Panel considered it premature to advise when a further review should be conducted.

17.1.2 Response of the Proponents

SC/61/JR1 summarised the views of JARPN II scientists to SC/61/Rep1 and described the manner in which the main scientific suggestions would be addressed. Overall, the Proponents considered SC/61/Rep1 to be an objective and balanced review of the first six years of the programme. They welcomed the comments and suggestions received, and considered that many would lead to improvements in programme research. The Proponents also noted that many of the comments apply to assessments of other species and stocks currently considered under the RMP and AWMP, particularly with regard to issues of stock structure.

Several of the papers presented to the Panel were revised in response to comments and submitted to this meeting (SC/61/JR2-9). SC/61/JR1 summarises additional recommendations from the Panel that Japanese scientists have agreed to, at least in principle. Some of these will be addressed in the near future, while others will take longer to implement given the complexity of the research programme, data availability or other logistics.

However, the Proponents could not agree with all of the comments and recommendations made by the Panel. Some involved considerable logistical or financial implications, such as the research that had been recommended by the Panel to compare lethal and non-lethal methods. The Proponents offered to review and summarise existing data that might be helpful to such a research project. However, they did not consider it feasible to add the study itself to the already ambitious research objectives of the JARPN II programme. Another example is that the Proponents did not anticipate being able to undertake a comparative contaminant analysis using samples from by-caught minke whales from J-stock. They explained that fishermen are currently only required to obtain a sample for genetics before a carcass is released for market. Fishermen do not have the expertise to select and collect the required internal tissues and so, as it currently stands, the necessary samples would not be available for study.

The Proponents also did not agree in principle with a few comments and recommendations, as explained in SC/61/JR1. For example, they did not agree with the general recommendation of the Panel to include MSYR(mat)=1% in calculations of the effect of the catches on the stocks. It was their view that this would not be consistent with other on-going IWC assessments under AWMP. They agreed that *IST*s would provide the best basis for evaluating the effects of catches on the stocks but noted that the plausibility of different scenarios and parameters should first be discussed in detail and agreed by the Scientific Committee. They also did not agree with the recommendation to include stock structure scenarios C and D for the Western North Pacific common minke whale. It was their view that these scenarios are no longer plausible in light of recent data and that this issue should also be examined by the Scientific Committee. Finally, the Panel had suggested that the effect of the research on North Pacific sei whales be recalculated without extrapolation, based on the JARPN II boundary at 170°E. The Proponents commented that there is no significant genetic heterogeneity in that species and so an assessment without the extrapolation would not provide meaningful information. However, they are undertaking additional analyses to further justify and quantify the extrapolation factor.

17.1.3 Discussion of the Scientific Committee

The Committee received the Panel report and the response prepared by the Proponents, as well as several papers with new or revised information based on Panel comments (SC/61/JR2-9) discussed in sub-committees. The Committee commended the Panel on having undertaken its review in a critical but constructive manner. However, it also expressed concern that the Panel was not provided with the information and guidance necessary to review programme progress, to draw conclusions regarding the appropriateness of programme sample sizes, and to assess the effects on two of the stocks (common North Pacific minke whales and sei whales).

Some members highlighted concerns in SC/61/Rep1 regarding slow progress to date on ecosystem modelling, a primary goal of JARPN II research. It was the view of these members that lack of progress on a primary objective should be of considerable concern to the Scientific Committee, and noted that similar concerns had been raised in the 2006 IWC review of the JARPA programme (IWC, 2008d). They further commented that there have been noteworthy advances in the field of ecological modelling since the start of the JARPN II research programme, and that these should be reviewed and incorporated. They highlighted the importance of sensitivity analysis to inform decisions on what data are most needed to improve predation models (Boyd, 2002; Overholtz and Link, 2006; Trzcinski *et al.*, 2006), the

importance of novel modelling approaches to inform ecosystem-based management (Hjermann *et al.*, 2007; Hjermann *et al.*, 2004a; Hjermann *et al.*, 2004b; 2004c) and recent advances in data collection for, and analysis of, cetacean-habitat relationships (Doniol-Valcroze *et al.*, 2007; Friedlaender *et al.*, 2006; Redfern *et al.*, 2006; Stevick *et al.*, 2008; Tynan, 2004). It was their view such approaches should be evaluated and incorporated as a matter of urgency, to ensure that JARPN II sampling is as efficient as possible and that models can differentiate between alternative hypotheses of ecosystem dynamics. These members recommended that field sampling be suspended until the JARPN II programme is re-designed such that it can be adequately reviewed.

Others responded that while more emphasis must be placed on the ecological modelling, SC/61/Rep1 had also described the JARPN II programme as ambitious, noted that it is still in its early phases and recognised that the data obtained thus far have the potential to be of great value in ecological modelling. They also disagreed with the conclusion that JARPA had failed to meet one of its primary objectives. Although it has not yet been possible to estimate the natural mortality rate from JARPA data, the Proponents commented that new analyses with different methodologies are still being pursued for that research.

SC/61/Rep1 had severely questioned the scientific value of the programme's small and unrepresentative catches of sperm whales. Some members reiterated the Panel's questioning of the value of the data derived from sperm whales against all of the objectives of the programme. When asked how the Proponents would respond to these criticisms, the Proponents clarified that the initial field work had focussed on small sperm whales for logistical reasons, and that preliminary Ecopath modelling confirmed the potential for a species effect. They therefore plan to increase their capability to take larger animals. However, because the ecosystem model is still in the early stages of development they will continue to take a small number of samples, including larger animals, and will include areas where sampling was previously limited. Some members expressed strong concern that notwithstanding broader criticisms they have about the overall JARPN II programme, a decision by the Proponents to continue with the take of sperm whales brings into question the credibility and purpose of the review process itself. In the view of these members, a refusal to alter any aspect of the lethal sampling, even when confronted with such strong criticism from a review, brought into question the value of the time and money invested in this process. The Proponents expressed their strong disagreement with this and expanded their explanation above.

SC/61/JR1 had left some members uncertain regarding the Proponents' response to the Panel recommendation for a study of lethal versus non-lethal research methods. It was clarified in discussion that while this will not be considered an additional objective of JARPN II, the Proponents do consider this an important point and are interested to undertake a study. However, the nature of that research will be determined upon further reflection and review of available data. They anticipated starting this review intersessionally.

The Committee sought further clarification from the Proponents as to their plans and timeline to develop sub-objectives, as recommended by the Panel for future review purposes. The Proponents agreed that such milestones should be important components in JARPN II research, but were not yet prepared to commit to specific details given the complexity of the research programme. Some members specifically requested that the details of short-term objectives be brought back to the Committee.

Some members expressed strong concern that the review had, through lack of any measurable objectives in the JARPN II programme, been unable to provide any of the key advice on sample sizes and effects on stocks. SC/61/Rep1 reflected the Panel's major concerns on this issue. These members noted that the Commission had particular concerns over the scientific basis for lethal sampling of a large number of whales each year, and wished also to be informed on how these takes might affect populations. Advice of this nature is central to the purview of the Scientific Committee and is arguably at the core of the advice requested by the Commission. These members stated that failure to deliver on these aspects of the JARPN II review emphasises the incomplete nature and limitations of the current review. The Proponents responded by noting their agreement with the Panel's recommendation to develop quantifiable sub-objectives, and the work already started in this regard, following which these concerns could be addressed.

17.2 Japan – JARPA II – Antarctic minke whales and fin whales

Details of the 2008/2009 field season can be found in document SC/61/O3. The document was not discussed by the Committee.

17.3 Japan – JARPN II – North Pacific common minke whales, Bryde's sei and sperm whales

Details of the 2008 field season are presented in documents SC/61/O4-6. These documents were not discussed by the Committee.

17.4 Iceland – North Atlantic common minke whales

SC/61/O10 presented an update on the progress of the Icelandic research programme on common minke whales. With the exception of satellite tracking, programme field work was completed in September 2007 when the target sample size of 200 common minke whales was reached. No decision has been taken by Icelandic authorities regarding implementation of the part of the programme concerning fin and sei whales. Data analyses are currently in various stages of completion. Some of the analyses had been delayed due to the fact that the sampling period was longer than anticipated, as well as for other logistical and economic reasons.

Vikingsson stated that analytical results for common minke whales are anticipated by early 2011, and so a final review of the research may be feasible in that year or, more likely, in 2012.

Some members noted that a key objective of the Icelandic research programme was the study of the ecological role

of common minke whales. These members asked the Proponents about progress against this objective. The Proponents responded that this had also been delayed by the longer sampling period and fact that they had not been able to find an appropriate scientist immediately. However, the work was initiated in 2008 as a PhD project.

17.5 Review of new or continuing proposals

17.5.1 JARPA II

There was no new information available for review under this agenda item. Two statements were received related to this agenda item and can be found in Annex R.

17.5.2 JARPN II

There was no new information available for review under this agenda item. Two statements were received related to this agenda item can be found in Annex R.

17.6 Evaluate the performance of the agreed procedure for reviewing scientific permit proposals, and periodic and final review of results from scientific permit research

SC/61/Rep1 was the first review following the agreed procedure for review of special permit proposals, as well as periodic and final review of results from special permit programmes. The Committee discussed the implementation of this procedure, and especially the selection of Panel participants. The Committee clarified that this discussion was in no way a reflection on the scientists that served on the Panel in this case, but solely a discussion of process.

'Annex P' indicated that the review should be undertaken by 'a small specialist workshop with a limited but adequate number of invited experts (who may or may not be present members of the Scientific Committee). A limited number of scientists associated with the proposal should attend the workshop in an advisory role, primarily to present the proposal and answer points of clarification. It is important that the composition of the specialist group is considered balanced and fair' (IWC, 2009o, pp.398-99).

SC/61/SCP1 questioned whether the 'Annex P' process produced a partial and objective review panel. The authors identified 'independence' as an important quality of a review panel member, whereas at least five members of the Panel had published on data from one of Japan's special permits or with a scientist affiliated with such a programme. That half of the invited experts had a direct link to the programme under review raised concerns about the perceived or actual independence achieved in the process. One of the authors had approached the Committee Chair requesting that a 'conflict of interest' statement be obtained from each member of the Panel, but this request was not acted upon. This was viewed by the authors as a missed opportunity for transparency in this process. On this topic, the authors believed that members of the Scientific Committee should also be allowed to observe the proceedings, while playing no role in closed discussions or conclusions. 'Annex P' is silent on the issue of observers and specific requests by the authors to observe the process last year were denied. Finally, a large percentage of the Panel were regular members of the Scientific Committee, at least four of which had played an important role in earlier reviews of special permits. This raised the question of whether this review marked a true departure from the previous review process. The authors recommended that the criteria for panel eligibility be more clearly specified, that a 'conflict of interest' statement be required from participants, that Committee participation on the panel be limited, and that representatives of national delegations be permitted to observe.

Bjørge clarified that the procedure used to identify experts for the review panel in this case had followed the agreed procedure. Based on the list of names nominated by the Standing Steering Group (SSG), the SC Chair, Vice-Chair and the Head of Science made a final selection of 14 experts. However, it was difficult to co-ordinate participants and dates and some of the initially invited participants declined. Ultimately, 18 of the nominated experts were invited. When some nominated experts with particular specialties declined, the Chair, Vice-chair and Head of Science invited three experts not nominated by the SSG for required expertise. The final overall composition was considered to be balanced and fair in that there were (1) at least two experts for each topic to be considered, (2) a sufficient number of experts with background on the Scientific Committee and (3) a sufficiently broad range of views and perspectives. The final list of experts was approved by the SSG and he believed the Panel was both balanced and fair as witnessed by the scientific quality of the report.

With respect to a 'conflict of interest' declaration, Bjørge believed that given the difficulties in arriving at the consensus approach in 'Annex P', it was important not to divert from the process, especially after invitations had been issued and the correct process had been followed. The question of observers had been a difficult one, as 'Annex P' did not provided for observers; in fact Scientific Committee members do not attend workshops or other meetings as observers but rather as participants and so this would have been a new procedure, had it been allowed. One rationale behind 'Annex P' was to minimise outside influence on the Panel and the presence of observers, including their potential interactions with the Panel members outside sessions, might have been construed to do this. After careful consideration and consultation with the Chair of the Commission he had decided not to allow observers at this workshop and to place it on the agenda for discussion at the present annual meeting.

In discussion, some pointed out that if Panel members were permitted to have no relationship to special permit research then scientists with strongly voiced objections to lethal research should also be excluded. However, they considered those kinds of exclusions to significantly reduce the expertise available to the review. They expressed the view that the issue was one of balance. Balance between the need for expertise/knowledge and independence and that the need for expertise/knowledge should have priority. Some believed that the Panel members should not need detailed knowledge of the Scientific Committee to understand and review the science of its members, and so could be drawn exclusively from the independent scientific community. However, it was noted that a previous attempt to undertake a review for

RMP that did not include Scientific Committee members was ultimately not productive. One suggested alternative approach would be for a few SC members to be available to the Panel, perhaps providing presentations on relevant information. The Panel might also benefit from other technical updates relevant to a review, especially for rapidly advancing scientific fields like ecosystem modelling.

On the subject of 'conflict of interest' statements, some expressed the view that these should not be necessary, while others considered them a common requirement and unlikely to negatively impact panel building in the future. There was additional discussion of the subject of observer attendance, and what degree of interaction they might have with the Panel outside of the closed sessions. Bjørge clarified that these had not been allowed last year due to logistics and the desire to ensure candid comments from Panel members. Some agreed that this was an important consideration.

In conclusion, some were in favour of modifying the language of 'Annex P' to more clearly specify who may participate and observe. Others thought that it is difficult to obtain a panel that all would consider fair and balanced and adding specificity to the Annex would not necessarily be an improvement as it depends on the scientific objectives of the research being considered.

Discussion of procedure also focussed on the inability of the Panel to complete its assigned tasks. Some members expressed the view that, in the future, it may be worthwhile to review the Proponents' materials before scheduling the review to ensure that the Panel receives sufficient information. A question was raised as to whether the Panel would receive the response of the Proponents in order to judge how well they addressed the concerns (this is already provided for in 'Annex P'). There was a suggestion that the review process may need specific guidance on what portion of the Panel's recommendations must be accepted in order consider a Proponent's response acceptable. Materials prepared by the Proponents in response to a review could also be directed to the most appropriate sub-committee at the Scientific Committee for discussion (as was the case this year for stock structure discussions within Western North Pacific common minke whales and ecosystem modelling.

As noted by the panel, one factor that has limited progress in discussions about 'scientific whaling' is lack of a coherent framework for evaluating the relative merits of lethal vs non-lethal take. SC/61/O1suggested that cost-effectiveness analysis (CEA) could be used in this way. Unlike cost-benefit analysis (which requires that costs and benefits be measured in the same currency), CEA can accommodate different metrics for costs and effects (that is, outcomes or consequences). This is generally done either by standardising costs and seeing which treatment produces the better outcome, or by standardising the effects and seeing which method accomplishes the desired outcome at least cost. CEA has been widely used in health care (for example, by comparing which of two or more treatment options for cancer produces the best results given a fixed cost) and conservation (for example, by comparing which of various habitat conservation measures produces the greatest benefit per dollar cost). In the context of scientific whaling, the costs would be the effort required to collect samples (vessels, fuel, labour, and so forth). The primary effects would be the scientific information developed from the samples and the consequences of sampling on the populations. The simplest application of CEA in this case would probably be to standardise costs, which could be done by taking actual effort expended under the JARPN II or a similar programme of scientific whaling and considering the most effective non-lethal sampling programme that could be conducted for the same level of effort. This exercise would almost certainly highlight inherent tradeoffs between different types of effects (e.g., increasing information content might entail more negative consequences for the population). In that case, the choice between the two programmes would rest on assigning weights to the various effects, which inherently involves applying a set of values to this problem. The cost-effectiveness framework can therefore illuminate the tradeoffs that are present in choosing between the two programmes, but it cannot indicate (or is unlikely to indicate) which is preferable from a social perspective. Nevertheless, CEA could be useful in helping to objectively evaluate aspects of the problem that are amenable to quantitative analysis and in helping to focus discussions on a narrower set of normative issues.

In discussion, the author clarified that this would not be a simple analysis, and further thought would be required to weigh specific costs and benefits in the context of special permits. The Committee **welcomes** the scientific framework discussed in SC/61/O1 and **encourages** that it be developed and further discussed next year.

17.7 Work plan

The Committee recognised that a number of important considerations had been raised with respect to whether it was necessary or not to revise 'Annex P'. It noted that there was no need to establish a review panel in the forthcoming intersessional period and it agreed that the issue of possible revisions should be placed on the agenda for its meeting next year, to allow time for further reflection. The Review Panel had noted that it had not yet completed its review. It had asked the Scientific Committee to consider the most appropriate way to ensure that this is completed. The Committee agrees to discuss this as next year's meeting. Other issues relating to the work plan are dealt with under Item 22; budgeting matters are considered under Item 24.

18 WHALE SANCTUARIES

The Committee received no new proposals for sanctuaries this year. The report of an international workshop on marine protected areas (SC/61/O20) was discussed under Annexes K and M.

19 SOUTHERN OCEAN RESEARCH PARNERSHIP

This item was placed on the agenda in response to a request from Australia, who developed the initiative on the Southern Ocean Research Partnership (SORP). A SORP

planning workshop took place in Sydney, Australia from 23 to 26 March 2009 where Committee members (and others) were invited to discuss and direct the initiative that was first proposed in the Commission last year (IWC/60/16).

The Chair stated that the purpose of the plenary session was to inform the Committee about the outcomes of the SORP planning workshop, to discuss the initiative's broad objectives, potential projects and its future work.

Gales introduced papers SC/60/O16 'Report of the Planning Workshop of the Southern Ocean Research Partnership (SORP)' and paper SC/60/O17 'Southern Ocean Research Partnership Workshop: Summary of Outcomes'.

The workshop participants agreed that: 'SORP is an integrated, collaborative, non-lethal whale research consortium that aims to maximise conservation outcomes of Southern Ocean whales through an understanding of the status, health, dynamics and environmental linkages of their populations and the threats they face.' SORP will include participation and collaborations which are global and will be open to all nations and research organisations who wish to contribute to the SORP objectives. These partners will be essential in delivering the outcomes from the SORP.

The primary focus of the SORP is the large whale species managed by the IWC, including the humpback whale, blue whale (both Antarctic and pygmy forms), fin whale, Antarctic minke whale, sei whale, southern right whale, and sperm whale. Killer whales will also be considered as an important component of the Southern Ocean ecosystem. The Southern Ocean will be the regional focus of the partnership, but relevant research efforts will also include associated migratory corridors and breeding grounds.

Two overarching research themes were agreed at the workshop, under which research proposals will be assessed. The research questions (and associated projects) listed under these themes represent a summary of the core questions identified by the group (full details can be found in the workshop report).

Theme 1: Post-exploitation whale population structure, health and status.

Theme 2: Changing atmosphere and oceans: Southern Ocean whales and their ecosystems.

A two-tiered SORP research framework was developed and agreed. Specific criteria for these two types of project will be developed and agreed by the SORP Steering Committee. The first tier of SORP core projects will drive the SORP initiative and directly address the SORP objective of improving our understanding of the status and health of whales within the Southern Ocean ecosystem and the threats and environmental changes they may face. The second tier of SORP associated projects may contribute to the SORP objectives, however, they will be effectively standalone research efforts that do not necessarily benefit from the collaborative framework, or are likely to be focused on smaller spatial scales, or on species of lesser interest to the consortium.

The workshop agreed on the need for a symposium and workshop to review and update developments in non-lethal research techniques for whales: 'Living Whales in the Southern Ocean Ecosystem: A symposium and workshop on non-lethal research techniques'. This international meeting will be planned for 2011. A Steering Committee to plan and conduct this initiative will be established within the SORP.

The workshop recognised that many potential SORP projects would benefit from a single-season, multi-platform, integrated and coordinated research effort around the Southern Ocean (e.g. The SORP Year of the Whale: 2013/14). Planning for such events takes many years, and such an effort would need to be incorporated within other large-scale research efforts. A Steering Committee to plan and conduct this initiative will be established within the SORP.

A SORP Steering Committee will be formed to oversee the work and direction of the Partnership while the Australian Marine Mammal Centre will assist in the overall coordination of SORP and manage the reporting responsibilities. Membership of the steering committee will, at least, include regional representation from the participating governments. Membership of the IWC (e.g. Chair of the Southern Hemisphere whale Sub-Committee) would also be advantageous, as would membership from major multi-disciplinary programs such as the Integrated Ice and Ecosystem Dynamics program (ICED).

The Steering Committee will also assess where existing and newly proposed research efforts fit within the research framework (core or associated status) and facilitate external peer review of proposed research projects for scientific merit. It will assess the relevance of the proposal to SORP objectives and the degree to which it benefits from the partnership framework. Qualifying projects will be centrally registered as 'core' or 'associated' SORP projects.

The Committee **welcomes** this initiative and the ongoing commitment of Australia to the programme. It also welcomed this large-scale integrated research concept and its broad objectives.

In discussion, the need to define specific projects, objectives and sub-objectives, both long and short term, was seen as critical for the success of SORP. It had not been possible to achieve this level of detail in the time available at the initial workshop where the focus was on the broader questions, However, Gales acknowledged that the defining specific objectives and sub-objectives is essential and will be a core task for the Steering Committee. He further noted that specific projects will require their own small steering committees which can then define their own specific objectives.

It was noted that at the October 2009 Biennial Conference on the Biology of Marine Mammals there will be a symposium on a large regional collaborative research project (SPLASH and YONAH). The future development of SORP will benefit from the lessons learned in the planning and execution of these large-scale projects.

The potential role of CCAMLR in SORP was noted and the joint CCAMLR/IWC workshop (SC/61/Rep2)

outcomes feed directly into the SORP themes. It was suggested that a formal involvement of CCAMLR could be established through the SORP Steering Committee, or simply through a dialogue between the organisations. It was suggested that CCAMLR's Ecosystem Monitoring and Management group is probably the right forum in which to raise potential collaborations between CCAMLR and SORP.

There was some discussion on the funds available for SORP projects. It was clarified that funding will be derived primarily through science funding mechanisms of the participating governments and organisations. Initially it is hoped national programmes can direct efforts to SORP objectives and SORP can be used to leverage other funds.

There was considerable support expressed for the 'Year of the Whale' project in that it was agreed that conducting a co-ordinated well-designed multi-vessel synoptic survey programme on a circumpolar scale would address the major questions on whale distribution and abundance that it is difficult, if not impossible to address in a piecemeal fashion. Such a landmark project would be highly challenging. To attempt such a project would require that its main objectives are identified as soon as possible so the resources (including vessel time which needs to be secured well in advance) needed to achieve the objectives can be secured. While the total cost may be high, in the larger scale of Antarctic research, the investment of each country may not be that large. While such a synoptic circumpolar survey would be ideal, the difficulties in obtaining multiple vessels conducting months-long synoptic surveys were noted. If a full circumpolar programme cannot be realised, alternative approaches, such as more targeted spatial surveys or large scale, synoptic acoustic surveys would have to be considered.

The scope of projects that would fit within SORP's hierarchical scheme of core and associated projects was discussed (e.g. how would breeding habitats and structure fit into the scheme). Gales noted that there are clear linkages between all of the large whales and their lower latitude breeding grounds so these projects would be considered by the Steering Committee. All projects, however, should be assessed based on how well they will benefit from the SORP framework. Small, regional projects are likely to gain less from the SORP framework than larger, broad-scale projects.

It was suggested that SORP could have a broader species focus than initially outlined at the workshop to include other baleen and toothed whales (e.g. small cetaceans, dwarf minke whale, pygmy right whale). Gales recalled that they discussed this issue at length and recognised that directed research is extremely challenging for some species due to the infrequency of encounters. Small and other cetaceans are not excluded and it is hoped useful data will be provided by SORP projects even though they be the projects aimed to address questions related to large whales.

Gales reported that the formation of the SORP Steering Committee was the next key step in SORP's development (it will work towards identifying specific projects and objectives). Through discussions with the members of the IWC Scientific Committee, Gales hoped that he will be able to finalise the membership of the SORP Steering Committee such that their work can begin immediately. When the SORP Steering Committee has been established, it is hoped that specific projects and objectives can be identified and that ways to secure necessary resources identified. If sufficient progress has been made then details of the SORP projects will be presented for discussion at the next year's meeting.

The Scientific Committee recognised that one of the biggest challenges for the newly established SORP Steering Committee will be to secure support and resources from governments. Several members reported that internal negotiations were ongoing and hoped that commitments to allocate resources toward the SORP initiative could be announced very soon.

In conclusion, the Committee **endorses** the general approach developed for the SORP described above and looks forward to receiving further reports on progress with respect to further defined objectives and proposals, and to providing input to its ongoing work. Gales thanked attendees for their helpful and positive comments.

20 ACTIONS ARISING FROM INTERSESSIONAL REQUESTS FROM THE COMMISSION

20.1 Response with respect to matters raised in the intersessional correspondence group

20.1.1 Background

At the March 2008 Intersessional Meeting on the Future of IWC, a large part of the meeting focused on ways to improve approaches to discussions and negotiations within the organisation (see IWC/61/7rev). The role of science was one of seven broad areas addressed.

There was agreement that the provision of sound scientific advice is essential to the functioning of the IWC and that one of the more positive features of the organisation is its strong scientific element. It was noted that the work of the IWC Scientific Committee is internationally recognised as providing the best available knowledge on conservation and management for cetaceans and that the Committee has a good record in achieving consensus on nearly all of its recommendations to the Commission. Nevertheless, comments were made by some participants that the current workload of the Scientific Committee is too high, difficult to prioritise and, mainly because of its timing in conjunction with the Commission, not adequately integrated into the policy work of the Commission. The need to review the composition and function of the Scientific Committee was also suggested (e.g. improving the involvement of scientists from developing countries and the procedures for inviting scientists to the Committee).

With respect to the role of science and the Scientific Committee, the Commission agreed at its 2008 Annual Meeting that there are aspects of the Committee's work and functioning that would benefit from review. It therefore decided to establish an Intersessional Correspondence Group on Issues Related to the Scientific

Committee (ICG) to address the following issues (see Annex A of IWC/M09/5 for full Terms of Reference):

(1) Consideration of the advantages and disadvantages of separating the annual meeting of the Scientific Committee from that of the Commission;

(2) Consideration of ways to increase participation in the Scientific Committee of scientists from developing countries in the work of the Scientific Committee;

(3) Consideration of ways in which the Scientific Committee can assist in improving the knowledge and technical capability of scientists from countries where cetacean research is in its infancy so that they can better contribute to the work of the Scientific Committee and to conservation and management issues within their region;

(4) Review of the process for inviting participants to the Scientific Committee.

IWC/M09/5 collates and summarises the responses of 16 countries who replied to the Secretariat's call for comments (i.e. Argentina, Australia, Brazil, Denmark, France, Germany, Italy, Ireland, Japan, Mexico, The Netherlands, New Zealand, Peru, Spain, UK, and USA).

The report was well received by the Commission at its intersessional meeting in Rome in March 2009 (IWC/61/7). In summary, the responses received showed that there was general agreement that the Scientific Committee worked effectively and that its processes were sound, but that ways should be investigated to: (a) further identify the advantages and disadvantages of separating the annual meeting of the Scientific Committee and make recommendations; (b) further identify ways to improve communication between the Scientific Committee and the Commission and make recommendations; (c) facilitate the participation of suitably qualified scientists from developing countries in the priority work of the Scientific Committee and to ensure that the priority work included issues relevant to a broad range of countries and make recommendations; and (d) facilitate capacity building for scientists in developing countries with respect to cetacean conservation and science and make recommendations.

In concluding the discussions at the intersessional meeting, the Chair of the Commission had observed that there was support for the separation of the Scientific Committee and Commission meetings. With respect to a way forward, he proposed that the Scientific Committee and Finance and Administration Committee be requested separately to review the issues in Madeira and to forward their recommendations to the Commission. The Commission would then establish a small group in Madeira to continue the work.

20.1.2 Response of the Committee

The Committee examined the summary of responses given in IWC/M09/5 and a general discussion ensued in plenary. Given the relative shortage of time, the Committee authorised the Convenors to complete this section of the report after the meeting. The report is structured following the report in IWC/M09/5. The Committee did not spend time considering financial aspects as these would be discussed in the Finance and Administration Committee, although some general comments were made.

(1) Consideration of the advantages and disadvantages of separating the annual meeting of the Scientific Committee from that of the Commission; this will include inter alia:

> *(a) logistical and financial aspects;(b) scientific aspects;(c) communication with the Commission;(d) confidentiality aspects;(e) consideration of the applicability of other 'models' such as that of the IPCC.*

The Committee noted that most of the primary issues relevant to the Scientific Committee had been included in the summary report of IWC/M09/5. The Committee wished **draw the Commission's attention** to the matters raised below.

(1) Some separation between the two meetings could have advantages in terms of extra time to finalise the report, and the ability to write an executive summary – both of which could improve communication with the Commission.

(2) However, it also draws the Commission's attention to the disadvantage of the time allowing additional analyses to be undertaken and presented directly to the Commission without the Committee's ability to comment on these – while a Rule of Procedure might be written to try to prevent such analyses being presented to the Commission this might prove difficult to enforce in practice; the greater the gap between the meetings, the greater the likelihood of additional analyses.

(3) Should the Commission decide to separate the two meetings, careful consideration needs to be given to:

> (a) Whether the Scientific Committee meeting is moved back or whether the Commission meeting is moved forward – the present meeting time (May-June) is generally feasible for scientists from both hemispheres but earlier dates may not be suitable for those from the Southern Hemisphere given their summer field season;
> (b) Giving the Scientific Committee advance warning before at least one meeting, particularly if the meeting is made earlier as this will affect the ability to complete proposed intersessional tasks on time.

(4) The Committee **agrees** that the iterative nature of its work would require Annual Meetings if its present workload remains.

(5) The Committee agrees that the rotation of venues assist in its ability to widen participation, facilitate the attendance of different local scientists (see items below) and include regional issues on its agenda.

(6) The nature of the Committee's work is very different from that of IPCC and it believes that the present IWC model is suitable.

(2) Consideration of ways to increase participation in the Scientific Committee of scientists from developing countries in the work of the Scientific Committee; this will include inter alia:

> *(a) selection process and preparation for meeting;(b) financial aspects;(c) relationship with the overall invited participant process (see 4 below).*

Again, the Committee noted that most of the primary issues relevant to the Scientific Committee had been included in the summary report of IWC/M09/5. The Committee wished **draw the Commission's attention** to the matters raised below.

(1) The Committee agrees that its primary function is as an advisory body rather than an educational body;

(2) The Committee supports increased participation of suitably qualified scientists from developing countries;

(3) If the increased participation is through the invited participant process, then the current rules for selection should apply i.e. the decision process is via the Committee Chair, Head of Science and convenors, taking into account priority topics – the present Rules allow for persons selected as IPs from developing countries to be designated as national delegates should they and the Governments so wish;

(4) Although a seminar would be difficult to arrange, the new 'Scientific Committee handbook' (see Item 25) will be a valuable tool for briefing new scientists;

(5) The fundamental issue is probably financial.

(3) Consideration of ways in which the Scientific Committee can assist in improving the knowledge and technical capability of scientists from countries where cetacean research is in its infancy so that they can better contribute to the work of the Scientific Committee and to conservation and management issues within their region; this will include inter alia:

> *(a) possibility of regional training workshops (consider collaboration with other organisations, e.g. FAO, UNEP, IUCN);(b) provision of materials (e.g. documents);(c) financial aspects.*

Again, the Committee noted that most of the primary issues relevant to the Scientific Committee had been included in the summary report of IWC/M09/5. The Committee wished **draw the Commission's attention** to the matters raised below.

(1) The Committee is supportive of the idea of capacity building and many of its members already participate in such workshops around the world – this may remain the most effective approach;

(2) If the Committee is to assist in specialist workshops (on its own or in conjunction with other bodies) on complex issues, it essential that the attendees have reasonable quantitative skills to be able to benefit from them – the Committee is not the appropriate body to provide training in such skills;

(3) The Secretariat is making arrangements for up to two libraries in developing countries to receive a complete set of IWC volumes and the *Journal of Cetacean Research and Management*;

(4) As above, the new 'Scientific Committee handbook' (see Item 25) will be a valuable tool for scientists from developing countries as this will be web-based and include special sections on the Committee's work and key references;

(5) The Secretariat is currently investigating the costs involved in digitising all of the Scientific Committee papers.

(6) Again, a fundamental issue to resolve is probably that of finances.

(4) Review of the process for inviting participants to the Scientific Committee; this will include inter alia:

> *(a) objectives for inviting participants;(b) reasons for non-inclusion of IWC-funded participants on national delegations of developed countries;(c) selection process and advice;(d) financial aspects.*

Again, the Committee noted that most of the primary issues relevant to the Scientific Committee had been included in the summary report of IWC/M09/5. The Committee wished **draw the Commission's attention** to the matters raised below.

(1) The Committee agrees that the primary purpose of invited participants is to assist it in providing advice to the Commission on key issues - such scientists should be able to contribute to the priority work of the Committee.

(2) The last time the Committee undertook a major review of its process for inviting participants (IWC, 2003a) it also introduced the rule that enabled invited participants from developing countries to become national delegates.

(3) The Committee stresses that funded invited participants play an irreplaceable role in its work – and represent exceptional value for money as they receive only travel and subsistence.

(4) Notwithstanding the above, the Committee is sensitive to the need to improve the participation of scientists from developing countries as discussed under section (*2*) above.

20.2 Response to the request from the SWG on the Future of the IWC

20.2.1 Background

The Commission is engaging in major discussions about its future (IWC, 2009). These are complex and involve a number of issues, some of which have a scientific component. At the recent intersessional meeting in Rome (IWC/61/7rev), the Commission authorised its small working group on the future of the IWC (SWG):

> …. to request advice on issues, as required, from the Scientific Committee. The Scientific Committee is requested to make provision for urgent consideration of any such request from the SWG and to report to IWC/61.

The report of the SWG (IWC/61/6), including Annex G of that document, refers to the SWG and its request for advice from the Committee. In particular, this relates to the effects of catches of minke whales in the western North Pacific and the scientific analyses provided to support the Japanese proposal for an interim (5-year) catch limit whilst negotiations continue. The SWG report makes it clear that the Commission has not completed its discussions on its future and that 'nothing is agreed until everything is agreed'.

There was some discussion and disagreement within the Committee as to the correct interpretation of the request by the SWG for advice. The Committee was not in a position to resolve this.

The interpretations put forward involved three potential tasks referred to in IWC/61/6 and its Annexes:

(1) review the Data Availability Agreement with respect to tissue samples, DNA and sequenced data;

(2) develop plans to complete a full *Implementation Review* for western North Pacific common minke whales as soon as possible and certainly before the end of any interim period;

(3) begin to assess and provide its advice on the Japanese proposal and the scientific analyses provided to support it (SC/61/O15) noting that scientific advice on the effects of proposed catches will be required by the 2010 Annual Meeting.

Task (3) was the task that involved disagreement as to whether it was appropriate to include it. There was a consensus that the advice was clear that the Committee needed to provide a work plan and timeline to assess the Japanese proposal, but there was not consensus as to whether this had to be completed by IWC/62 (2010), nor was there agreement on whether or not the Committee should begin the process of reviewing the Japanese proposal during the present meeting.

Noting that the Commission itself was the appropriate body to determine the tasks of the Committee and also that in the advice below the Committee was in effect including work plans for future work that considers both (2) and (3), the Committee **agrees** that despite the different interpretation of IWC/61/6, it will present its views under each of items (1)-(3). The Commission would then inform the Committee of its wishes for the Committee's future work plan.

20.2.2 Response to the Commission's instructions

(1) REVIEW OF DATA AVAILABILITY AGREEMENT

Assessing and evaluating the Japanese proposal involves providing management advice and thus Procedure A of the Data Availability Agreement (DAA) applies. The present agreement is not specific with respect to samples themselves (genetic or otherwise) but experience from previous work under Procedure A has been that the raw laboratory analysed data are available but not the tissue samples themselves (e.g. see the extensive discussions of genetic data during the Bowhead *Implementation Review*, and the successful RMP *Implementations* of western North Pacific Bryde's whales and North Atlantic fin whales). This approach has been considered satisfactory in the past and the Committee **agrees** to continue with this approach. If tissue samples are to be considered under the terms of the DAA then there are a number of important technical and logistical issues (including CITES permits, timing, laboratory calibrations, etc) that would need to be addressed.

(2) TIMELINE AND WORK PLAN FOR COMPLETING AN *IMPLEMENTATION REVIEW*

The Committee has agreed a process for conducting *Implementations* and *Implementation Review*s, including a timetable (IWC, 2005b). See also Fig.1 of this report.

An *Implementation* consists of: (1) a *Pre-Implementation Assessment*; (2) trial structure development; (3) conditioning and agreeing final trials structure; (4) reviewing results of final trials; (5) completing the *Implementation* and making recommendations. Steps (2) - (5) should be completed within 2 years of completing step (1).

An *Implementation Review* consists of: (1) reviewing new data collected since the *Implementation*; (2) determining whether the new data suggest that revisions to the trials structure are required; (3) agreeing any new trials (equivalent to returning to step (2) or (3) of an *Implementation*); (4) completing the *Implementation Review* and making recommendations.

The *Implementation* for western North Pacific minke whales, completed in 2003, was not conducted under the process summarised above. An *Implementation Review* is thus overdue but the Committee agreed in 2007 (IWC, 2008e) that it should return to the *pre-Implementation assessment* stage, such that the *Implementation Review* becomes effectively an *Implementation*. The 2003 *Implementation* focussed on the impact of catches on the 'O' stock although it provided information on J-stock (which led to the present in-depth assessment process being undertaken in the Committee). To fully evaluate the impact of catches on stocks, hypotheses related to 'J' stock (or stocks) will also need to be a focus of the *Implementation Review*.

With this background, the Committee developed the following approach and timetable.

If the *pre-Implementation assessment* can be completed at next year's Annual Meeting, the *Implementation Review* should be completed at the 2012 Annual Meeting. Completing the *pre-Implementation assessment* at the 2010 Annual Meeting will require an intersessional meeting with Terms of Reference to address:

(1) stock structure hypotheses;

(2) estimation of dispersal rates;

(3) abundance estimation (including $g(0)$);

(4) future sighting survey programmes;

(5) catch data (including alternative series);

(6) future whaling operations;

(7) other anthropogenic removals, including incidental catches; and

(8) biological parameters.

A steering group will be required and the Committee **agrees** that this should be the responsibility of the Chair, Vice-Chair and Head of Science, in consultation with the Convenors.

(3) TIMELINE FOR ADVICE ON THE PROPOSAL FOR AN INTERIM CATCH OF MINKE WHALES BY JAPANESE SMALL-TYPE COASTAL OPERATIONS AT THE 2010 ANNUAL MEETING

The Committee has previously agreed that the most appropriate way to provide advice on the effects of catches on stocks of whales not subject to aboriginal subsistence whaling is within the framework of *Implementation Simulation Trials* that are used in the RMP (IWC, 2008f). It was noted that this conclusion was also reached by the JARPNII review panel (SC/61/Rep1) with respect to the effect of JARPNII catches on western North Pacific minke whales. Under Item 10.2.3 (western North Pacific minke whales) this year, the Committee had agreed that *Implementation Simulation Trial* methodology should be used for assessment purposes.

The Committee noted that providing advice within an *IST* framework is not necessarily the same as using the *CLA* itself to calculate catch limits. In particular some proposals (e.g. those for scientific permit catches and the present Japanese proposal) specify the catches and ask for the Committee's advice on the effects of those catches on stocks, rather than asking the Committee to provide advice on a catch limit using the *CLA* (i.e. in accord with the Commission's conservation and user objectives for commercial whaling). Having said that, it would be possible in any comparison of trajectories to compare *inter alia* those for the proposed catches, those for zero catches and those for catches under the *CLA.* As noted under (8) it is for the Commission to set conservation objectives with respect to whaling.

Plans to complete an *Implementation Review* for western North Pacific minke whales are given under Item (2) above. However, this will not be completed before the 2012 Annual Meeting. Assessment and provision of advice by the 2010 Annual Meeting will require an intersessional workshop.

That intersessional workshop will need to (subject to determination by the Commission): complete steps (1) – (5) in the *IST* proposal below, as well as providing further review of the scientific analyses in SC/61/O15, and perhaps consider the possibility of using the other approaches (such as that developed under the AWMP to provide interim advice for aboriginal subsistence whaling). The Committee will need to develop a steering group to ensure that the appropriate analyses are undertaken in a timely fashion and the Committee **agrees** that this should be the responsibility of the Chair, Vice-Chair and Head of Science in consultation with the Convenors.

The Committee notes that the approach given below could be used to fulfil an instruction to develop a timeline to be able to develop advice in time for the 2010 Annual Meeting. In presenting this approach the Committee recognises that the only way to provide advice in such a timeframe is to adhere to the framework of the 2003 *Implementation*. The approach requires that:

(1) The trials *structure* used will be that in the 2003 *Implementation*, including stock structure hypotheses; i.e. new information will not be used to update the trials structure[10];

(2) The abundance estimates, including consideration of how to use estimates of g(0), will be updated;

(3) The dispersal rates will be updated using new genetic information;

(4) The mixing proportions, and hence the mixing matrices, will be updated using new genetic and morphometric information;

(5) The time-series of catches (including bycatches)will be updated;

(6) The trials will be reconditioned based on the modifications to the parameters given (2) – (5).

(7) The trials will be used to investigate the effect of the proposed interim catch on the 'O' and 'J' stocks, including the provision of trajectories[11] of population size under at least zero catches, incidental catches only, and incidental catches and the proposed interim catches; and

(8) Advice will be provided on the effects of the proposed catches in the context of conservation objectives agreed by the Commission.

The plausibility weights assigned to the trials will be those on which the 2003 *Implementation* was based[8]. In particular, the plausibility weights assigned to MSY rates of 1% and 4% on the mature component of the population will be as for the 2003 *Implementation*[12].

Although this process is similar to an *Implementation Review*, it does not follow completely the Guidelines and Requirements for *Implementations* (IWC, 2005c). As such, following the above abbreviated approach may delay the process of completing an *Implementation Review* by up to a year if both paths (2) and (3) are followed. The primary difference between this process and the undertaking of a full *Implementation Review* involves the treatment of J-stock.

[10] One exception could be with respect to stock structure hypothesis C. That was based almost completely on the application of the 'Boundary Rank' method. As noted in SC/61/Rep 1, the considerable new genetic data could be used in a new Boundary Rank analysis. This could either confirm the need to retain Hypothesis C or allow it to be rejected. The situation is more complex for the other hypotheses.

[11] The list of scenarios that the Committee will produce trajectories for will depend on the conservation objectives provided by the Commission.

[12] Unless the Committee agrees to change the range of MSY rates for use in the RMP at its 2010 Annual Meeting (see Item 5).

COMMENTS ON SC/61/O15

The Committee notes that while it spent a considerable amount of its time assessing western North Pacific common minke whales, and updating information in the appropriate working group (Annex G1), it was unable to spend very much time considering the details of SC/61/O15.

In the context of the Committee beginning to assess and providing advice on the proposal for Japanese small-type coastal whaling before providing advice in 2010, it notes that SC/61/O15 provides some of the information needed to complete steps (1)-(5) of (3) above. Specifically, it contributes information on g(0) and recent abundance, incidental catches, the sex ratio of catches, some of the stock structure hypotheses considered in 2003 and the proportion of 'J' stock spatially, which will be useful when revising the conditioning of the trials.

However, compared to the approach outlined above, the analyses in SC/61/O15 differ in a number of respects from the 2003 *Implementation*, in particular with respect to MSYR and the range of stock structure hypotheses considered. SC/61/O15 explains the reasons its authors believe justify these differences. However, the discussions within SC/61/Rep 1 (on stock structure and effect of catches upon stocks) and Annex G1 (on stock structure) reveal that these modifications are not acceptable to all the Committee at this time.

In summary, the Committee **agrees** that whilst SC/61/O15 contributes useful information for its review of the Japanese proposal, further work and an intersessional workshop is needed if the Committee is to provide advice in 2010. A steering group will be required and the Committee **agrees** that this should be the responsibility of the Chair, Vice-Chair and Head of Science, in consultation with the Convenors.

STATEMENTS

Although the Committee agreed the above text by consensus, a number of participants also wished to make statements on the issue. These are given below but they were not provided in writing until after the close of the Plenary session and so there was no time available for the Committee to discuss them or for responses to be drafted if other members had wished.

20.3 Statements on Item 20.2

(1) COOKE AND OTHERS

While agreeing that the above proposals are a reasonable response to the request of the Commission's Small Working Group, Cooke, Apostolaki, Bass, Brownell, Burkhardt-Holm, Kock, Iniguez, Leaper, Lyrholm, Ritter, and Simmonds noted that option (3) would involve providing, at least for an interim period, management advice that is not based on using the RMP to calculate catch limits. Although option (3) envisages using the framework of the 'RMP implementation trials' to provide advice, it is important to remember that the RMP is primarily a mechanism for determining sustainable catch limits, in which such trials are used only to aid decisions on area boundaries and related options. Under option (3) the RMP would not be used to determine catch limits. Instead, advice would be given on the effect on the stocks of pre-determined catch levels, which may exceed the limits that the RMP would allow. This is an important distinction.

(2) APOSTOLAKI

Apostolaki raised concerns about the process that was followed in addressing the SWG's 'request for the Scientific Committee to provide a draft, non-binding work plan and timeline to fully assess the Japanese small-type coastal whaling proposal'. She noted contradictions between the main text of IWC/61/6 and its Annex G. For example, while the main body of that report suggests Annex G was prepared 'to assist the Scientific Committee in providing advice on a work plan and timeline to assess Japan's proposal', Annex G itself 'instructs' the SC to undertake certain tasks and sets specific deadlines for completion of the work requested. Such differences have been a source of considerable confusion about whether Annex G provides suggestions or instructions to the Committee and thus, about what the Committee needed to do. She suggested that an appropriate process would have been for the Committee to have discussed Annex G as a first step to responding to the request for providing advice rather than to interpret the suggestions as instructions. There were also concerns about whether the deadlines used in Annex G had been decided on the basis of information in Annex D[13]. These dates are no longer appropriate and that emphasises further the need for the Committee to ensure that what was proposed in Annex G is the appropriate way forward.

(3) MIGUEL IÑIGUEZ

I do not support the abandonment of the methods that have been developed carefully over years by the Scientific Committee and believe that the *Implementation Review* process should be used and note that this would be expected to take at least until 2012. The timeline is dependent on a number of factors including availability of suitable data and an agreed set of stock structure hypotheses.

21 RESEARCH AND WORKSHOP PROPOSALS AND RESULTS

Table 13 lists the proposed intersessional meetings and workshops. Financial implications and further details are dealt with under Item 24.

Results from IWC funded projects are dealt with under the relevant Agenda Items.

21.1 Review results from previously funded research proposals

Results from IWC funded projects are dealt with under the relevant agenda items.

21.2 Review proposals for 2009/10

No unsolicited research proposals were received.

[13] Annex D, which provides the background material for Annex G, indicates that "if the 2003 Implementation is used, this [i.e. provide management advice and evaluate whether catch limits are acceptable] could occur at Madeira. If full Review occurs then would take at least until 2010 meeting"

Table 13
Workshops and intersessional meetings planned for 2009/10.

Subject	Agenda item	Venue	Dates	Steering Group
SOWER cruise: planning	Annex G, App. 2	Tokyo	24-26 September 2009	Q13
North Pacific sighting survey meeting	Item 10.9	Tokyo	27-28 September 2009	Q15
Pollution 2000+ Phase II scoping group meeting	Annex K, App. 2	Barcelona	February 2009	Q23
North Pacific minke whale meeting	Item 20.2.2; Annex G1	TBA	TBA	Q18
Workshop on Greenland fisheries	Annex E	Copenhagen	Spring 2009	Q2
MSYR review Workshop	Annex D, item 2.1	Seattle	Spring 2009	Q3
Pre-meeting AWMP (early start)	Annex E, item 2.1	Morocco?	2 day pre-meeting	Q1
Pre-meeting IA (early start)	Annex G, item 6.1.6	Morocco?	1 day pre-meeting	Q11

22 COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2010 MEETING

Revised Management Procedure (RMP)[14]

The following issues are high priority topics:

(1) conduct workshop to estimate the parameters of the environmental model and finalise the Bayesian meta-analysis so that a final decision can be made on the range for MSYR in the RMP at the 2010 meeting;
(2) complete review of the range of MSYR values for use in the RMP;
(3) finalise the approach for evaluating proposal amendments to the CLA;
(4) finalise the audit of the Bryde's whale survey data;
(5) use the Bryde's whale *Implementation Simulation Trials* to evaluate the effect size (and power) for current and historical age-composition data;
(6) previous (and any new) genetic power analyses for the western North Pacific Bryde's whales should be reviewed;
(7) the trade-off between the cost of finding Bryde's whales and successfully attaching satellite tags and the value of this information to address questions of stock structure should be evaluated;
(8) review the research proposal for the North Atlantic fin whale 'variant with research' to be submitted to the 2010 meeting; and
(9) review the North Atlantic fin whale abundance estimates for use in the CLA.

Aboriginal Whaling Management Procedure (AWMP)

The following issues are high priority topics:

(1) code (and hence validate) the sex-ratio method and the associated robustness tests;
(2) hold, if needed, an intersessional workshop to refine the specifications and implementation of the sex-ratio methods and the associated robustness tests so that a decision can be taken at the 2010 Annual Meeting on whether the sex-ratio method can be used to provide management advice;
(3) develop a short working paper on appropriate operating models for West Greenland fin whales;
(4) conduct an *Implementation Review* for the Eastern North Pacific gray whales; and
(5) review the progress on any new analyses and make a decision on the need for a pre-meeting to facilitate completion of the *Gray Whale Implementation Review* at the 2010 Annual Meeting.

Bowhead, right and gray whales (BRG)

The following issues are high priority topics:

(1) assess the stock structure and abundance of the Eastern Canada and West Greenland bowhead whales in order to advise the Commission as requested in Schedule 13(b)(3)(iv);
(2) perform the annual review of catch information and new scientific information for the B-C-B Seas stock of bowhead and Eastern North Pacific gray whales in order to advise the Commission as requested in Schedule 13(b)(1) and (2);
(3) review new information on all stocks of right whales, Western North Pacific gray whales, and the small stocks of bowhead whales; and
(4) review the report of the intersessional Steering Group on the assessment of southern right whales.

In-depth assessment (IA)

The following issues are high priority topics:

(1) produce agreed abundance estimates of Antarctic minke whales;
(2) conduct an analysis of ageing errors that could be used in catch-at-age analyses of Antarctic minke whales and review the results;
(3) continue development of the catch-at-age models of the Antarctic minke whales; and
(4) continue the examination of the differences between minke abundance estimated from CPII and CPIII, particularly the impact of sea ice on the abundance estimates.

Highest priority next year will be given to obtaining the abundance estimates of Antarctic minke whales using the IDCR/SOWER survey data.

North Pacific common minke whales (NPM)[14]

The following issues are high priority topics:

(1) continue work on integration of available abundance estimates from Japanese and Korean surveys with consideration of migration as well as correction of g(0);
(2) continue work on investigation of stock structure for western North Pacific common minke whales including stocks in the Sea of Japan and the Yellow Sea; and
(3) continue work for drawing information on the trend and/or relative abundance index.

[14] Depending on the outcome of Commission discussions in response to Item 20.2.

Bycatch and other human-induced mortality (BC)
The following issues are high priority topics:
(1) collaborate with FAO on collation of relevant fisheries data and joining FIRMS;
(2) estimation of rates of entanglement and entanglement mortality;
(3) progress in including information in national Progress Reports;
(4) review of methods to estimate mortality from ship strikes;
(5) continue development of the international database of ship strike incidents; and
(6) review methods for assessing mortality from acoustic sources and marine debris.

Stock definition (SD)
The following issues are high priority topics:
(1) progress on TOSSM (new tests of methods new reference datasets);
(2) update guidelines on DNA Data Quality;
(3) review proposed guidelines on analysis of genetic data for use in management;
(4) other statistical and genetic issues related to stock definition; and
(5) consideration of possible definitions of 'unit to conserve' (noting that Appendix 2 this year represents significant progress).

DNA (DNA)
The following issues are high priority topics:
(1) review genetic methods for species, stock and individual identification;
(2) review of results of the 'amendments' work on sequences deposited in GenBank;
(3) collection and archiving of tissue samples from catches and bycatches; and
(4) reference databases and standard for diagnostic DNA registries.

Environmental concerns (E)
The following issues are high priority topics:
(1) SOCER – the focus of the SOCER for SC/62 will be Arctic polar seas;
(2) POLLUTION 2000+ phase II planning (carried over from last year);
(3) anthropogenic sound (focus on shipping noise);
(4) review progress on work from the three sub-groups of the 2nd climate change workshop;
(5) review progress of the cetacean emerging and resurging disease (CERD); and
(6) other habitat related issues.

Ecosystem modelling (EM)
The following issues are high priority topics:
(1) discussion of EM's role in the SC;
(2) consider models that are relevant to the Committee's evaluation of special permit whaling, as well as other relevant ecosystem models; and
(3) discuss the issues surrounding functional responses at next year's meeting.

Southern Hemisphere whales other than Antarctic minke whales (SH)
The following issues are high priority topics:
(1) humpback whales-complete the assessment of breeding stock B;
(2) blue whales (Antarctic and pygmy); and
(3) prepare for assessment of breeding stocks D, E and F.

Small cetaceans (SM)
The following issues are high priority topics:
(1) the status of small cetaceans in the eastern tropical Atlantic;
(2) consider report from the intersessional working group on climate change;
(3) takes of small cetaceans; and
(4) review progress on previous recommendations.

Scientific permits (SP)
The following issues are high priority topics:
(1) consider need to revise 'Annex P'; and
(2) mechanism to complete Panel Review.

Whalewatching (WW)
The following issues are high priority topics:
(1) review whalewatching off North Africa;
(2) assess the impacts of whalewatching on cetaceans (methods and results of changes in behaviour and movement patterns; methods and results of physiological changes to individuals; and methods and results of demographic and distributional changes);
(3) review reports from Intersessional Working Groups;
(4) evaluate data from platforms of opportunity;
(5) review of whale-watching guidelines and regulations; and
(6) review of risks to cetaceans from whale-watching vessel collisions.

23 DATA PROCESSING AND COMPUTING NEEDS FOR 2009/10

The Committee identified and agreed the requests for intersessional work to be undertaken by the Secretariat given in Table 14.

24 FUNDING REQUIREMENTS FOR 2009/10

Table 15 summarises the complete list of recommendations for funding made by the Committee. The total required to meet its preferred budget is £308,320. The Committee **recommends** all of these proposed expenditures to the Commission. This figure is below the projected amount available for funding (£308,500). 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. The Committee **strongly recommends** that the Commission accepts its budget of £308,320.

A summary of each of the items is given below, by sub-committee or standing Working Group. Full details can be found under the relevant Agenda Items and Annexes as given in the table.

Table 14

Computing tasks/needs for 2009/10.

RMP – preparations for *Implementation*

(1) Work related to the proposed MSYR workshop (Item 5.3)
(2) Work with Pastene to use the Bryde's whale *Implementation Simulation Trials* to evaluate the effect size (and power) for current and historical age-composition data (Item 6.1.3)
(3) Finalise the audit of survey data for western north Pacific Bryde's whales (Item 6.1.3)

AWMP

(1) Code (and hence validate) and run the West Greenland minke whale sex-ratio method and the associated robustness tests (Annex E item 3.3)

NPM

(1) Update the control program for North Pacific minke whales and undertake any work required for a possible intersessional Workshop (see Item 10.2.4)

In-depth assessment

(1) Validation of the 2008/09 SOWER cruise data for incorporation into the DESS database
(2) Complete validation of the 1995-97 blue whale cruise data and incorporate into the DESS database
(3) Prepare a catch series for North Pacific sei whales (see Item 10.9)

Southern Hemisphere whale stocks

(1) Preparation of a 'final' revised Southern Hemisphere catch data series, including validation of new individual data, and in particular prepare a catch series for humpback breeding stock B (see Item 10.3.3)

By-catch

(1) Input by-catch data from the last season (2008) and for previous seasons (from 2004 back) into the by-catch database (see Item 7.1)

Table 15

Summary of budget requests

	Plenary Item first	Short title	Requested (£)
	RMP		
1	Item 5.1; Annex D	RMP MSY intersessional workshop.	17,500
2	Item 6.4; Annex D	computing support for North Pacific minke whale analyses	17,500
	AWMP		
3	Item 8.1; Annex E	Workshop to continue assessment of common minke whales off West Greenland.	10,000
4	Item 8; Annex E	AWMP developers fund.	8,000
	IA		
5	Item 10.8;Annex G	IDCR/SOWER biopsy and photo-identification records database.	12,000
6	Item 10.1.1; Annex G	Abundance estimates of Antarctic minke whales using SOWER data.	5,000
7	Item 10.1.1; Annex G	Import of 2008/09 SOWER data and assist abundance working group.	7,100
8	Item 10.8.2; Annex G	SOWER 2009/10 cruise and planning meeting; NP sighting survey meeting.	71,000
	IANP		
9	Item 6.4, Annex G1	Intersessional workshop on North Pacific minke whales	20,000
10	Items 10.2.1, 10.2.2; Annex G	Updated simulations of dispersal for western North Pacific minke whales.	10,000
	SH		
11	Item 10.3; Annex H	Modelling of Southern Hemisphere Humpback Populations.	3,500
12	Item 10.3; Annex H	Interchange analysis, migratory connections, and mixing in Antarctic Feeding Grounds for Southern Hemisphere humpback whales Breeding Stock B.	10,000
13	Item 10.3; Annex H	Antarctic humpback whale catalogue.	15,000
14	Item 10.3; Annex H	Estimating abundance of Oceania humpback whales.	8,200
15	Item 10.4; Annex H	IWC-SOWER blue whale photo-identification continuation of archival and analysis.	3,500
	BC		
16	Item 7.6; Annex J	Further development and maintenance of the IWC ship strike database	10,000
17	Item 7.2; Annex J	Progress with bycatches and the Fisheries Resource Monitoring System (FIRMS).	4,000
	E		
18	Item 12.2; Annex K	Modelling workshop: Pollution in the 21st century.	9,020
19	Item 12.3; Annex K	State of the Cetacean Environment Report (SOCER).	3,000
	ALL		
20		Invited Participants to the 2010 Annual Meeting.	64,000
		Total	308,320

Revised Management Procedure

(1) MSYR INTERSESSIONAL WORKSHOP

The workshop is to enable the Committee to finalise its review of MSYR and decide whether the existing plausible range of (currently $MSYR_{(mat)}$=1% to 7%) for use in the RMP requires modification at the 2010 meeting.

(2) COMPUTING SUPPORT FOR NORTH PACIFIC MINKE WHALE ANALYSES

The ability to complete the programming work needed for any North Pacific minke whale analyses arising as a result of discussions under Item 20.2 in the Commission will be substantially enhanced by the extra computational support for the Secretariat that was funded last year for the North Atlantic fin whale.

Aboriginal Whaling Management Procedure

(3) WORKSHOP TO CONTINUE ASSESSMENT OF SEX RATIO METHODS FOR COMMON MINKE WHALES OFF WEST GREENLAND

The Committee has invested considerable effort in determining whether sex ratio methods can be used to assess common minke whales off West Greenland. Great progress has been made and holding this workshop should allow the Committee to finalise its discussions on this approach and focus on *SLA* development. This will primarily be a technical workshop to ensure that the simulation testing developed at this meeting is ready for consideration at the 2010 Annual Meeting so that a decision can be taken on whether the sex-ratio method can be used to provide management advice.

(4) AWMP DEVELOPERS FUND

The developers fund has been invaluable in the work of *SLA* development and related essential tasks of the SWG. It has been agreed as a standing fund by the Commission. The primary development tasks facing the SWG are for the Greenlandic fisheries. These tasks are of high priority to the Committee and the Commission. The fund is essential to allow progress to be made.

In-depth assessments

(5) DEVELOP BIOPSY SAMPLING AND PHOTO-ID IDCR/SOWER DATABASES TO COMPLEMENT IWC-DESS

Several sub-committees have noted the value of the additional information to sightings data collected by the long series of IDCR/SOWER cruises. The biopsy samples and photo-identification analyses are underway but the value of the additional biopsy sampling and photo-identification work will be greatly enhanced if the associated paper records can be coded and entered into a relational database that can be linked to the IWC-DESS database that contains the sightings and effort records. Donovan has begun work on this with respect to the biopsy samples but current Secretariat resources mean that the work will have to be done on an ad hoc basis. This item will provide the additional resources to ensure that the coding and database work can be undertaken in a timely fashion. It is hoped to have the major part of the work completed by the next Annual Meeting.

(6) ABUNDANCE ESTIMATES OF ANTARCTIC MINKE WHALES USING SOWER DATA

To facilitate the completion of the abundance estimates for Antarctic minke whales from the circumpolar II and III series of IDCR/SOWER data, it is likely that the developers of the OK and SPLINTR methods will need to meet in person. This request is to support travel for the SPLINTR team to work with the OK team in Japan.

(7) IMPORT OF 2008/09 SOWER DATA AND ASSIST ABUNDANCE WORKING GROUP

Funds are required to enable the 2008/09 IWC/SOWER data to be incorporated into DESS. Data summaries of the standard dataset will be provided to the intersessional correspondence group and errors will be corrected in the 'standard' and DESS datasets for the 2010 SC meeting.

(8) SOWER 2009/10 CRUISE AND PLANNING MEETING AND INFORMAL NORTH PACIFIC SIGHTING SURVEY MEETING

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 2009/10 SOWER cruise will investigate the relationship between Antarctic minke whale abundance estimates and sea ice conditions by cooperating with the Australian aerial survey that will be conducting line transects in the sea ice. This cooperative cruise could provide valuable information to help explain the difference in the abundance estimates from CPII and CPIII. The vessel is generously provided by the Government of Japan.

A small amount of funding is required to allow scientists to stay in Japan for two days after the SOWER planning meeting in order to review progress of intersessional work relating to the new North Pacific Sighting Survey programme, discussed under Item 10. As noted, the development of a full programme will assist the work of several sub-committees. The group will also examine plans for an initial survey in 2010.

North Pacific minke whales

(9) INTERSESSIONAL WORKSHOP ON NORTH PACIFIC MINKE WHALES

Discussions under item 10.2 and Item 20 show that Western North Pacific minke whales are a high priority item for the Commission. Whatever decision is taken by the Commission at the annual meeting in 2010 on future priorities will require an intersessional workshop.

(10) UPDATE SIMULATIONS OF DISPERSAL FOR WESTERN NORTH PACIFIC MINKE WHALES

Estimates of dispersal are required for undertaking a full *Implementation* review of WNP minke whales and to examine effects of Scientific Permit catches on stocks. The current management paradigm for WNP minke whales is based in part on simulations conducted in 2003 (Taylor and Martien, 2004) using mtDNA data available at that time. Recently, Japanese scientists have collected a great deal of new genetic information for WNP minke whales, and it is necessary to redo the simulations to incorporate the new data. Funding is required to accomplish this and the work will be probably carried out by either Gaggiotti or Kalinowski.

Southern Hemisphere humpback whales

(11) MODELLING OF SOUTHERN HEMISPHERE HUMPBACK POPULATIONS

Development of additional population dynamic models are a high priority for the completion of the assessment of breeding stock B. Funds are required to (1) modify

interchange models considered for breeding stock C; (2) simultaneously analyse all seven breeding stocks using the current age-aggregated model. This is desirable so the catch allocation uncertainty is taken into account in a consistent and even-handed manner; and (3) extend models to take account of catch sex- and length-distribution information.

(12) INTERCHANGE ANALYSIS, MIGRATORY CONNECTIONS, AND MIXING IN ANTARCTIC FEEDING GROUNDS FOR SOUTHERN HEMISPHERE HUMPBACK WHALES BREEDING STOCK B

In order to complete the assessment for breeding stock B at next year's Annual Meeting there is a need for further analysis of data 'in hand' for interchange analysis, migratory connections and mixing in Antarctic feeding grounds. Funds are required to assess the degree of interchange between sub-stocks in B1 and B2 using genetic and photographic information, and to inform about migratory connections, and mixing in Antarctic feeding grounds.

(13) 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. The work required to *inter alia* make the IWC/SOWER photographs more accessible is being carried out. The funds are required for database management and to further develop and enhance the system for online access. In addition, there are a large number of photographs awaiting processing and the money will facilitate this process. The work will be carried out by Carlson and Allen and is also relevant to project (5) above.

(14) ESTIMATING ABUNDANCE OF OCEANIA HUMPBACK WHALES

This project will review data quality and finalise photo-ID and genotype catalogues for humpback whales in Oceania (breeding stocks E2, E3 and F), for the purposes of capture-recapture analysis. The work will build on the work of the South Pacific Whale Research Consortium, members of which have coordinated research into humpback whale interchange and abundance across the Oceania region.

(15) IWC-SOWER BLUE WHALE PHOTO-IDENTIFICATION CONTINUATION OF ARCHIVAL AND ANALYSIS

To date over 22,000 images of blue whales from the IWC-SOWER circumpolar cruises have been archived. From these, 207 individual blue whales have been identified. Recently a set of 'missing' images (B/W negatives and prints) from SOWER 2001/02, 2002/03 (and possibly 2003/04) were re-discovered at the IWC Secretariat. These images will be transferred to South West Fisheries Science Center (SWFSC) shortly. Funds are required in order that the approximately 600 photos (representing an estimated 50 individual whales) to be digitised, processed and incorporated into the IWC-SOWER blue whale catalogue. Matches between years and Antarctic Areas will be made. This work will be conducted by Olson and is relevant to project (5) above.

Bycatch and other human-induced mortality

(16) FURTHER DEVELOPMENT AND MAINTENANCE OF THE IWC SHIP STRIKE DATABASE

The IWC ship strikes database has been developed intersessionally. Funding is required for: (1) database refinement, improvements to front end tools and for an email notification system; and (2) annual ongoing work by the data review group. The need for a global database of incidents involving collisions between vessels and whales has previously been recognised by the Committee, as well as other bodies such as the International Maritime Organization (IMO) and ACCOBAMS.

(17) PROGRESS JOINING THE FISHERIES RESOURCE MONITORING SYSTEM (FIRMS)

Collation and formatting of part of the IWC data on catches and bycatches for integrations into FIRMS has been completed. Funds are required for Simon Northridge to travel to FAO, Rome later this year to coordinate integration of the data and develop links between FAO and IWC.

Environment

(18) MODELLING WORKSHOP: POLLUTION IN THE 21ST CENTURY

The Committee has agreed that it will be valuable to begin Phase II of POLLUTION 2000+. The initial work will concentrate on: (1) developing an integrated modelling/risk assessment framework for evaluating the cause and effect relationships between pollutant exposure and cetacean populations; (2) evaluating existing models that could be tested; (3) assessing the model characteristics needed; (4) developing a prioritisation framework to evaluate the broad number of environmental pollutants; and (5) identify data needs and available datasets or case studies. The importance of this Workshop was established last year when the Committee received funding towards it. It was not possible to convene the Workshop intersessionally, but it is scheduled for February 2010. Further funding is required for Invited Participants at the Workshop.

(19) STATE OF THE CETACEAN ENVIRONMENT REPORT (SOCER).

The Committee regards SOCER to be useful document that provides a 'snapshot' of environmental developments relevant to cetaceans for scientists and non-scientists alike. Money is requested to support the production of this report.

Other

(20) INVITED PARTICIPANTS (IPS) FUND

The Committee **draws attention** to the essential contribution made to its work by the funded 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.

Table 16

Outline of the *Scientific Committee Handbook*. All sections apart from 9 already have substantial content.

1	Introduction	Introduces the origins of the Committee.
2	Place in the Commission system	Shows the relationship between the Committee, other bodies of the Commission and the Commission itself.
3	Membership and officers	This introduces the rules concerning membership including the categories of national delegates, invited participants and representatives of specified intergovernmental organisations, as well as the officers of the Committee.
4	Structure and meetings	This discusses the structure of the Committee (the plenary and sub-groups), the role of convenors, logistics of meetings and the use of intersessional correspondence groups.
5	Reports and papers	This covers national progress reports, Committee primary papers, 'for information' papers, working papers, and Committee reports themselves (including those of sub-groups and workshops)
6	Research Fund	This covers the research fund and applications for no-cost use of IWC-held data
7	Scientific permits	This covers the process for the review of special permits
8	Data Availability Agreement	This explains the Data Availability Agreement
9	Scientific work	The Scientific Committee covers a wide range of scientific subjects with respect to the conservation and management of cetaceans. Much of this is ongoing work. These sections are being written primarily by convenors of subgroups in conjunction with Donovan and Hammond, who will provide brief summaries of the work of the present sub-groups, including their remit from the Commission. Particularly for the more technical sub-groups the sections will include explanations (and in some cases PowerPoint presentations such as that given this year wrt the RMP *Implementation* Process) of fundamental tools used e.g. in RMP and AWMP. It will also contain sections with respect to: e.g. the catch database; the data from IDCR/SOWER cruises including (IWC-DESS, biopsy and photo-identification databases); the ship strikes database etc.

25 WORKING METHODS OF THE COMMITTEE

In response to discussions last year (IWC, 2009e), Donovan and Hammond presented a draft of a '*Scientific Committee Handbook*'. The handbook had been developed to provide a relatively simple explanation of the work of the Scientific Committee including its procedures. It is intended to be a living document, regularly updated and incorporated into the IWC website[15] and to be of interest for scientists and non-scientists alike.

The structure of the document at present is shown in Table 16.

The Committee **welcomes** the draft of the *Handbook*, recognising that it represents a considerable amount of work. It believes that it will become valuable tool for old and new members alike, as well as other bodies of the Commission and the general scientific community. Members with suggestions and comments for additions and amendments are invited to send those directly to the authors.

The Committee also briefly discussed the policy regarding the citation of Scientific Committee documents last reviewed in 2002 (IWC, 2003a, p. 87). It was agreed to revisit this issue next year, recognising *inter alia* the need to: ensure transparency with respect to advice provided by the Committee and to respect the rights of scientists to first publication of their data.

[15] It will be uploaded after the meeting onto http://www.iwcoffice.org/sci_com/handbook.htm

26 ELECTION OF OFFICERS

Election of a new Vice-Chair was scheduled for this year. According to the Rules of Procedure for the Scientific Committee (IWC, 2005b, p.59), the current Vice-Chair, Palka, becomes Chair after the closure of the Commission meeting. The Heads of Delegations acknowledged that they this year had two very well qualified candidates for new Vice-Chair and Kitakado was elected as next Vice-Chair by secret ballot.

27 PUBLICATIONS

The completion of the RMP Special Issue has been given high priority; Hammond and Donovan undertook to complete the volume before the next Annual Meeting. The Special Issue of the *Journal* on Southern Hemisphere humpback whales is progressing well and will be published in January 2010.

28 OTHER BUSINESS

On behalf of the Committee Bjørge thanked Frietas for organising the Scientific Committee dinner. He also thanked Rogan for her work as Convenor of the small cetaceans sub-committee for the previous five years and wished her successor, Fortuna, well in the role. The Committee gave Bjørge a standing ovation for his outstanding work as Chair of the Committee. His fair and wise handling of difficult issues and his good humour were particularly noted. Bjørge expressed his pleasure in working with the Secretariat during his time in Chair and he expressed particular gratitude to Donovan for his support and advice. Bjørge wished Palka, the incoming Chair, well in the position and finally he thanked Miller for all her help, particularly in relation to the organisation of Invited Participants.

29 ADOPTION OF REPORT

The report was adopted at 18:20hr on 12 June 2009. As usual, final editing was carried out by the Convenors after the meeting.

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